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Certification Docket for the Remedial Action Performed at the Colonie Interim Storage Site Vicinity Properties in Colonie and Albany, New York, in 1984 and 1985

Department of Energy
Technical Services Division
Oak Ridge Operations Office

July 1989

[redacted]

CERTIFICATION DOCKET FOR THE REMEDIAL ACTION PERFORMED AT THE COLONIE INTERIM STORAGE SITE VICINITY PROPERTIES IN COLONIE AND ALBANY, NEW YORK, IN 1984 AND 1985

JULY 1989

Prepared for

UNITED STATES DEPARTMENT OF ENERGY

Oak Ridge Operations Office

Under Contract No. DE-AC05-81OR20722

By

Bechtel National, Inc.

Oak Ridge, Tennessee

Bechtel Job No. 14501

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INTRODUCTION TO THE CERTIFICATION DOCKET FOR THE REMEDIAL ACTION PERFORMED AT THE COLONIE INTERIM STORAGE SITE VICINITY PROPERTIES IN COLONIE AND ALBANY, NEW YORK, IN 1984 AND 1985

Description of the Formerly Utilized Sites Remedial Action Program at Colonie, New York

The U.S. Department of Energy (DOE), Office of Nuclear Energy, Office of Remedial Action and Waste Technology, Division of Facility and Site Decommissioning Projects (and/or the predecessor agency, offices, and divisions) has implemented a remedial action project in Colonie, New York. The 1984 Energy and Water Appropriations Act authorized DOE to conduct a decontamination research and development project at four sites, including the site of the former National Lead (NL) Industries plant and its vicinity properties. The act was reauthorized in 1985. The work is being administered by the Formerly Utilized Sites Remedial Action Program (FUSRAP), one of four remedial action programs under the direction of the DOE Division of Facility and Site Decommissioning Projects. The United States Government authorized DOE to initiate FUSRAP in 1974 to identify, clean up, or otherwise control sites where residual radioactive material (exceeding current guidelines) remains from the early years of the nation's atomic energy program or commercial operations causing conditions that Congress has mandated DOE to remedy. The objectives of FUSRAP are to:

- Identify and assess all sites formerly utilized to support early Manhattan Engineer District/Atomic Energy Commission (MED/AEC) nuclear work to determine whether further decontamination and/or control is needed

- Decontaminate and/or apply controls to these sites to permit conformance with current applicable guidelines

- Dispose of and/or stabilize all generated residues in a radiologically and environmentally acceptable manner

- Accomplish all work in accordance with appropriate landowner agreements, local and state environmental and land use requirements to the extent permitted by Federal law, and applicable DOE orders, regulations, standards, policies, and procedures

- Certify, at the completion of remedial action, that the radiological conditions of the subject sites comply with guidelines and are appropriate for future use

FUSRAP is currently being managed by the DOE Oak Ridge Operations Office (ORO). As the Project Management Contractor (PMC) for FUSRAP, Bechtel National, Inc. (BNI) is the DOE representative for planning, managing, and implementing FUSRAP.

The NL plant began working with depleted uranium in 1958, performing operations dealing with the casting, machining, and milling of this uranium into various items. In subsequent years, NL Industries used depleted uranium to make counterweights for airplanes and projectiles for the armed services. Early in 1980, the State of New York ordered that the NL plant be closed. The plant reopened in May 1980 but did not run at a 100 percent production rate. It operated until DOE took possession of the facility in February 1984 to begin decontamination activities.

Teledyne Isotopes surveyed the neighborhood surrounding the NL plant for radioactivity in 1980 and determined that uranium released into the air through stack emissions had deposited on residential and commercial properties and structures. The survey also showed that the majority of the contamination was in the direction of the prevailing winds.

In October 1983, more detailed radiological surveys of the individual vicinity properties surrounding the NL plant (including private residences) were performed by Oak Ridge National Laboratory (ORNL). These surveys were designed to locate all properties on which uranium contamination exceeded DOE guidelines.

DOE developed a remedial action plan to remove the contamination in the Colonie area in two phases. The priority in the first phase is to remove contaminated materials from residential properties, and then from commercial vicinity properties. The contaminated materials removed from these properties are being stored temporarily at the Colonie Interim Storage Site (CISS). The second phase will consist of decontaminating the CISS; a separate Remedial Investigation/Feasibility Study-Environmental Assessment is being conducted in preparation for this phase.

Executive Order 11991 empowered the Council on Environmental Quality (CEQ) to issue regulations to federal agencies for implementing those procedural provisions of the National Environmental Policy Act (NEPA) that are mandatory under law. The CEQ issued the regulations containing guidance and specific requirements in June 1979. The DOE guidelines for implementing the NEPA process and satisfying the CEQ regulations were made effective on March 28, 1980.

The NEPA process requires FUSRAP decision-makers to identify and assess the environmental consequences of proposed actions before beginning remedial activities, developing disposal sites, or transporting and disposing of radioactive wastes. Documentation required by NEPA in support of remedial action is prepared by Argonne National Laboratory (ANL). Supporting documentation is provided by the FUSRAP PMC through the preparation of a series of engineering studies and environmental reports to evaluate remedial action alternatives for the site under consideration. The action deemed appropriate by DOE based on the NEPA process evaluations is then implemented with consideration for public safety and in compliance with applicable federal, state, and local requirements.

For the site discussed in this report, the NEPA requirements were satisfied by the preparation of an Action Description Memorandum, which led to issuance of a Memorandum to File documenting that the project had no significant impact on the environment.

Work performed under FUSRAP is governed by the provisions of the DOE quality assurance program plan for FUSRAP, which complies with DOE Order 5700.6. Work performed under FUSRAP by the PMC or by architect-engineers, construction and service subcontractors, and other project subcontractors is governed by the quality assurance program plan as specified in the FUSRAP Project Quality Assurance Manual. Effectiveness of implementation is appraised on a regular basis by the BNI quality assurance organization and by DOE-ORO.

Remedial action has been completed on the properties identified in this docket. On June 19, 1989, DOE certified that the properties are in compliance with applicable DOE standards and criteria developed to protect health, safety, and the environment. On July 13, 1989, the notice of certification for the Federal Register was signed.

Purpose

The material in this docket consists of documents supporting the certification by DOE that the radiological conditions at the subject properties are in compliance with radiological guidelines and standards determined to apply to this site and that use of these properties will not result in any measurable radiological hazard to the general public derived from the activities of DOE predecessor agencies.

The certification docket contains only the material deemed most pertinent to the certification of these properties; the comprehensive package of records is available and will be archived by DOE through the Assistant Secretary for Management and Administration after certification. Copies of this docket will be available for public review between 9:00 a.m. and 4:00 p.m., Monday through Friday (except federal holidays) at the DOE Public Reading Room located in Room 1E-190 of the Forrestal Building, 1000 Independence Avenue, S.W., Washington, D.C. Copies

will also be available in the Public Document Room, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, Tennessee, and the Colonie Library, 629 Albany-Shaker Road, Loudonville, New York 12210.

Property Identification

The properties are listed by their addresses, as identified in the radiological survey reports prepared by Oak Ridge National Laboratory. The 11 properties that were included in the 1984 remedial action are listed first, followed by the 24 properties included in the 1985 remedial action.

Parcel 1 located on 27/29 Yardboro Avenue, City of Albany, identified as Block 1, Lot 36 (per tax map; no identification per access agreement).

Parcel 2 located on 52 Yardboro Avenue, City of Albany, identified as Block 1, Lot 13 (per tax map); as Block 1, Lots 11, 12 and 13 (per access agreement).

Parcel 3 located on 68 Yardboro Avenue, City of Albany, identified as Block 1, Lots 4, 5 and 6 (per tax map); as Block 1, Lots 4, 5, 6, 7 and 8 (per access agreement).

Parcel 4 located on 74 Yardboro Avenue, City of Albany, identified as Block 1, Lot 36 (per tax map); as Block 1, Lot 3 (per access agreement).

Parcel 5 located on 78 Yardboro Avenue, City of Albany, identified as Block 1, Lot 2 (per tax map); as Block 1, Lot 2 (per access agreement).

Parcel 6 located on 80 Yardboro Avenue, City of Albany, identified as Block 1, Lot 1 (per tax map); as Block 1, Lot 1 (per access agreement).

Parcel 7 located on 33 Palmer Avenue, City of Albany, identified as Block 1, Lot 37 (per tax map); as Block 1, Lot 37 (per access agreement).

Parcel 8 located on 1114 Central Avenue, Town of Colonie, identified as Block 0806 (per tax map; no identification per access agreement).

Parcel 9 located on 1144 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 10 located on 1144A Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 11 located on 1159 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 12 located on 5 Yardboro Avenue, City of Albany, identified as Block 1, Lot 26 (per tax map; no identification per access agreement).

Parcel 13 located on 24 Yardboro Avenue, City of Albany, identified as Block 1, Lot 17 (per tax map; no identification per access agreement).

Parcel 14 located on 25/27 Yardboro Avenue, City of Albany, identified as Block 1, Lot 36 (per tax map; no identification per access agreement).

Parcel 15 located on 50 Yardboro Avenue, City of Albany, identified as Block 1, Lot 14 (per tax map) as Block 1, Lots 18, 19, 20, 21, 22 and 23 (per access agreement).

Parcel 16 located on 1100 Central Avenue, City of Albany, identified as Block 1, Lot 24 (per tax map; no identification per access agreement).

Parcel 17 located on 1104 Central Avenue, City of Albany, identified as Block 0806 (per tax map; no identification per access agreement).

Parcel 18 located on 1118 Central Avenue, Town of Colonie, identified as Block 0806 (per tax map; no identification per access agreement).

Parcel 19 located on 1129 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 20 located on 1146 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 21 located on 1147 Central Avenue, Town of Colonie, identified as Block 0905 (per tax map; no identification per access agreement).

Parcel 22 located on 1148 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 23 located on 1150 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 24 located on 1152 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 25 located on 1160 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 26 located on 1160/62 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 27 located on 1161/63 Central Avenue, Town of Colonie, identified as Block 0905 (per tax map; no identification per access agreement).

Parcel 28 located on 1166 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 29 located at 1167 Central Avenue, Town of Colonie, identified as Block 0905 (per tax map; no identification per access agreement).

Parcel 30 located on 1168 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 31 located on 1170 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 32 located on 1185 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 33 located on 1195 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 34 located on 7 Palmer Avenue, City of Albany, identified as Block 1, Lot 35 (per tax map; no identification per access agreement).

Parcel 35 located on 10 Garden Lane, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Docket Contents

Exhibit I is a summary of remedial action activities at the subject properties. It provides a brief history of the origin of the

contamination at the NL plant and vicinity properties and summarizes the radiological characterizations conducted, the remedial action performed, and post-remedial action/verification activities.

The following documents contain the guidelines that determine the need for remedial action. The subject properties have been decontaminated to comply with these guidelines. The first document listed is included as Appendix A of Exhibit I; the next three documents are included by reference in Exhibit II (1); and the remaining documents are included in Exhibit II (1).

U.S. Department of Energy. "U.S. Department of Energy Guidelines for Residual Radioactivity at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites," Rev. 2, March 1985.

U.S. Department of Energy. Design Criteria for Formerly Utilized Sites Remedial Action Program (FUSRAP) and Surplus Facilities Management Program (SFMP), 14501-00-DC-01, Rev. 2, Oak Ridge, TN, March 1986.

Bechtel National, Inc. Hazard Assessment for Radioactive Contamination on the Roof of the Commercial Building at 1104 Central Avenue in Colonie, New York, Oak Ridge, TN, May 1989.

Bechtel National, Inc. Hazard Assessment for Radioactive Contamination on the Roof of the Commercial Building at 50 Yardboro Avenue in Colonie, New York, Oak Ridge, TN, May 1989.

Letter, E.L. Keller, Director, Technical Services Division, Oak Ridge Operations Office, Department of Energy, to R.L. Rudolph, Bechtel National, Inc. "ALARA Determination for Colonie Vicinity Properties," March 26, 1984.

Memorandum, E.G. DeLaney, Manager, FUSRAP/Surplus Facilities Group, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, Department of Energy Headquarters, to E.L. Keller, Director, Technical Services Division, Oak Ridge Operations Office, Department of Energy. "Colonie Vicinity Property Decontamination; Guidance for First Group of Properties," April 30, 1984.

Letter, E.G. DeLaney, Manager, FUSRAP/Surplus Facilities Group, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, Department of Energy Headquarters, to R. Guimond, Director, Criteria and Standards Division, Environmental Protection Agency, April 30, 1984.

Letter, E.L. Keller, Director, Technical Services Division, Oak Ridge Operations Office, Department of Energy, to R.L. Rudolph, Bechtel National, Inc. "Surface Contamination Levels; Colonie Vicinity Property Remedial Action," September 12, 1984.

Letter, E.L. Keller, Director, Technical Services Division, Oak Ridge Operations Office, Department of Energy, to Dr. W. Condon, New York State Task Force on Former NL Plant, New York Department of Health. "Subsurface Soil Sampling for Colonie Vicinity Properties," September 27, 1984.

The following documents authorized or designated the remedial action at the 35 subject properties. A copy of each is included in Exhibit II (2).

Letter, F.E. Coffman, Director, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, Department of Energy Headquarters, to J. LaGrone, Manager, Oak Ridge Operations Office, Department of Energy. "Authorization to Conduct Remedial Action at Vicinity Properties in Colonie, New York," September 28, 1984.

Letter, J.E. Baublitz, Acting Director, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, to Distribution. "Authorization to Conduct Remedial Action," June 24, 1985.

Memorandum, E.G. DeLaney, FUSRAP/Surplus Facilities Group, Division of Remedial Action Projects, to E.L. Keller, Director, Technical Services Division, Oak Ridge Operations Office. "Colonie Vicinity Property Decontamination; Guidance for First Group of Properties," April 30, 1984.

The following documents describe the radiological condition of the subject properties before remedial action. They are referenced in this docket in Exhibit II (3).

Teledyne Isotopes. A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Westwood, NJ, October 31, 1980.

1984 Properties

Oak Ridge National Laboratory. Results of the Radiological Survey at 1114 Central Avenue (included in report for 1118 Central Avenue), Albany, New York (AL022), Oak Ridge, TN, June, 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1144 Central Avenue, Colonie, New York (AL010), Oak Ridge, TN, March 1984.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1144A Central Avenue, Colonie, New York (AL011), Oak Ridge, TN, March 1984.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1159 Central Avenue, Colonie, New York (AL028), ORNL/RASA-84/231, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 33 Palmer Avenue, Albany, New York (AL006), Oak Ridge, TN, March 1984.

Oak Ridge National Laboratory. Results of the Radiological Survey 27/29 Yardboro Avenue, Albany, New York (AL012), Oak Ridge, TN, March 1984.

Oak Ridge National Laboratory. Results of the Radiological Survey at 52 Yardboro Avenue, Albany, New York (AL005), Oak Ridge, TN, March 1984.

Oak Ridge National Laboratory. Results of the Radiological Survey at 68 Yardboro Avenue, Albany, New York (AL004), Oak Ridge, TN, March 1984.

Oak Ridge National Laboratory. Results of the Radiological Survey at 74 Yardboro Avenue, Albany, New York (AL003), Oak Ridge, TN, March 1984.

Oak Ridge National Laboratory. Results of the Radiological Survey at 78 Yardboro Avenue, Albany, New York (AL001), Oak Ridge, TN.

Oak Ridge National Laboratory. Results of the Radiological Survey at 80 Yardboro Avenue, Albany, New York (AL002), Oak Ridge, TN, March 1984.

1985 Properties

Oak Ridge National Laboratory. Results of the Radiological Survey at 1100 Central Avenue, Colonie, New York (AL041), ORNL/RASA-84/293, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1104 Central Avenue, Colonie, New York (AL042), ORNL/RASA-84/294, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1118 Central Avenue, Colonie, New York (AL022), ORNL/RASA-84/225, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1129 Central Avenue, Colonie, New York (AL043), ORNL/RASA-84-295, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1146 Central Avenue, Colonie, New York (AL024), ORNL/RASA-84/227, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1147 Central Avenue, Colonie, New York (AL034), ORNL/RASA-84/286, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1148 Central Avenue - Front, Colonie, New York (AL025), ORNL/RASA-84/228, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1148 Central Avenue - Rear (10 Garden Lane), Colonie, New York (AL023), ORNL/RASA-84/228, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1150 Central Avenue, Colonie, New York (AL026), ORNL/RASA-84/229, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1152 Central Avenue, Colonie, New York (AL027), ORNL/RASA-84-230, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1160 Central Avenue, Colonie, New York (AL021), ORNL/RASA-84/224, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1160/1162 Central Avenue, Colonie, New York (AL020), ORNL/RASA-84/223, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1163/1161 Central Avenue, Colonie, New York (AL056), ORNL/RASA-85/11, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1166 Central Avenue, Colonie, New York (AL053), ORNL/RASA-85/8, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1167 Central Avenue, Colonie, New York (AL054), ORNL/RASA-85/9, Oak Ridge, TN, September 1986.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1168 Central Avenue, Colonie, New York (AL052), ORNL/RASA-85/7, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1170 Central Avenue, Colonie, New York (AL051), ORNL/RASA-85/6, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1185 Central Avenue, Colonie, New York (AL032), ORNL/RASA-84/284, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1195 Central Avenue, Colonie, New York (AL065), ORNL/RASA-85/20, Oak Ridge, TN, June 1986.

Oak Ridge National Laboratory. Results of the Radiological Survey at 7 Palmer Avenue, Albany, New York (AL017), ORNL/RASA-84/96, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 5 Yardboro Avenue, Albany, New York (AL031), ORNL/RASA-84/283, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 24 Yardboro Avenue, Albany, New York (AL019), ORNL/RASA-84/222, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 25/27 Yardboro Avenue, Albany, New York (AL016), ORNL/RASA-84/112, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 50 Yardboro Avenue, Albany, New York (AL013), ORNL/RASA-84/111, Oak Ridge, TN, June 1985.

The documents listed below fulfill the NEPA requirements for the subject properties. The second document also contains radiological data for some of the subject properties. The first two documents are included by reference in Exhibit II (4); the third document is included in Exhibit II (4).

Argonne National Laboratory. Action Description Memorandum, Proposed 1984 Remedial Actions for Vicinity Properties at Colonie, New York, Argonne, IL, May 4, 1984.

Argonne National Laboratory. Action Description Memorandum Revision: Proposed 1984 Remedial Actions at Colonie, New York, Argonne, IL, June 5, 1984.

Memorandum, F.E. Coffman, Director, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, to NE-24 Distribution. "Review of Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site Relative to NEPA Requirements," June 25, 1984.

The access agreements signed by the property owners and DOE before remedial action was initiated are included by reference in Exhibit II (5). The affected properties are listed here by address.

1100 Central Avenue
1104 Central Avenue
1114 Central Avenue
1118 Central Avenue
1129 Central Avenue
1144 Central Avenue
1144A Central Avenue
1146 Central Avenue
1147 Central Avenue
1148 Central Avenue
1150 Central Avenue
1152 Central Avenue
1159 Central Avenue
1160 Central Avenue
1160/62 Central Avenue
1161/63 Central Avenue
1166 Central Avenue
1167 Central Avenue
1168 Central Avenue
1170 Central Avenue
1185 Central Avenue
1195 Central Avenue
10 Garden Street
7 Palmer Avenue
33 Palmer Avenue
5 Yardboro Avenue
24 Yardboro Avenue
25/27 Yardboro Avenue
27/29 Yardboro Avenue
50 Yardboro Avenue
52 Yardboro Avenue
68 Yardboro Avenue
74 Yardboro Avenue
78 Yardboro Avenue
80 Yardboro Avenue

The following reports describe the extent of the remedial action and document the successful decontamination of the 35 subject properties. These reports are included by reference in Exhibit II (6).

Bechtel National, Inc. Post-Remedial Action Report for the Colonie Interim Storage Site Vicinity Properties - 1984, DOE/OR/20722-72, Oak Ridge, TN, March 1986.

Bechtel National, Inc. Post-Remedial Action Report for the Colonie Interim Storage Site Vicinity Properties - 1985, DOE/OR/20722-92, Oak Ridge, TN, March 1988.

Exhibit II (7) contains the documents related to the successful decontamination of the subject properties. The first two documents are included in Exhibit II (7); the three verification reports are included in Exhibit II (7) by reference.

Letter, James D. Berger, Program Manager, Radiological Site Assessment Program, to E.G. DeLaney, Director, Division of Facility and Site Decommissioning Projects, Office of Nuclear Energy. "Independent Verification - 1984 Remedial Action of Colonie Vicinity Properties: Colonie, New York," February 26, 1986.

Letter, James D. Berger, Program Manager, Radiological Site Assessment Program, to E.G. DeLaney, Director, Division of Facility and Site Decommissioning Projects, Office of Nuclear Energy. "Independent Verification - 1985 Remedial Action of Colonie Vicinity Properties: Colonie, New York," February 26, 1986.

Oak Ridge Associated Universities. Verification of 1984 Remedial Action Vicinity Properties Colonie Interim Storage Site, Colonie, New York, Oak Ridge, TN, April 1986.

Oak Ridge Associated Universities. Verification of 1985 Remedial Action Vicinity Properties Colonie Interim Storage Site, Colonie, New York, Oak Ridge, TN, November 1986.

Oak Ridge Associated Universities. Verification of Remedial Actions at 1104 Central Avenue and 50 Yardboro Avenue, Colonie, New York, Oak Ridge, TN, June 1989.

Exhibit II (8) states that the State of New York was kept fully informed of all DOE activities.

Exhibit II (9) states that there will be no radiologically based restrictions on the subject properties.

The Federal Register notice notifies the public of DOE's intent to certify that the subject properties comply with applicable DOE standards and criteria. The text of the Federal Register Notice is included in Exhibit II (10).

Baublitz, J.E., Acting Director, Office of Remedial Action and Waste Technology, Office of Nuclear Energy, Department of Energy Federal Register notice: "Department of Energy Office of Environmental Protection, Safety, and Emergency Preparedness, Certification of Remedial Action at Properties Located in Colonie and Albany, New York," July, 13, 1989.

The documents listed below validate the final certification of the subject properties and are included in Exhibit II (11).

Memorandum, J.J. Fiore, Director of Facility and Site Decommissioning, Office of Nuclear Energy, Department of Energy, to J.E. Baublitz, Acting Director, Office of Remedial Action and Waste Technology, Office of Nuclear Energy, Department of Energy, NE-20. "Recommendation for Certification of Remedial Action at Properties Associated with the National Lead (NL) Industries Plant, Colonie, New York," June 19, 1989.

P. J. Gross, Director, Technical Services Division, Oak Ridge Operations Office, Department of Energy, "Statement of Certification: Vicinity Properties Associated with the National Lead (NL) Industries Plant," (one statement for each property).

Cost data and waste volumes associated with the entire remedial action at the vicinity properties are included in Exhibit I of this docket.

Exhibit I *Summary of Remedial Action Activities*

EXHIBIT I

SUMMARY OF REMEDIAL ACTION ACTIVITIES

JULY 1989

Prepared for

UNITED STATES DEPARTMENT OF ENERGY

OAK RIDGE OPERATIONS OFFICE

Under Contract No. DE-AC05-81OR20722

By

Bechtel National, Inc.

Oak Ridge, Tennessee

Bechtel Job No. 14501

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ABBREVIATIONS

cm	centimeter
cm^2	square centimeter
dpm	disintegrations per minute
ft	foot
h	hour
ls	lump sum
lf	linear feet
m^2	square meter
mg/cm^2	milligrams per square centimeter
mrad/h	millirad per hour
mrem	millirem
mrem/yr	millirem per year
pCi/g	picocuries per gram
WL	working level
yd^2	square yard
yd^3	cubic yard

LIST OF ACRONYMS

ADM	Action Description Memorandum
AEC	Atomic Energy Commission
ANL	Argonne National Laboratory
BNI	Bechtel National, Inc.
CISS	Colonie Interim Storage Site
DOE	Department of Energy
EPA	Environmental Protection Agency
FIDLER	Field Instrument for Detecting Low Energy Radiation
FY	Fiscal year
FUSRAP	Formerly Utilized Sites Remedial Action Program
IVC	Independent Verification Contractor
MED	Manhattan Engineer District
NL	National Lead Industries
NRC	Nuclear Regulatory Commission
ORAU	Oak Ridge Associated Universities
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Operations
PMC	Project Management Contractor
TLD	Thermoluminescent dosimeter

1.0 INTRODUCTION

Exhibit I summarizes the activities culminating in the certification that radiological conditions at the properties discussed in this docket are in compliance with applicable guidelines and that future use of the properties will result in no radiological exposure above Department of Energy (DOE) criteria and standards established to protect members of the general public and occupants of the site. These activities were conducted under the Formerly Utilized Sites Remedial Action Program (FUSRAP) (Ref. 1). This summary includes a discussion of the remedial action process at these properties: the characterization of their radiological status, their designation as requiring remedial action, the remedial action performed, and verification that the radioactivity has been removed. Further detail on each activity can be found in the referenced documents.

The properties addressed in this docket include residential and commercial properties in the City of Albany, New York (on Central, Palmer, and Yardboro Avenues), and in the Town of Colonie, New York (on Central Avenue and Garden Lane). Figure 1-1 shows the locations of these properties.

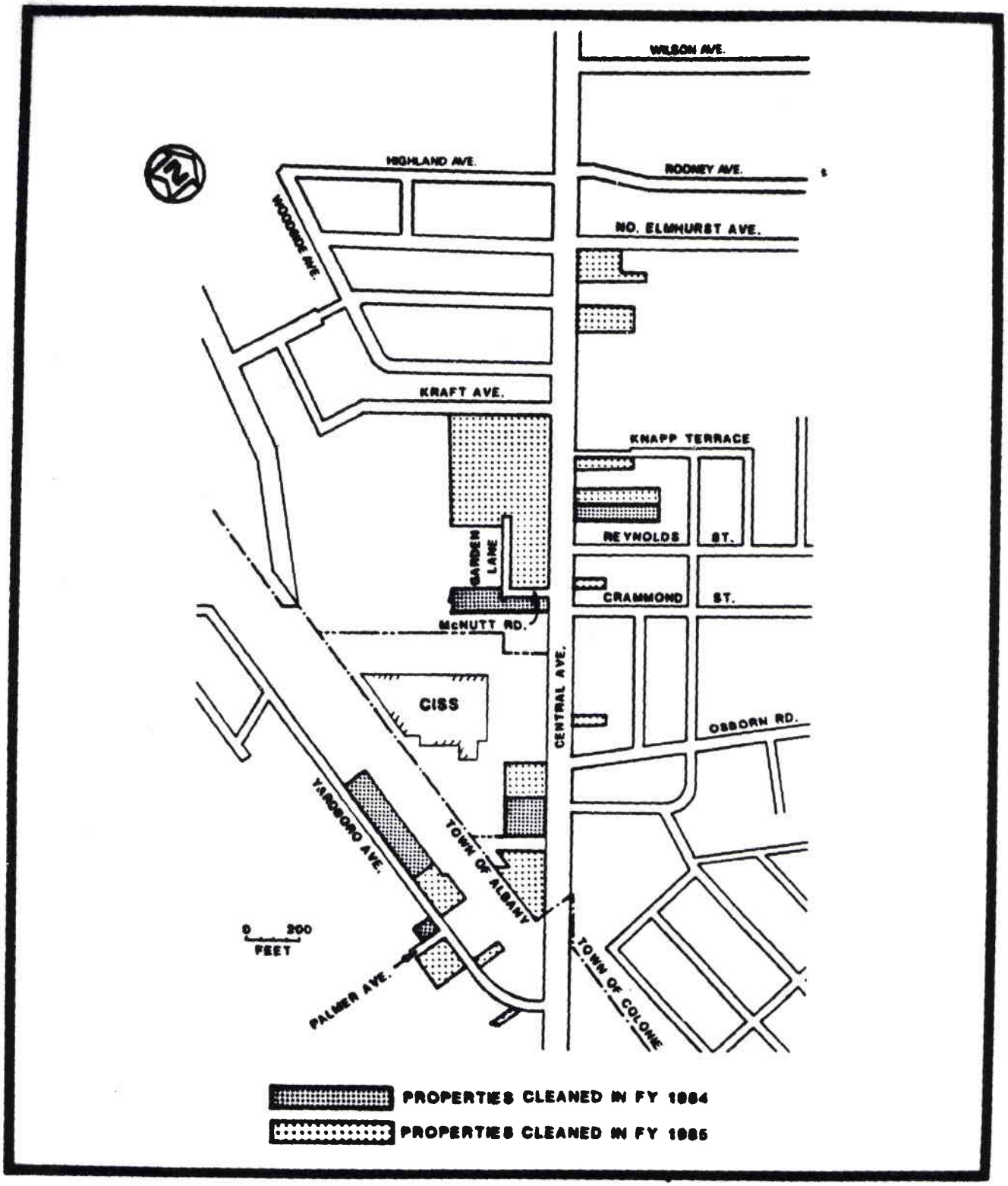

FIGURE 1-1 MAP OF THE CISS AND VICINITY PROPERTIES

2.0 SITE HISTORY

During the 1950s, National Lead (NL) Industries began manufacturing uranium products at its Colonie plant, operating under a license issued by the Atomic Energy Commission (AEC). Between 1958 and 1968, NL Industries held numerous AEC contracts for the fabrication of slightly enriched (in the uranium-235 isotope) uranium fuel elements and chemical processing of nonirradiated, slightly enriched uranium scrap (Refs. 2, 3, and 4).

After termination of the AEC contracts, work at the NL plant was limited to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium (Refs. 2, 3, and 4).

On February 15, 1980, the New York State Supreme Court issued an order temporarily restraining NL Industries from operating its Colonie facility on the basis that the facility emitted contaminants as airborne releases of uranium compounds. The temporary restraining order was amended on May 12, 1980, to allow NL Industries to continue operating on a limited basis. The amended order also required the company to initiate an independent investigation to assess all adverse environmental conditions in soils and on properties in the vicinity of the facility that might have been caused by the airborne discharge of radioactive particulates from the plant. Operations at the plant were halted in the spring of 1984 (Refs. 2, 3, and 4).

In 1984, Congress passed the 1984 Energy and Water Appropriations Act, which authorized DOE to conduct a decontamination research and development project at four sites, including the site of the former NL Industries plant and its vicinity properties. The act was reauthorized in 1985. DOE took possession of the plant in 1984 to begin the cleanup process. The Colonie Interim Storage Site (CISS) was developed by DOE on the NL site located in the Town of Colonie, New York, at 1130 Central Avenue. It is approximately 4 mi northwest of downtown Albany and about 3 mi southeast of Colonie.

Central Avenue runs along the northeastern side of the CISS property; the Conrail main line and a railroad siding border it on the southern side. Residential properties lie beyond the railroad. Most of the 11.2-acre CISS is occupied by the former NL Industries, Inc. property and buildings formerly used to manufacture a variety of products from depleted uranium. The remaining 2 acres of the site, donated to DOE by the Niagara Mohawk Power Corporation in 1985, lie to the west of the original property. Land use in the vicinity of the CISS is primarily commercial and residential. Most of the radioactive contamination on the vicinity properties is from airborne releases of uranium from the processing operations at the plant. Figure 1-1 shows the locations of the vicinity properties decontaminated in 1984 and 1985 (Refs. 2, 3, and 4).

3.0 SITE DESCRIPTION

The properties discussed in this report are referred to as either 1984 properties or 1985 properties. These properties are described briefly below.

3.1 PROPERTIES DECONTAMINATED IN 1984

Remedial action was performed on seven properties located just south of the NL building along Yardboro and Palmer Avenues within the limits of the City of Albany, New York. Four other properties are located just northwest of the NL building along Central Avenue within the limits of the Town of Colonie. Of these properties, nine are residential, and two are commercial. These properties are:

1114 Central Avenue
1144 Central Avenue
1144A Central Avenue
1159 Central Avenue
33 Palmer Avenue
27/29 Yardboro Avenue
52 Yardboro Avenue
68 Yardboro Avenue
74 Yardboro Avenue
78 Yardboro Avenue
80 Yardboro Avenue

3.2 PROPERTIES DECONTAMINATED IN 1985

Remedial action was performed on seven properties located south of the NL plant along Yardboro and Palmer Avenues within the limits of the City of Albany, New York. The other 17 are located east, northeast, and northwest of the NL building along Central Avenue and Garden Lane within the limits of the Town of Colonie. Fifteen of these properties are residential, and nine are commercial. These properties are:

1100 Central Avenue
1104 Central Avenue
1118 Central Avenue
1129 Central Avenue
1146 Central Avenue
1147 Central Avenue
1148 Central Avenue
1166 Central Avenue
1167 Central Avenue
1168 Central Avenue
1170 Central Avenue
1185 Central Avenue
1195 Central Avenue
10 Garden Lane

4.0 RADIOLOGICAL HISTORY AND STATUS

4.1 RADIOLOGICAL SURVEYS

In 1980, Teledyne Isotopes was contracted by NL Industries to perform a radiological survey of the facility and its vicinity (Ref. 4); results indicated measurable deposition of radioactive contaminants on properties primarily to the northwest and southeast of the plant (i.e., in the directions of prevailing winds).

Beginning in October 1983, Oak Ridge National Laboratory (ORNL) began performing more detailed radiological surveys of the individual properties surrounding the NL plant (Refs. 4 through 39), which included residential and commercial properties. These surveys were performed to locate all properties on which uranium contamination exceeded DOE remedial action guidelines. BNI and its radiological support subcontractor, Eberline Analytical Corporation (EAC), later known as Thermo Analytical/Eberline (TMA/E), surveyed the properties again at the time of remedial action to more accurately define the boundaries of contamination.

By August 1985, ORNL had completed radiological surveys of 67 residential properties in the vicinity of the former NL plant. Of these, 36 were designated as requiring remedial action (Refs. 40, 41, and 42). Remedial action was performed on 11 of these properties in 1984, and on 24 properties in 1985. The one remaining property is a vacant lot adjacent to the CISS; it will be decontaminated when remedial action is conducted at the CISS.

4.2 REMEDIAL ACTION GUIDELINES

The radiological guidelines determined by DOE to be applicable to cleanup of radioactive materials at the CISS are summarized below.

These site-specific guidelines were developed by DOE and New York State officials and were reviewed by the U.S. Environmental Protection Agency (EPA) (Ref. 43).

1158 Central Avenue
1161 Central Avenue
1160 Central Avenue
1161 Central Avenue
1160/1162 Central Avenue

7 Palmer Avenue
5 Yardboro Avenue
24 Yardboro Avenue
25/27 Yardboro Avenue
50 Yardboro Avenue

4.0 RADIOLOGICAL HISTORY AND STATUS

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The site-specific remedial action guidelines for the Colonie vicinity properties are:

- Soil contaminated with depleted uranium will be removed if concentrations exceed 35 pCi/g when averaged over the top 2 in. of soil and a 1076-ft^2 area.
- Any contaminated area exceeding 100 pCi of depleted uranium per gram of soil averaged over the top 2 in. of soil and 10 ft^2 will be removed.
- At depths greater than 2 in., the criteria are numerically the same; however, concentrations will be averaged over a 6-in. depth.
- For contamination of surfaces such as roofs and asphalt, remedial action will be conducted if the beta-gamma measurement averaged over 10 ft^2 exceeds 0.2 mrad/h, or if the maximum exposure rate in any 1076-ft^2 area exceeds 1.0 mrad/h.

The guidelines also allow for some flexibility through the use of supplemental standards, which may be used for areas where the standard guidelines are not appropriate. If review, on a case-by-case basis, determines that the area meets the DOE basic whole-body dose limit of 100 mrem/yr, the area may still be released for use without radiological restrictions.

Supplemental guidelines have been established for portions of two of the subject properties: 1104 Central Avenue (Ref. 44) and 50 Yardboro Avenue (Ref. 45). Both of these properties have structures with portions of the roofs that are above standard remedial action guidelines. During the development of the supplemental standards, three conservative exposure scenarios were evaluated: (1) exposure to a worker repairing the roof, (2) exposure to an individual working full-time inside the building, and (3) exposure to a resident who turns the roof into rubble, mixes the rubble with soil, and eats food from the garden grown in the contaminated soil. Calculations indicated that the most significant exposure scenario was the exposure to an individual working full time inside the building. However, for all scenarios, the calculated whole-body dose was less than 10 mrem, which is less than the DOE standard of 100 mrem/yr.

The methodology used to determine radiation doses received from various pathways and the associated calculations are presented in References 46 and 47.

Table 4-1 summarizes the DOE remedial action guidelines; the complete guidelines are provided in Appendix A. The document containing FUSRAP design criteria also contains additional information regarding federal regulations (Ref. 48).

4.3 POST-REMEDIAL ACTION STATUS

As shown in the post-remedial action reports for the subject properties (Refs. 49 and 50), the samples taken after removing the radioactive soil show that there is no area where radioactive contamination exists that exceeds the supplemental guidelines or the remedial action guideline of 35 pCi/g for uranium (when averaged over a 1076-ft^2 area) agreed upon by the State of New York and DOE. The remedial action performed by BNI on the properties discussed in this report has been independently reviewed by the Oak Ridge Associated Universities Radiological Site Assessment Program. The purpose of this review was to verify the data supporting the adequacy of the remedial action and to confirm that the site is in compliance with applicable remedial action guidelines.

Based on all data collected, these properties conform to all applicable radiological guidelines established for release of these properties (Refs. 49 through 54).

In addition to the surveys that have been performed on behalf of DOE, measures have been taken by the New York State officials to monitor remedial action activities. These measures include observing on-site operations and procedures, and analyzing archived soil samples.

TABLE 4-1

REMEDIAL ACTION GUIDELINES FOR STRUCTURE SURFACES

Indoor/Outdoor Structure Surface Contamination

Radionuclide[b]	Allowable Surface Residual Contamination[a] (dpm/100 cm^2) Average[c,d]	Maximum[c,e]	Removable[c,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
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]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.

[b]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.

[c]Measurements of average contamination 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.

[d]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.

[e]The maximum contamination level applies to an area of not more than 100 cm^2.

[f]The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, measuring the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of surface area less than 100 cm^2 is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. The numbers in this column are maximum amounts.

5.0 SUMMARY OF REMEDIAL ACTION

The following subsections briefly describe the remedial action process and measures taken to protect the public and the environment.

5.1 PRE-REMEDIAL ACTION ACTIVITIES

Based on the ORNL survey results (Refs. 4 through 39), DOE designated the subject properties for remedial action (Refs. 40, 41, and 42), i.e., if radionuclide concentrations exceeded applicable guidelines, contamination was to be removed from the properties until the concentrations were within the guideline values.

An Action Description Memorandum (ADM) was prepared by Argonne National Laboratory (ANL) describing the need for remedial action, and the remedial action required (Refs. 2, 3, and 55).

BNI began engineering design work and with its radiological support subcontractor, TMA/E, surveyed the properties to more accurately define the boundaries of the contamination.

Before BNI performed remedial action, access agreements had to be obtained from individual property owners to allow authorized entry to the property and permission to do the work. These agreements, termed Memo Agreements, granted DOE and its contractors the right to perform the remedial action. It also stated the scope of work, DOE responsibilities, and the plan to restore the properties to an "as was" condition. Concurrently, BNI continued engineering design work and related activities to hire local subcontractors to perform the cleanup work (Refs. 56 and 57).

5.2 DECONTAMINATION ACTIVITIES

After the access agreements had been reached, the design work completed, and a subcontract awarded, the local subcontractor began work. Drawings showing the extent of the contamination in the soil

on each property were then given to the excavation subcontractor hired to perform the work. The subcontractor removed the soil as indicated in the drawings, placed it in covered boxes, and transported it to the former NL plant, where it is being stored until a final disposal site is selected.

For most excavations, less than 3 in. of soil was removed. The uranium released while the plant was operating was insoluble (i.e., would not dissolve in water) and deposited in the top few inches of the soil. In a few cases, excavation was slightly deeper because the uranium had washed deeper into the soil around roots of trees and shrubs. The volumes of material removed during the 1984 and 1985 remedial action activities were 618 yd^3 and 281 yd^3, respectively. During excavation, the subcontractor was required to keep all areas free from dust and to avoid spilling the contaminated soil onto any clean areas. Personnel trained in radiation protection observed all activities to ensure that safety procedures were followed.

To comply with applicable guidelines, removal of some material other than soil was also required. Decontamination activities in 1984 included the removal of tar paper from one flat roof, scabbling of asphalt on two properties, removal of a stone driveway, and replacement of a wooden door to a coal chute. In 1985, decontamination included vacuuming of asphalt, scabbling of asphalt on two properties, and cleaning and replacing gutters on seven properties. The figures in the post-remedial action reports (Refs. 49 and 50) indicate the remedial action at each of the properties. These figures are also presented in Exhibit III.

Excavated material was placed in covered boxes to prevent the spread of contamination to work areas and haul routes, and was transported to the CISS. The haul trucks used to transport the radioactive material were surveyed for radioactive contamination after depositing each load of contaminated material was deposited. The trucks were decontaminated as necessary before being permitted on any public road. This procedure ensured that no contamination was

brought back onto roads or to the properties. Using this combination of procedures, the subcontractor controlled the contamination and prevented its spread outside controlled areas.

Air sampling was performed to demonstrate compliance with DOE standards for airborne radioactivity. Samples were collected by pulling large quantities of air through a filter. Airborne dust that could contain radioactive materials was captured by the filter, which was then removed and analyzed for radioactivity. Because the amount of air drawn through the filter is known, the concentration of radioactivity in the air can be calculated.

Air monitoring showed that airborne uranium concentrations were below DOE radiation protection guidelines for members of the general public. The DOE standard is 5×10^{-12} pCi/ml (see Appendix A). There were 58 measurements taken. The measured uranium concentrations ranged from 0.0007×10^{-12} to 0.8×10^{-12} pCi/ml.

After the radioactively contaminated materials were removed, the properties were restored according to the conditions of the access agreements. This included backfilling the excavated areas with clean fill material. If shrubbery or trees were removed during the remedial action, they were replaced (or other arrangements were made with the individual property owners). In some cases, removing the contamination necessitated alterations to buildings, fences, or pavement. If this occurred, the affected structures were restored.

Personnel trained in radiation protection observed all operations to ensure that established safety procedures were followed. These procedures were designed to minimize the exposure of workers and residents.

5.3 POST-REMEDIAL ACTION SAMPLING

After the contaminated material was removed, another radiological

survey was conducted to ensure that the property had been adequately decontaminated (i.e., no uranium concentrations existed in excess of 35 pCi/g). This survey used two techniques. First, the excavated areas were scanned with a Field Instrument for Detecting Low Energy Radiation (FIDLER). If FIDLER readings indicated remaining contamination, more soil was removed until FIDLER readings indicated levels below 35 pCi/g. Soil samples were taken after the FIDLER scan, were analyzed by the TMA/E laboratory, and showed contamination levels below 35 pCi/g.

For those cases where surfaces other than soil required remedial action, the pancake beta-gamma detector was used to perform another survey after removal of the contaminated surface. If no additional contamination in excess of DOE guidelines was found, the surface was restored (when necessary).

In addition to the sampling performed by BNI for DOE, New York State officials performed an independent survey of some properties as they were cleaned.

5.4 VERIFICATION ACTIVITIES

The independent verification contractor (IVC) is responsible for preparing a generic plan outlining the procedures to be used during verification activities. The IVC may conduct two types of verification reviews, Type A or B, at a site or group of properties. Type A verification reviews include reviews of the remedial action data and of radiological contractors' data and possibly analyses of some samples. Type B verification reviews include an on-site visit and a survey involving direct measurements and sampling and/or split sample analyses. The IVC may increase or decrease the scope of the verification survey on the basis of field data.

Following the verification reviews, the IVC prepares a verification report and submits it to DOE. In addition to the surveys that have been performed on behalf of DOE, measures have been taken by New

York State officials to monitor remedial action activities. These measures include observing on-site operations and procedures, and analyzing archived soil samples.

5.5 PUBLIC AND OCCUPATIONAL EXPOSURES

5.5.1 Public Exposure

The radiological exposure to the residents following remedial action on each of the vicinity properties is less than 100 mrem/yr above the background radiation level. This is true for the total dose from all pathways.

5.5.2 Occupational Exposure

During the period January 1, 1984, through December 31, 1985, a total of 35 employees working at the CISS and its vicinity properties were monitored for exposure to beta-gamma radiation. Monitoring results measured from thermoluminescent dosimeters (TLDs) indicated that 26 employees (about 75 percent) received no measurable exposures over their entire working period. Of the remaining nine employees who received measureable doses, only one received a dose exceeding 100 mrem/yr. The other doses were less than 30 mrem/yr. These doses were well below the annual limit of 5,000 mrem/yr established by DOE for occupational workers (Ref. 58). In fact, the highest dose received, 176 mrem/yr, is less than 3.6 percent of this annual limit.

The data shown in Table 5-1 reflect the number of employees in each dose range for the monitoring period. The average dose received by the employees during the working period was approximately 8 mrem.

5.6 COST

The final subcontract bid item quantities and costs for the remedial action conducted in 1984 are given in Table 5-2. Table 5-3 provides this information for the 1985 remedial action.

TABLE 5-1

EXPOSURE DATA FOR CISS VICINITY PROPERTIES

January 1, 1984, through December 31, 1985

Number of Employees	Dose Range (mrem)
26	0
7	1 to 20
1	20 to 30
1	$\geq$100[a]

[a]Highest annual dose received was 176 mrem.

TABLE 5-2

REMEDIAL ACTION COSTS FOR THE CISS VICINITY PROPERTIES DECONTAMINATED IN 1984

Description	Final Quantity	Unit Price ($)	Final Amount ($)
Mobilization	ls[a]	$ 1,000.00	$ 1,000.00
Furnish and install vehicle decon facility	ls	31,000.00	31,000.00
Operate vehicle decontamination facility	ls	2,500.00	2,500.00
Traffic control	ls	2,500 00	2,500.00
Crushed stone paving	ls	7,000.00	7,000.00
Clearing Central Avenue	ls	3,000.00	3,000.00
Excavate contaminated material - Central Avenue	ls	13,245.00	13,245.00
Topsoil - Central Avenue	ls	4,908.00	4,908.00
Grass establishment - Central Avenue	ls	2,000.00	2,000.00
Demobilization	ls	1,000.00	1,000.00
Excavation - Yardboro and Palmer Avenues	1,357 yd^2	10.00	13,570.00
Topsoil - Yardboro and Palmer Avenues	130 yd^3	20.00	2,600.00
Grass establishment - Yardboro and Palmer Avenues	1,287 yd^2	3.00	3,861.00
Hot spot excavation	200 yd^3	65.00	13,000.00
Repair fire protection water valve	ls	750.00	750.00
Elect. work/additional security lighting	ls	7,200.00	7,200.00
Hook up 6,000-gallon septic tank	ls	935.00	935.00
Move stockpiled soil at 1144A Central Avenue	60 yd^3	50.00	3,000.00

TABLE 5-2

(Continued)

Description	Final Quantity	Unit Price ($)	Final Amount ($)
Removal of trees 3-in. diameter and larger	ls	1,300.00	1,300.00
Clearing - Yardboro and Palmer Avenues	0	.40/ft^2	-0-
Clear, excavate, and backfill 1114 and 1159 Central Avenue	ls	6,122.00	6,122.00
Remove contamination from asphalt	ls	2,000.00	2,000.00
Remove contaminated roof at 1114 Central Avenue	ls	1,000.00	1,000.00
Sonotubes in Bay 4	10 ea	110.00	1,100.00
Power Pole at Decontamination Facility	ls	1,505.00	1,505.00
3-Man survey crew	138.5 h	56.00	7,756.00
Office work	368.75 h	34.00	12,537.50
Crew Chief office work	9 days	24.50	220.50
Travel time 3-man crew	22 trips	5.00	110.00
Title search	$250.00	Actual Cost	250.00
		Total:	$146,969.00

[a]Lump sum is abbreviated as "ls."

TABLE 5-3

REMEDIAL ACTION COSTS FOR THE CISS VICINITY PROPERTIES DECONTAMINATED IN 1985

Description	Final Quantity	Unit Price ($)	Final Amount ($)
Mobilization	ls[a]	$12,186.00	$ 12,186.00
Assembly of op. veh. vehicle wash facility	ls	3,500.00	3,500.00
Stockpile preparation and development	ls	8,000.00	8,000.00
Medical examinations	ls	3,000 00	3,000.00
Demobilization	ls	2,000.00	2,000.00
Chain-link fence	ls	4,500.00	4,500.00
Contaminated soil excavation 0-3"	2,888 yds^2	10.00	28,880.00
Contaminated soil excavation 3"	35 yd^3	70.00	2,450.00
Backfill	35 yd^3	25.00	875.00
Crushed stone surface	144 tons	30.00	4,320.00
Asphalt surface scabbling	153 yd^2	10.00	1,530.00
Asphalt removal	-	5.00	-
Asphalt surfacing	-	75.00	-
Topsoil	1,826 yd^2	2.00	3,652.00
Sodding	1,745 yd^2	3.25	5,671.25
Landscaping	-	50.00	-
Move shelving	ls	434.00	434.00
Decontaminate gutters	200 lf	6.00	1,200.00
Remove trees	ls	250.00	250.00
Sweep/vacuum asphalt	ls	351.00	351.00
Move overburden	ls	975.00	975.00
Move pipe, engine, parts, and replace - 50 Yardboro	ls	375.00	375.00

TABLE 5-3

(Continued)

Description	Final Quantity	Unit Price ($)	Final Amount ($)
Asphalt sealant in lieu of asphalt surfacing	153 yd^2	5.30	810.90
3-Man survey crew	59 h	59.92	3,535.28
Office work	197.5 h	36.38	7,185.05
Crew Chief office work	12 days	26.21	314.52
Travel time - crew	13 trips	5.35	69.55
2-Man survey crew	24.5 h	40.14	983.43
Title search	159.00	Not to exceed $400.00	159.00
		Total:	$97,206.98

REFERENCES

1. U.S. Department of Energy. Description of the Formerly Utilized Sites Remedial Action Program, ORO-777, Oak Ridge, TN, September 1980.

2. Argonne National Laboratory. Action Description Memorandum, Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site, Argonne, IL, June 5, 1984.

3. Argonne National Laboratory. Action Description Memorandum (ADM) Revision: Proposed 1984 Remedial Actions at Colonie, New York, Argonne, IL, June 5, 1984.

4. Teledyne Isotopes. A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Westwood, NJ, October 31, 1980.

5. Oak Ridge National Laboratory. Results of the Radiological Survey at 1100 Central Avenue, Colonie, New York (AL041), ORNL/RASA-84/293, Oak Ridge, TN, July 1985.

6. Oak Ridge National Laboratory. Results of the Radiological Survey at 1104 Central Avenue, Colonie, New York (AL042), ORNL/RASA-84/294, Oak Ridge, TN, July 1985.

7. Oak Ridge National Laboratory. Results of the Radiological Survey at 1114 Central Avenue (included in report for 1118 Central Avenue), Colonie, New York (AL022), ORNL/RASA-84/225, Oak Ridge, TN, June 1985.

8. Oak Ridge National Laboratory. Results of the Radiological Survey at 1118 Central Avenue, Colonie, New York (AL022), ORNL/RASA-84/225, Oak Ridge, TN, June 1985.

9. Oak Ridge National Laboratory. Results of the Radiological Survey at 1129 Central Avenue, Colonie, New York (AL043), ORNL/RASA-84/295, Oak Ridge, TN, July 1985.

10. Oak Ridge National Laboratory. Results of the Radiological Survey at 1144 Central Avenue, Colonie, New York (AL010), Oak Ridge, TN, March 1984.

11. Oak Ridge National Laboratory. Results of the Radiological Survey at 1144A Central Avenue, Colonie, New York (AL011), Oak Ridge, TN, March 1984.

12. Oak Ridge National Laboratory. Results of the Radiological Survey at 1146 Central Avenue, Colonie, New York (AL024), ORNL/RASA-84/227, Oak Ridge, TN, July 1985.

13. Oak Ridge National Laboratory. Results of Radiological Survey at 1147 Central Avenue, Colonie, New York (AL034), ORNL/RASA-84/286, Oak Ridge, TN, July 1985.

14. Oak Ridge National Laboratory. Results of the Radiological Survey at 1148 Central Avenue - Front, Colonie, New York (AL025), ORNL/RASA-84/228, Oak Ridge, TN, June 1985.

15. Oak Ridge National Laboratory. Results of the Radiological Survey at 1150 Central Avenue, Colonie, New York (AL026), ORNL/RASA-84/229, Oak Ridge, TN, June 1985.

16. Oak Ridge National Laboratory. Results of the Radiological Survey at 1152 Central Avenue, Colonie, New York (AL027), ORNL/RASA-84-230, Oak Ridge, TN, June 1985.

17. Oak Ridge National Laboratory. Results of the Radiological Survey at 1159 Central Avenue, Colonie, New York (AL028), ORNL/RASA-84/231, Oak Ridge, TN, June 1985.

18. Oak Ridge National Laboratory. Results of the Radiological Survey at 1160 Central Avenue, Colonie, New York (AL021), ORNL/RASA-84/224, Oak Ridge, TN, June 1985.

19. Oak Ridge National Laboratory. Results of the Radiological Survey at 1160/1162 Central Avenue, Colonie, New York (AL020), ORNL/RASA-84/223, Oak Ridge, TN, July 1985.

20. Oak Ridge National Laboratory. Results of the Radiological Survey at 1163/1161 Central Avenue, Colonie, New York (AL056), ORNL/RASA-85/11, Oak Ridge, TN, July 1985.

21. Oak Ridge National Laboratory. Results of the Radiological Survey at 1166 Central Avenue, Colonie, New York (AL053), ORNL/RASA-85/8, Oak Ridge, TN, July 1985.

22. Oak Ridge National Laboratory. Results of the Radiological Survey at 1167 Central Avenue, Colonie, New York (AL054), ORNL/RASA-85/9, Oak Ridge, TN, September 1986.

23. Oak Ridge National Laboratory. Results of the Radiological Survey at 1168 Central Avenue, Colonie, New York (AL052), ORNL/RASA-85/7, Oak Ridge, TN, July 1985.

24. Oak Ridge National Laboratory. Results of the Radiological Survey at 1170 Central Avenue, Colonie, New York (AL051), ORNL/RASA-85/6, Oak Ridge, TN, July 1985.

25. Oak Ridge National Laboratory. Results of the Radiological Survey at 1185 Central Avenue, Colonie, New York (AL032), ORNL/RASA-84/284, Oak Ridge, TN, July 1985.

26. Oak Ridge National Laboratory. Results of the Radiological Survey at 1195 Central Avenue, Colonie, New York (AL065), ORNL/RASA-85/20, Oak Ridge, TN, June 1986.

27. Oak Ridge National Laboratory. Results of the Radiological Survey at 10 Garden Lane (included in report for 1148 Central Avenue - Rear), Colonie, New York (AL023), ORNL/RASA-84/228, Oak Ridge, TN, June 1985.

28. Oak Ridge National Laboratory. Results of the Radiological Survey at 7 Palmer Avenue, Albany, New York (AL017), ORNL/RASA-84/96, Oak Ridge, TN, June 1985.

29. Oak Ridge National Laboratory. Results of the Radiological Survey at 33 Palmer Avenue, Albany, New York (AL006), Oak Ridge, TN, March 1984.

30. Oak Ridge National Laboratory. Results of the Radiological Survey at 5 Yardboro Avenue, Albany, New York (AL031), ORNL/RASA-84/283, Oak Ridge, TN, July 1985.

31. Oak Ridge National Laboratory. Results of the Radiological Survey at 24 Yardboro Avenue, Albany, New York (AL019), ORNL/RASA-84/222, Oak Ridge, TN, June 1985.

32. Oak Ridge National Laboratory. Results of the Radiological Survey at 25/27 Yardboro Avenue, Albany, New York (AL016), ORNL/RASA-84/112, Oak Ridge, TN, June 1985.

33. Oak Ridge National Laboratory. Results of the Radiological Survey at 27/29 Yardboro Avenue, Albany, New York (AL012), March 1984.

34. Oak Ridge National Laboratory. Results of the Radiological Survey at 50 Yardboro Avenue, Albany, New York (AL013), ORNL/RASA-84/111, Oak Ridge, TN, June 1985.

35. Oak Ridge National Laboratory. Results of the Radiological Survey at 52 Yardboro Avenue, Albany, New York (AL005), Oak Ridge, TN, March 1984.

36. Oak Ridge National Laboratory. Results of the Radiological Survey at 68 Yardboro Avenue, Albany, New York (AL004), Oak Ridge, TN, March 1984.

37. Oak Ridge National Laboratory. Results of the Radiological Survey at 74 Yardboro Avenue, Albany, New York (AL003), Oak Ridge, TN, March 1984.

38. Oak Ridge National Laboratory. Results of the Radiological Survey at 78 Yardboro Avenue, Albany, New York (AL001), Oak Ridge, TN, March 1984.

39. Oak Ridge National Laboratory. Results of the Radiological Survey at 80 Yardboro Avenue, Albany, New York (AL002), Oak Ridge, TN, March 1984.

40. Letter, F.E. Coffman, Director, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, Department of Energy Headquarters, to J. LaGrone, Manager, Oak Ridge Operations Office, Department of Energy. "Authorization to Conduct Remedial Action at Vicinity Properties in Colonie, New York," September 28, 1984.

41. Letter, J.E. Baublitz, Acting Director, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, to Distibution. "Authorization to Conduct Remedial Action," June 24, 1985.

42. Memorandum, E.G. DeLaney, FUSRAP/Surplus Facilities Group, Division of Remedial Action Projects, to E.L. Keller, Director, Technical Services Division, Oak Ridge Operations Office. "Colonie Vicinity Property Decontamination; Guidance for First Group of Properties," April 30, 1984.

43. Letter, W.J. Condon, Bureau of Environmental Radiation Protection, New York Department of Health, to L. Campbell, Oak Ridge Operations Office, Department of Energy. February 9, 1984.

44. Memorandum, J. J. Fiore, Director of Facility and Site Decommissioning, Office of Nuclear Energy, Department of Energy, to B. D. Walker, Acting Director, Technical Services Division, Oak Ridge Operations office, Department of Energy, "Approval of Supplemental Limits for Roof of the Commercial Building at 1104 Central Avenue, Colonie, New York (Colonie Vicinity Property AL042)" May 15, 1989.

45. Memorandum, J. J. Fiore, Director of Facility and Site Decommissioning, Office of Nuclear Energy, Department of Energy, to B. D. Walker, Acting Director, Technical Services Division, Oak Ridge Operations Office, Department of Energy, "Approval of Supplemental Limits for Roof of the Commercial Building at 50 Yardboro Avenue, Colonie, New York (Colonie Vicinity Property AL013)" May 17, 1989.

46. Bechtel National, Inc. Hazard Assessment for Radioactive Contamination on the Roof of the Commercial Building at 1104 Central Avenue in Colonie, New York, Oak Ridge, TN, May 1989.

47. Bechtel National, Inc. Hazard Assessment for Radioactive Contamination on the Roof of the Commercial Building at 50 Yardboro Avenue in Colonie, New York, Oak Ridge, TN, May 1989.

48. U.S. Department of Energy. Design Criteria for Formerly Utilized Sites Remedial Action Program (FUSRAP) and Surplus Facilities Management Program (SFMP), 14501-00-DC-01, Rev. 2, Oak Ridge, TN, March 1986.

49. Bechtel National, Inc. Post-Remedial Action Report for the Colonie Interim Storage Site Vicinity Properties - 1984, DOE/OR/20722-72, Oak Ridge, TN, March 1986.

50. Bechtel National, Inc. Post-Remedial Action Report for the Colonie Interim Storage Site Vicinity Properties - 1985, DOE/OR/20722-92, Oak Ridge, TN, March 1988.

51. Oak Ridge Associated Universities. Verification of 1984 Remedial Action Vicinity Properties Colonie Interim Storage Site, Colonie, New York, Oak Ridge, TN, April 1986.

52. Oak Ridge Associated Universities. Verification of 1985 Remedial Action Vicinity Properties Colonie Interim Storage Site, Colonie, New York, Oak Ridge, TN, November 1986.

51. Letter, J.D. Berger, Manager, Radiological Assessment Program, Oak Ridge Associated Universities, to E.G. DeLaney, Director, Division of Facilities and Site Decommissioning Projects, Office of Nuclear Energy, Department of Energy Headquarters. "Independent Verification - 1984 Remedial Action of Colonie Vicinity Properties: Colonie, New York," February 26, 1986.

52. Letter, J.D. Berger, Manager, Radiological Assessment Program, Oak Ridge Associated Universities, to E.G. DeLaney, Director, Division of Facilities and Site Decommissioning Projects, Office of Nuclear Energy, Department of Energy Headquarters. "Independent Verification - 1985 Remedial Action of Colonie Vicinity Properties: Colonie, New York," November 21, 1986.

53. Memorandum, F.E. Coffman, Director, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, to NE-24 Distribution. "Review of Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site Relative to NEPA Requirements," June 25, 1984.

54. U.S. Department of Energy. Remedial Action Work Plan for the Colonie Site, ORO-847, Oak Ridge, TN, June 1984.

55. U.S. Department of Energy. Remedial Action Work Plan for the Colonie Site, ORO-847, Revision 1, August 1985.

56. U.S. Department of Energy. Environmental Protection, Safety and Health Protection Program for DOE Operations, Chapter XI, "Requirements for Radiation Protection, DOE Order 5480.A, August 13,1981.

GLOSSARY

Alpha-emitting - See radiation.

Background Radiation - Background radiation refers to naturally occurring radiation emitted from either cosmic (i.e., from the sun) or terrestrial (i.e., from the earth) sources. Exposure to this type of radiation is unavoidable, and its level varies greatly depending on geographic location; e.g., New Jersey typically receives 100 mrem/yr, Colorado receives about 300 mrem/yr, and some areas in South America receive up to 7000 mrem/yr. Naturally occurring terrestrial radionuclides include uranium, radium, potassium, thorium, etc. These dose levels do not include the concentrations of naturally occurring radon inside buildings.

Beta-gamma-emitting - See radiation.

Centimeter - A centimeter is a metric unit of measurement for length; 1 inch is equal to 2.54 centimeters; 1 foot is equal to approximately 30 centimeters.

Contamination - Contamination is used generally to mean a concentration of radioactive materials in the soil exceeding naturally occurring levels. Contamination may or may not exceed the DOE cleanup levels.

Counts per minute - A count is the unit of measurement registered by a radiation detection instrument when radiation imparts its energy within the sensitive range of the detector probe. The number of counts registered per minute can be related to the number of disintegrations per minute occurring from a radioactive material.

Disintegrations per minute - Disintegrations per minute is the measurement indicating the amount of radiation being released from a substance per minute. See the definition of picocurie.

Dose - Dose as used in this report is actually dose equivalent and is used to relate absorbed dose (mrad) to an effect on the body. Dose is measured in mrem. Examples of dose are: a dose of 500,000 mrem to the whole body in a short time causes death in 50 percent of the people who receive it; a dose of 5,000,000 mrem may be delivered to a cancerous tumor during radiation treatment; normal background radiation results in an annual dose of about 100 mrem; DOE radiation protection standards limit the dose to members of the general public to 100 mrem/yr above background levels; living in a brick house results in a dose of about 75 mrem/yr above background.

Exposure rate - Exposure rate is the rate at which radiation imparts energy to the air. Exposure is typically measured in microroentgens (uR), and the exposure rate is typically given as uR/h. The dose to the whole body can be approximated by multiplying the exposure rate by the number of hours of exposure. For example, if an individual were exposed to gamma radiation at a rate of 20 uR/h for 168 hours per week (continuous exposure) for 52 weeks per year, the whole-body dose would be 170 mrem.

Gamma Radiation - See radiation.

Gram - A gram is a metric unit for weight. It takes 454 grams to make 1 pound; 1 ounce equals 28 grams.

Meter - A meter is a metric unit of measurement for length; 1 meter is equal to approximately 39 inches.

Microcurie - A microcurie (uCi) is 1,000,000 picocuries (see picocuries for additional explanation).

Microroentgens - Microroentgens (uR) is a unit used to measure radiation exposure. For further information, see the definition of radiation exposure.

Milliliter - A milliliter (ml) is a metric unit of measure for volume. There are 3,785 ml in 1 gallon.

Millirad - Millirad is a measure of the amount of energy imparted by radiation to a unit of mass. An absorbed dose rate is expressed in terms of mrad/h.

Millirem - Millirem is the unit used to measure radiation doses to man. The DOE limit is 100 mrem above background radiation levels in any one year for members of the general public. Naturally occurring radioactive substances in the ground result in a yearly exposure to everyone of about 100 mrem. To date, no difference can be detected in the health of population groups exposed to 100 mrem/yr above background and in the health of groups who are not exposed.

Picocuries - A picocurie is the unit of measure for radioactivity just as an ounce is a unit to measure weight. One picocurie means that one radioactive particle is released on the average of every 27 seconds.

Radium-226 - Radium-226 is a naturally occurring, radioactive material that spontaneously emits alpha radiation.

Radiation - There are three primary types of radiation: alpha, beta, and gamma. Alpha radiation travels less than an inch in air before it stops. Alpha radiation cannot penetrate the outer layer of skin on the body. Beta radiation can penetrate the outer layers of skin but cannot reach the internal organs of the body. Gamma radiation is the most penetrating type and can usually reach the internal organs.

Radionuclide - A radionuclide is another word meaning a particular radioactive element. For example, uranium-235 is a radionuclide, uranium-238 is another, thorium-232 another, and so on.

Remedial action - Remedial action is a general term used to mean "cleanup of contamination that exceeds DOE guidelines." It refers to any action required so that a property can be released for use as noncontaminated. In practice, this may mean removing grass and

soil, cutting trees, removing asphalt, etc. Remedial action also includes restoring remediated properties to their original conditions, to the extent that this is possible.

Uranium - Uranium is a naturally occurring, radioactive element. The principal use of uranium -- when refined -- is for the production of fuel for nuclear reactors. Uranium in its natural form (as it exists at the three areas covered in this report) is not suitable for use as a fuel source.

APPENDIX A

U.S. DEPARTMENT OF ENERGY
GUIDELINES FOR RESIDUAL RADIOACTIVITY AT
FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM
AND
REMOTE SURPLUS FACILITIES MANAGEMENT PROGRAM SITES

U.S. DEPARTMENT OF ENERGY GUIDELINES FOR RESIDUAL RADIOACTIVE MATERIAL AT FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM AND REMOTE SURPLUS FACILITIES MANAGEMENT PROGRAM SITES

(Revision 2, March 1987)

A. INTRODUCTION

This document presents U.S. Department of Energy (DOE) radiological protection guidelines for cleanup of residual radioactive materials and management of the resulting wastes and residues. It is applicable to sites identified by the Formerly Utilized Sites Remedial Action Program (FUSRAP) and remote sites identified by the Surplus Facilities Management Program (SFMP).* The topics covered are basic dose limits, guidelines and authorized limits for allowable levels of residual radioactive material, and requirements for control of the radioactive wastes and residues.

Protocols for identification, characterization, and designation of FUSRAP sites for remedial action; for implementation of the remedial action; and for certification of a FUSRAP site for release for unrestricted use are given in a separate document (U.S. Department of Energy 1986) and subsequent guidance. More detailed information on applications of the guidelines presented herein, including procedures

* A remote SFMP site is one that is excess to DOE programmatic needs and is located outside a major operating DOE research and development or production area.

for deriving site-specific guidelines for allowable levels of residual radioactive material from basic dose limits, is contained in "A Manual for Implementing Residual Radioactive Material Guidelines" (U.S. Department of Energy 1987) referred to herein as the "supplement".

"Residual radioactive material" is used in these guidelines to describe radioactive materials derived from operations or sites over which the Department of Energy has authority. Guidelines or guidance to limit the levels of radioactive material to protect the public and environment are provided for: (1) residual concentrations of radionuclides in soil material, (2) concentrations of airborne radon decay products, (3) external gamma radiation level, (4) surface contamination levels, and (5) radionuclide concentrations in air or water resulting from or associated with any of the above.

A "basic dose limit" is a prescribed standard from which limits for quantities that can be monitored and controlled are derived; it is specified in terms of the effective dose equivalent as defined by the International Commission on Radiological Protection (ICRP 1977, 1978). The basic dose limits are used for deriving guidelines for residual concentrations of radionuclides in soil material. Guidelines for residual concentrations of thorium and radium in soil, concentrations of airborne radon decay products, allowable indoor external gamma radiation levels, and residual surface contamination concentrations are based on existing radiological protection standards or guidelines (U.S. Environmental Protection Agency 1983; U.S. Nuclear Regulatory Commission 1982; and Departmental Orders). Derived guidelines or limits based on the basic dose limits for those quantities are only used when the guidelines provided in the existing standards cited above are shown to be inappropriate.

A "guideline" for residual radioactive material is a level of radioactivity or of the radioactive material that is acceptable if the use of the site is to be unrestricted. Guidelines for residual radioactive material presented herein are of two kinds: (1) generic,

site-independent guidelines taken from existing radiation protection standards, and (2) site-specific guidelines derived from basic dose limits using site-specific models and data. Generic guideline values are presented in this document. Procedures and data for deriving site-specific guideline values are given in the supplement. The basis for the guidelines is generally a presumed worst case plausible scenario for a site.

An "Authorized Limit" is a level of residual radioactive material or radioactivity that must not be exceeded if the remedial action is to be considered completed and the site is to be released for unrestricted use. The Authorized Limit for a site will include limits for each radionuclide or group of radionuclides, as appropriate, associated with the residual radioactive material in the soil or in surface contamination of structures and equipment, and in the air or water, and, where appropriate, a limit on external gamma radiation resulting from the residual material. Under normal circumstances, expected to occur at most sites, Authorized Limits for residual radioactive material or radioactivity are set equal to guideline values. Exceptional conditions for which Authorized Limits might differ from guideline values are specified in Sections D and F. A site may be released for unrestricted use only if the conditions do not exceed the Authorized Limits or approved supplemental limits as defined in Section F.1 at the time remedial action is completed. Restrictions and controls on use of the site must be established and enforced if the site conditions exceed the approved limits, or if there is potential to exceed the dose limit if the site use was not restricted (Section F.2). The applicable controls and restrictions are specified in Section E.

DOE policy requires that all exposures to radiation be limited to levels that are as low as reasonably achievable (ALARA). For sites to be released for unrestricted use, the intent is to reduce residual radioactive material to levels that are as far below Authorized Limits as reasonable considering technical, economic, and social factors. At sites where the residual material is not reduced to levels that permit release for unrestricted use, ALARA policy is implemented by establishing controls to reduce exposure to levels that are as low as reasonably achievable. Procedures for implementing ALARA policy are discussed in the supplement. ALARA policies,

procedures, and actions shall be documented and filed as a permanent record upon completion of remedial action at a site.

B. BASIC DOSE LIMITS

The basic dose limit for the annual radiation dose received by an individual member of the general public is 100 mrem/year. The internal committed effective dose equivalent, as defined in ICRP Publication 26 (ICRP 1977) and calculated by dosimetry models described in ICRP Publication 30 (ICRP 1978), plus dose from penetrating radiation sources external to the body shall be used for determining the dose. This dose shall be described as the "Effective Dose Equivalent". Every effort shall be made to ensure that actual doses to the public are as far below the dose limit as is reasonably achievable.

Under unusual circumstances it will be permissible to allow potential doses to exceed 100 mrem/year where such exposures are based upon scenarios which do not persist for long periods and where the annual life time exposure to an individual from the subject residual radioactive material would be expected to be less than 100 mrem/year. Examples of such situations include conditions that might exist at a site scheduled for remediation in the near future or a possible, but improbable, one-time scenario that might occur following remedial action. These levels should represent doses that are as low as reasonably achievable for the site. Further, no annual exposure should exceed 500 mrem.

C. GUIDELINES FOR RESIDUAL RADIOACTIVE MATERIAL

C.1 Residual Radionuclides in Soil

Residual concentrations of radionuclides in soil shall be specified as above-background concentrations averaged over an area of 100 sq meters. Generic guidelines for thorium and radium are specified below. Guidelines for residual concentrations of other radionuclides shall be derived from the basic dose limits by means of an environmental pathway analysis using

site-specific data where available. Procedures for these derivations are given in the supplement.

If the average concentration in any surface or below surface area less than or equal to 25 sq meters exceeds the Authorized Limit or guideline by a factor of $(100/A)^{1/2}$, where A is the area of the elevated region in square meters, limits for "Hot Spots" shall also be applicable. These Hot Spot Limits depend on the extent of the elevated local concentrations and are given in the supplement. In addition, every reasonable effort shall be made to remove any source of radionuclide that exceeds 30 times the appropriate soil limit irrespective of the average concentration in the soil.

Two types of guidelines are provided, generic and derived. The generic guidelines for residual concentrations of the Ra-226, Ra-228, Th-230, and Th-232 are:

- 5 pCi/g, averaged over the first 15 cm of soil below the surface
- 15 pCi/g, averaged over 15-cm-thick layers of soil more than 15 cm below the surface

These guidelines take into account ingrowth of Ra-226 from Th-230 and of Ra-228 from Th-232, and assume secular equilibrium. If either Th-230 and Ra-226 or Th-232 and Ra-228 are both present, not in secular equilibrium, the appropriate guideline is applied as a limit to the radionuclide with the higher concentration. If other mixtures of radionuclides occur, the concentrations of individual radionuclides shall be reduced so that 1) the dose for the mixtures will not exceed the basic dose limit, or 2) the sum of the ratios of the soil concentration of each radionuclide to the allowable limit for that radionuclide will not exceed 1 ("unity"). Explicit formulas for calculating residual concentration guidelines for mixtures are given in the supplement.

C.2 Airborne Radon Decay Products

Generic guidelines for concentrations of airborne radon decay products shall apply to existing occupied or habitable structures on private property

that are intended for unrestricted use; structures that will be demolished or buried are excluded. The applicable generic guideline (40 CFR 192) is: In any occupied or habitable building, the objective of remedial action shall be, and a reasonable effort shall be made to achieve, an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 WL.* In any case, the radon decay product concentration (including background) shall not exceed 0.03 WL. Remedial actions by DOE are not required in order to comply with this guideline when there is reasonable assurance that residual radioactive materials are not the cause.

C.3 External Gamma Radiation

The average level of gamma radiation inside a building or habitable structure on a site to be released for unrestricted use shall not exceed the background level by more than 20 μR/h and shall comply with the basic dose limit when an appropriate use scenario is considered. This requirement shall not necessarily apply to structures scheduled for demolition or to buried foundations. External gamma radiation levels on open lands shall also comply with the basic dose limit considering an appropriate use scenario for the area.

C.4 Surface Contamination

The generic guidelines provided in the Table 1, Surface Contamination Guidelines are applicable to existing structures and equipment. These guidelines are adapted from standards of the U.S. Nuclear Regulatory

* A working level (WL) is any combination of short-lived radon decay products in one liter of air that will result in the ultimate emission of 1.3×10^5 MeV of potential alpha energy.

TABLE 1 SURFACE CONTAMINATION GUIDELINES

Radionuclides [2]	Allowable Total Residual Surface Contamination (dpm/100 cm^2) [1]		
	Average [3, 4]	Maximum [4, 5]	Removable [4, 6]
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 α	15,000 α	1,000 α
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above	5,000 β-γ	15,000 β-γ	1,000 β-γ

1 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 measured by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

2 Where surface contamination by both alpha- and beta-gamma-emitting radionuclides exists, the limits established for alpha- and beta-gamma-emitting radionuclides should apply independently.

3 Measurements of average contamination should not be averaged over an area of more than 1 m^2. For objects of less surface area, the average should be derived for each such object.

4 The average and maximum dose rates associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h and 1.0 mrad/h, respectively, at 1 cm.

5 The maximum contamination level applies to an area of not more than 100 cm^2.

6 The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and measuring the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of surface area less than 100 cm^2 is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. The numbers in this column are maximum amounts.

Commission (1982)* and will be applied in a manner that provides a level of protection consistent with the Commission's guidance. These limits apply to both interior and exterior surfaces. They are not directly intended for use on structures to be demolished or buried, but, should be applied to equipment or building components that are potentially salvageable or recoverable scrap. If a building is demolished, the guidelines in Section C.1 are applicable to the resulting contamination in the ground.

C.5 Residual Radionuclides in Air and Water

Residual concentrations of radionuclides in air and water shall be controlled to levels required by DOE Environmental Protection Guidance and Orders, specifically DOE Order 5480.1A and subsequent guidance. Other Federal and/or state standards shall apply when they are determined to be appropriate.

D. AUTHORIZED LIMITS FOR RESIDUAL RADIOACTIVE MATERIAL

The Authorized Limits shall be established to: 1) ensure that, as a minimum, the Dose Limits specified in Section B will not be exceeded under the worst case plausible use scenario consistent with the procedures and guidance provided, or 2) where applicable generic guidelines are provided, be consistent with such guidelines. The Authorized Limits for each site and vicinity properties shall be set equal to the generic or derived guidelines except where it can be clearly established on the basis of site specific data, including health, safety and socioeconomic considerations, that the guidelines are not appropriate for use at the specific site. Consideration

* These guidelines are functionally equivalent to Section 4 - Decontamination for Release for Unrestricted Use of NRC Regulatory Guide 1.86, but are applicable to Non-Reactor facilities.

should also be given to ensure that the limits comply with or provide an equivalent level of protection as other appropriate limits and guidelines (i.e., state, or other Federal). Documentation supporting such a decision should be similar to that required for supplemental limits and exceptions (Section F), but should be generally more detailed because it covers an entire site.

Remedial actions shall not be considered complete unless the residual radioactive material levels comply with the Authorized Limits. The only exception to this requirement will be for those special situations where the supplemental limits or exceptions are applicable and approved as specified in Section F. However, the use of supplemental limits and exceptions should only be considered if it is clearly demonstrated that it is not reasonable to decontaminate the area to the Authorized Limit or guideline value. The Authorized Limits are developed through the project offices in the field (Oak Ridge Technical Services Division for FUSRAP) and approved by the headquarters program office (the Division of Facility and Site Decommissioning Projects).

E. CONTROL OF RESIDUAL RADIOACTIVE MATERIAL AT FUSRAP AND REMOTE SFMP SITES

Residual radioactive material above the guidelines at FUSRAP and remote SFMP sites must be managed in accordance with applicable DOE Orders. The DOE Order 5480.1A and subsequent guidance or superceding orders require compliance with applicable Federal, and state environmental protection standards.

The operational and control requirements specified in the following DOE Orders shall apply to interim storage, interim management, and long-term management.

a. 5440.1C, Implementation of the National Environmental Policy Act

b. 5480.1A, Environmental Protection, Safety, and Health Protection Program for DOE Operations as revised by DOE 5480.1 change orders and the 5 August 1985 memorandum from Vaughan to Distribution

c. 5480.2, Hazardous and Radioactive Mixed Waste Management

d. 5480.4, Environmental Protection, Safety, and Health Protection Standards

e. 5482.1A, Environmental Safety, and Health Appraisal Program

f. 5483.1A, Occupational Safety and Health Program for Government-Owned Contractor-Operated Facilities

g. 5484.1, Environmental Protection, Safety, and Health Protection Information Reporting Requirements

h. 5000.3, Unusual Occurrence Reporting System

i. 5820.2, Radioactive Waste Management

E.1 Interim Storage

a. Control and stabilization features shall be designed to ensure, to the extent reasonably achievable, an effective life of 50 years and, in any case, at least 25 years.

b. Above-background Rn-222 concentrations in the atmosphere above facility surfaces or openings shall not exceed: (1) 100 pCi/L at any given point, (2) an annual average concentration of 30 pCi/L over the facility site, and (3) an annual average concentration of 3 pCi/L at or above any location outside the facility site (DOE Order 5480.1A, Attachment XI-1).

c. Concentrations of radionuclides in the groundwater or quantities of residual radioactive materials shall not exceed existing Federal, or state standards.

d. Access to a site shall be controlled and misuse of onsite material contaminated by residual radioactive material shall be prevented through appropriate administrative controls and physical barriers--active and passive controls as described by the U.S. Environmental Protection Agency (1983--p. 595). These control features should be designed to ensure, to the extent reasonable, an effective life of at least 25 years. The Federal government shall have title to the property or shall have a long-term lease for exclusive use.

E.2 Interim Management

a. A site may be released under interim management when the residual radioactive material exceeds guideline values if the residual radioactive material is in inaccessible locations and would be unreasonably costly to remove, provided that administrative controls are established to ensure that no member of the public shall receive a radiation dose exceeding the basic dose limit.

b. The administrative controls, as approved by DOE, shall include but not be limited to periodic monitoring as appropriate, appropriate shielding, physical barriers to prevent access, and appropriate radiological safety measures during maintenance, renovation, demolition, or other activities that might disturb the residual radioactivity or cause it to migrate.

c. The owner of the site or appropriate Federal, state, or local authorities shall be responsible for enforcing the administrative controls.

E.3 Long-Term Management

Uranium, Thorium, and Their Decay Products

a. Control and stabilization features shall be designed to ensure, to the extent reasonably achievable, an effective life of 1,000 years and, in any case, at least 200 years.

b. Control and stabilization features shall be designed to ensure that Rn-222 emanation to the atmosphere from the waste shall not: (1) exceed an annual average release rate of 20 $pCi/m^2/s$, and (2) increase the annual average Rn-222 concentration at or above any location outside the boundary of the contaminated area by more than 0.5 pCi/L. Field verification of emanation rates is not required.

c. Prior to placement of any potentially biodegradable contaminated wastes in a long-term management facility, such wastes shall be properly conditioned to ensure that (1) the generation and escape of biogenic gases will not cause the requirement in paragraph b. of this section (E.3) to be exceeded, and (2) biodegradation within the facility will not result in premature structural failure in violation of the requirements in paragraph a. of this section (E.3).

d. Groundwater shall be protected in accordance with Appropriate Departmental orders and Federal and state standards, as applicable to FUSRAP and remote SFMP sites.

e. Access to a site should be controlled and misuse of onsite material contaminated by residual radioactive material should be prevented through appropriate administrative controls and physical barriers--active and passive controls as described by the U.S. Environmental Protection Agency (1983--p. 595). These controls should be designed to be effective to the extent reasonable for at least 200 years. The Federal government shall have title to the property.

Other Radionuclides

f. Long-term management of other radionuclides shall be in accordance with Chapters 2, 3, and 5 of DOE Order 5820.2, as applicable.

F. SUPPLEMENTAL LIMITS AND EXCEPTIONS

If special site specific circumstances indicate that the guidelines or Authorized Limits established for a given site are not appropriate for a portion of that site or a vicinity property, then the field office may request that supplemental limits or an exception be applied. In either case, the field must justify that the subject guidelines or Authorized Limits are not appropriate and that the alternative action will provide adequate protection giving due consideration to health and safety,

environment and costs. The field office shall obtain approval for specific supplemental limits or exceptions from headquarters as specified in Section D of these guidelines and shall provide to headquarters those materials required for the justification as specified in this section and in the FUSRAP and SFMP protocols and subsequent guidance documents. The field office shall also be responsible for coordination with the state or local government of the limits or exceptions and associated restrictions as appropriate. In the case of exceptions, the field office shall also work with the state and/or local governments to insure that restrictions or conditions of release are adequate and mechanisms are in place for their enforcement.

F1. Supplemental Limits

The supplemental limits must achieve the basic dose limits set forth in this guideline document for both current and potential unrestricted uses of the site and/or vicinity property. Supplemental limits may be applied to a property or portion of a property or site if, on the basis of a site specific analysis, it is determined that certain aspects of the property or portion of the site were not considered in the development of the established Authorized Limits and associated guidelines for the site, and as a result of these unique characteristics, the established limits or guidelines either do not provide adequate protection or are unnecessarily restrictive and costly.

F2. Exceptions

Exceptions to the Authorized Limits defined for unrestricted use of the site may be applied to a portion of a site or a vicinity property when it is established that the Authorized Limits cannot be achieved and restrictions on use of the site or vicinity property are necessary to provide adequate protection of the public and environment. The field office must clearly demonstrate that the exception is necessary, and the restrictions will provide the necessary degree of protection and that they comply with the requirements for control of residual radioactive material as set forth in Part E of these guidelines.

F3. Justification for Supplemental Limits and Exceptions

Supplemental limits and exceptions must be justified by the field office on a case by case basis using site specific data. Every effort should be made to minimize the use of the supplemental limits and exceptions. Examples of specific situations that warrant the use of supplemental standards and exceptions are:

a. Where remedial actions would pose a clear and present risk of injury to workers or members of the general public, notwithstanding reasonable measures to avoid or reduce risk.

b. Where remedial actions--even after all reasonable mitigative measures have been taken--would produce environmental harm that is clearly excessive compared to the health benefits to persons living on or near affected sites, now or in the future. A clear excess of environmental harm is harm that is long-term, manifest, and grossly disproportionate to health benefits that can reasonably be anticipated.

c. Where it is clear that the scenarios or assumptions used to establish the Authorized Limits do not under plausible current or future conditions, apply to the property or portion of the site identified and where more appropriate scenarios or assumptions indicate that other limits are applicable or necessary for protection of the public and the environment.

d. Where the cost of remedial actions for contaminated soil is unreasonably high relative to long-term benefits and where the residual radioactive materials do not pose a clear present or future risk after taking necessary control measures. The likelihood that buildings will be erected or that people will spend long periods of time at such a site should be considered in evaluating this risk. Remedial actions will generally not be necessary where only minor quantities of residual radioactive

materials are involved or where residual radioactive materials occur in an inaccessible location at which site-specific factors limit their hazard and from which they are costly or difficult to remove. Examples are residual radioactive materials under hard-surface public roads and sidewalks, around public sewer lines, or in fence-post foundations. A site-specific analysis must be provided to establish that it would not cause an individual to receive a radiation dose in excess of the basic dose limits stated in Section B, and a statement specifying the residual radioactive material must be included in the appropriate state and local records.

e. Where there is no feasible remedial action.

G. SOURCES

Limit or Guideline	Source
Basic Dose Limits	
Dosimetry Model and Dose Limits	International Commission on Radiological Protection (1977, 1978)
Generic Guidelines for Residual Radioactivity	
Residual Concentrations of Radium and Thorium in Soil Material	40 CFR 192
Airborne Radon Decay Products	40 CFR 192
External Gamma Radiation	40 CFR 192
Surface Contamination	Adapted from U.S. Nuclear Regulatory Commission (1982)
Control of Radioactive Wastes and Residues	
Interim Storage	DOE Order 5480.1A and subsequent guidance
Long-Term Management	DOE Order 5480.1A and subsequent guidance; 40 CFR 192; DOE order 5820.2

H. REFERENCES

International Commission on Radiological Protection, 1977. Recommendations of the International Commission on Radiological Protection (Adopted January 17, 1977). ICRP Publication 26. Pergamon Press, Oxford. [As modified by "Statement from the 1978 Stockholm Meeting of the ICRP." Annals of the ICRP, Vol. 2, No. 1, 1978.]

International Commission on Radiological Protection, 1978. Limits for Intakes of Radionuclides by Workers. A Report of Committee 2 of the International Commission on Radiological Protection. Adopted by the Commission in July 1978. ICRP Publication 30. Part 1 (and Supplement), Part 2 (and Supplement), Part 3 (and Supplements A and B), and Index. Pergamon Press, Oxford.

U.S. Evironmental Protection Agency, 1983. Standards for Remedial Actions at Inactive Uranium Processing Sites; Final Rule (40 CFR 192). Federal Register 48(3):590-604 (January 5, 1983).

U.S. Department of Energy, 1984. Formerly Utilized Sites Remedial Action Program. Summary Protocol: Identification - Characterization - Designation - Remedial Action - Certification. Office of Nuclear Energy, Office of Terminal Waste Disposal and Remedial Action, Division of Remedial Action Projects. April 1984.

U.S. Department of Energy, 1987. Supplement to U.S. Department of Energy Guidelines for Residual Radioactivity at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites. A Manual for Implementing Residual Radioactivity Guidelines. Prepared by Argonne National Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, and Pacific Northwest Laboratory for the U.S. Department of Energy.

U.S. Nuclear Regulatory Commission, 1982. Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material. Division of Fuel Cycle and Material Safety, Washington, D.C. July 1982.

U.S. Atomic Energy Commission, 1974. Regulatory Guide 1.86, Termination of Operating Licenses for Nuclear Reactors, June 1974

Exhibit II

Documents Supporting the Certification of the Remedial Action Performed at the Colonie Interim Storage Site Vicinity Properties in Colonie and Albany, New York, in 1984 and 1985

EXHIBIT II

DOCUMENTS SUPPORTING THE CERTIFICATION OF

THE REMEDIAL ACTION PERFORMED AT THE

COLONIE INTERIM STORAGE SITE VICINITY PROPERTIES

IN COLONIE AND ALBANY, NEW YORK, IN 1984 AND 1985

PREFACE

For the convenience of the reader, Exhibit II is paginated continuously. Each page number begins with the designator "II-" to distinguish the numbering systems used for Exhibit II from the individual numbering in the documents comprising Exhibit II. The Exhibit II page numbers on which the individual documents begin are given on pages ii and II-iii of this docket. These page numbers are also listed on the title page introducing each subpart of Exhibit II.

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Exhibit II (1) - Decontamination or Stabilization Criteria

The following documents contain the guidelines that determine the need for remedial action. The subject properties have been decontaminated to comply with these guidelines. The first document listed is included as Appendix A of Exhibit I, the next three documents are included here by reference, and the remaining documents are included on the following pages.

Page

U.S. Department of Energy. "U.S. Department of Energy Guidelines for Residual Radioactivity at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites," Rev. 2, March 1987.

U.S. Department of Energy. Design Criteria for Formerly Utilized Sites Remedial Action Program (FUSRAP) and Surplus Facilities Management Program (SFMP), 14501-00-DC-01, Rev. 2, Oak Ridge, TN, March 1986.

Bechtel National, Inc. Hazard Assessment for Radioactive Contamination on the Roof of the Commercial Building at 1104 Central Avenue in Colonie, New York, Oak Ridge, TN, May 1989.

Bechtel National, Inc. Hazard Assessment for Radioactive Contamination on the Roof of the Commercial Building at 50 Yardboro Avenue in Colonie, New York, Oak Ridge, TN, May 1989.

Letter, E.L. Keller, Director Technical Services Division, Oak Ridge Operations Office, Department of Energy, to R.L. Rudolph, Bechtel National, Inc. "ALARA Determination for Colonie Vicinity Properties," March 26, 1984. II-3

Exhibit II (1) - Decontamination or Stabilization Criteria (continued)

	Page
Memorandum, E.G. DeLaney, Manager, FUSRAP/Surplus Facilities Group, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, Department of Energy Headquarters, to E.L. Keller, Director, Technical Services Division, Oak Ridge Operations Office, Department of Energy. "Colonie Vicinity Property Decontamination; Guidance for First Group of Properties," April 30, 1984.	II-4
Letter, E.G. DeLaney, Manager, FUSRAP/Surplus Facilities Group, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, Department of Energy Headquarters, to R. Guimond, Director, Criteria and Standards Division, Environmental Protection Agency, April 30, 1984.	II-5
Letter, E.L. Keller, Director, Technical Services Division, Oak Ridge Operations Office, Department of Energy, to R.L. Rudolph, Bechtel National, Inc. "Surface Contamination Levels; Colonie Vicinity Property Remedial Action," September 12, 1984.	II-7
Letter, E.L. Keller, Director, Technical Services Division, Oak Ridge Operations Office Department of Energy, to Dr. W. Condon, New York State Task Force on Former NL Plant, New York Department of Health. "Subsurface Soil Sampling for Colonie Vicinity Properties," September 27, 1984.	II-8

Department of Energy
Oak Ridge Operations
P. O. Box E
Oak Ridge, Tennessee 37831

18057

MAR 26 1984

Bechtel National, Inc.
ATTN: R. L. Rudolph
PO Box 350
Oak Ridge, TN 37831

Gentlemen:

ALARA DETERMINATION FOR COLONIE VICINITY PROPERTIES

Information contained in Bechtel's letter of March 23, 1984 on the above subject was insufficient to make a determination of the extent of clean-up under the ALARA policy specified by DRAP in their memo dated February 24, 1984. In order to determine whether the ALARA criteria apply, total costs per property will be required. The total cost figures need to be provided as quickly as possible so that the criteria issues that remain between the Department and the State of New York can be resolved.

The information presented in the March 23 letter also creates some uncertainty concerning the manner in which the criteria comparison was carried out. The soil criteria proposed by New York are as follows:

General:
35pCi/g (U-238) for 5cm depth over an area of 3m x 3m ($9m^2$).

Hot Spot:
100pCi/g (U-238) for 5cm depth over an area of 0.5m x 0.5m ($0.25m^2$).

DOE's site-specific criteria recommendation was as follows:

General:
112pCi/g U-238 for 5cm depth over an area of $100m^2$.

Hot Spot:
375pCi/g U-238 for 5cm depth over an area of $1m^2$.

Sincerely,

E. L. Keller

E. L. Keller, Director
Technical Services Division

CE-53:Alexander

Action → Alexander

United States Government

Department of Energy

memorandum

18984

DATE: APR 30 1984

REPLY TO ATTN OF: NE-25

SUBJECT: Colonie Vicinity Property Decontamination; Guidance for First Group of Properties

TO: E. L. Keller, Director
Technical Services Division
Oak Ridge Operations Office

As you know, we have been trying to rationalize the basis for cleanup actions at Colonie. I believe we have done this in the attached letter to Rich Guimond, EPA. I want to provide you our views on what should be done on various properties in this first group, because we want to clean up to ALARA but not to an unreasonable level. These comments are made relative to the BNI cleanup drawings 39-DD02-C-01, -02, -03, and the ORNL property surveys as follows:

27/29 Yardboro--no need to clean up except for two small spots (about 39 pCi/g)
52 Yardboro--no need to clean up areas along west section of property (lots 54 and 56)
68 Yardboro--no need to clean up areas along street where soil contamination is below 35 pCi/g.
74 Yardboro--OK as proposed by BNI.
78 Yardboro--Clean up two small "hot" spots (410 pCi/g and 41 pCi/g).
80 Yardboro--OK as proposed by BNI.
124, 128, 130 Yardboro--No need to clean up.
33 Palmer--OK as proposed by BNI; clean up small area on North side of house.
1144 Central--Need to clean up the first 20-30 feet along street is questionable; please review.
1144A Central--OK as proposed by BNI.

I believe the actions outlined above will fully meet the principle of ALARA, provide ample protection for the public health, and are consistent with the direction of Congress to conduct a decontamination research and development project.

Edward G. DeLaney

Edward G. DeLaney, Manager
FUSRAP/Surplus Facilities Group
Division of Remedial Action Projects

Attachment

21229

18964

Department of Energy
Washington, D.C. 20545

APR 30 1984

Mr. Richard Guimond
Director, Criteria and Standards Division
Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Dear Mr. Guimond:

Thank you and your staff for taking the time to meet with us to review the radiological survey results, the health risk analyses, the cost estimates, and the tentative work plan for the cleanup of vicinity properties at Colonie, New York.

A revised copy of the the health risk analysis is enclosed. This revision corrects the error in averaging soil concentrations which you noted during our meeting and makes some changes to the source to dose transfer factors to make them more appropriate for the conditions at these properties. The results in Table 5 of the enclosure show that the annual dose rate at 7 of the 12 properties might exceed 10 mrem per year, but not 100 mrem per year if no cleanup is done. The DOE Order 5480.1A and guidance from the Assistant Secretary for Policy, Safety, and Environment is that the principle of reducing contamination to levels As Low As Reasonably Achievable (ALARA) should be used to reduce exposures to the range of 100 to 10 mrem/year, corresponding to an annual risk of 10^{-5} to 10^{-6} per year respectively.

Consistent with the strong application of the ALARA principle, we plan to do area cleanups for the 6 properties (52, 68, 74, 80 Yardboro; 1144, 1144A Central Avenue), and will do minor spot cleanup on 27/29 and 78 Yardboro and 33 Palmer.

We propose to cleanup soil to 35 pCi U-238 per gram of soil averaged over a 5 cm depth and an area of 10 meters by 10 meters. Any hot spot exceeding 100 pCi/g will be cleaned up. Cleanup of roofs and other surfaces, if needed, would be in accordance with NRC Regulatory Guide 1.86. However, the roof surveys show that roof cleanup is not needed and that the New York State criteria in Industrial Code Rule 38.22(2) Table 5 are not exceeded. Note that the State letter from Mr. Condon dated February 9, 1984 (enclosure 2) inaccurately quoted the surface contamination criteria in the State Code 38. The number cited for alpha (100 dpm/100 cm^2) is for removable contamination. The applicable number (1000 dpm/100 cm^2 averaged over any one surface) is for fixed contamination, since the roofs have been exposed to weather for 4 years. The correct table is in enclosure 3.

As is stated in the draft work plan we gave you, we will use a special alpha counting technique for soil samples which we estimate will have a minimum detectable activity of 7 pCi/g.

We believe that the plan and the criteria we propose to use will provide a fully adequate cleanup to protect public health and is as low as reasonably achievable. Please provide your comments by the first week in May. We plan to meet with the State of New York officials on May 9 to discuss this work.

Sincerely,

Edward G. DeLaney

Edward G. DeLaney, Manager
FUSRAP/Surplus Facilities Group
Division of Remedial Action Projects
Office of Nuclear Energy

3 Enclosures

Department of Energy
Oak Ridge Operations
P. O. Box E
Oak Ridge, Tennessee 37831

22093

September 12, 1984

Mr. R. L. Rudolph
Bechtel National, Inc.
P. O. Box 350
Oak Ridge, TN 37831

Dear Mr. Rudolph:

SURFACE CONTAMINATION LEVELS; COLONIE VICINITY PROPERTY REMEDIAL ACTION

This will confirm TSD's recent guidance regarding the potential need to remove contamination contained on or in media other than soils at the Colonie Site. This inquiry has specifically been made relative to asphalt, window ledges and surfaces of large trees.

The surface contamination guides specified in DOE's latest draft criteria for FUSRAP, based on NRC Reg Guide 1.86, should be used for these situations.

Sincerely,

E. L. Keller

E. L. Keller, Director
Technical Services Division

CE-53:Alexander

cc: J. Nemec, BNI
P. Crotwell, BNI
R. Robertson, BNI

Received by
SEP 13 1984
FUSRAP PDCC

22565

Department of Energy
Oak Ridge Operations
P. O. Box E
Oak Ridge, Tennessee 37831

September 27, 1984

Dr. W. Condon
New York State Task Force
on Former NL Plant
New York Department of Health
Tower Building
Albany, New York 12237

Dear Dr. Condon:

SUBSURFACE SOIL SAMPLING FOR COLONIE VICINITY PROPERTIES

As remedial action work has progressed at the Colonie vicinity properties, field measurements and subsurface soil data (soil beneath the top five centimeters) have indicated a more uniform distribution of uranium in subsurface soil at some locations than was originally expected. For such locations, the 35 pCi/g criterion will be applied to subsurface volumes sampled over a 15 cm depth, as is our normal procedure, rather than to three or more successive five centimeter layers. This approach will not affect the agreed upon procedure for surface soil, which will continue to be sampled to a depth of 5 centimeters.

DOE has also been advised of several situations involving measurable fixed surface contamination on asphalt paved areas, window ledges and small ledge areas of some larger trees. For such locations, the surface contamination criteria that has been agreed to in earlier discussions on fixed contamination on roofs will be applied.

Please contact Jake Alexander of my staff if you have questions on these matters, area code 615, 576-4451.

Sincerely,

E. L. Keller

E. L. Keller, Director
Technical Services Division

CE-53:Alexander

cc: P. Martinelli, NY Dept. of Law
S. Lukowski, Albany Co Health Dept.
J. Matusyek, NY Dept. of Health
K. Rimawi, NY Dept. of Health
P. Merges, NY Dept. of Env. Cons.
R. Fergea, NYDEC, Schnectady

Received by
SEP 27 1984
FUSRAP PDCC

T Nemec RNI

Exhibit II (2) - Designation or Authorization Documentation

The following documents designated or authorized the remedial action at the 35 subject properties. A copy of each follows.

	Page
Letter, F.E. Coffman, Director, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, Department of Energy Headquarters, to J. LaGrone, Manager, Oak Ridge Operations Office, Department of Energy. "Authorization to Conduct Remedial Action at Vicinity Properties in Colonie, New York," September 28, 1984.	II-10
Letter, J.E. Baublitz, Acting Director, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, to Distribution. "Authorization to Conduct Remedial Action," June 24, 1985.	II-11
Memorandum, E.G. DeLaney, FUSRAP/Surplus Facilities Group, Division of Remedial Action Projects, to E.L. Keller, Director, Technical Services Division, Oak Ridge Operations Office. "Colonie Vicinity Property Decontamination; Guidance for First Group of Properties," April 30, 1984.	II-14

23130

Keller

Cy. rec'd 10/4

United States Government

Department of Energy

memorandum

3603

file

DATE: SEP 28 1984

REPLY TO ATTN OF: NE-24

SUBJECT: Authorization to Conduct Remedial Action at Vicinity Properties in Colonie, New York

TO: Joe LaGrone, Manager
Oak Ridge Operations Office

Based on the preliminary radiological survey report by ORNL (attachment 1) and on the rationale expressed in the attachment to the memorandum to E. L. Keller from E. G. DeLaney dated April 30, 1984 (attachment 2), the following vicinity properties are being authorized for remedial action.

Figures 11, 12, 27, and 28 have been changed to reflect the correct address for each property. Figure 8 was also corrected to indicate 7.9 pCi/g instead of 79 pCi/g at grid point 0+16, 24R. The contractors should use their best judgment for determination of area and depth of excavation during remedial action.

The vicinity properties being authorized for remedial action include:

50 Yardboro Ave., Albany, NY
25/27 Yardboro Ave., Albany, NY
7 Palmer Ave., Albany, NY
1150 Central Ave., Colonie, NY
24 Yardboro Ave., Albany, NY
1160/1162 Central Ave., Colonie, NY
1160 Central Ave., Colonie, NY
1118 Central Ave., Colonie, NY
~~1140~~ Central Ave., Colonie, NY
1145 Central Ave., Colonie, NY
1148 Central Ave., Colonie, NY
1152 Central Ave., Colonie, NY
1159 Central Ave., Colonie, NY

If there are any questions, please call Mr. Arthur Whitman on FTS 233-5439.

FE Coffman

Franklin E. Coffman, Director
Office of Terminal Waste Disposal
and Remedial Action
Office of Nuclear Energy

2 Attachments

Sec 22853

28728

JUN 24 1985

MULTIPLE LETTERS - SEE ATTACHED LETTERS

Mr. William Ebel
Gray Hawk Development Corp.
8 Birchtree Road
Albany, New York 12205

Dear Mr. Ebel:

Although the report of the radiological survey of your property has not been finalized, the data suggests that there are minor levels of residual radioactive material in the soil and/or other material on your property. The health risks due to this minor amount of contamination are minimal. When the report is finalized, it will be forwarded to you.

The Energy and Water Appropriation Act for Fiscal Year 1984, enacted by Congress, directed the Department of Energy to undertake a decontamination research and development project involving the former National Lead site at Albany/Colonie, New York, and the properties in the vicinity that became contaminated from the site. This means that any properties in the vicinity of the former National Lead site which contain radioactive material derived from the site that is in excess of the radiological criteria established for the project will be considered for remedial action. With your permission, we are planning to perform remedial action on your property because your property exceeds the project criteria. You will be contacted by Mr. E. L. Keller of the Department's Oak Ridge Operations Office or his representative prior to any remedial action initiated on your property.

Should you have any questions, please contact Mr. E. L. Keller, Director, Technical Services Division, Oak Ridge Operations Office, U.S. Department of Energy, P.O. Box E, Oak Ridge, Tennessee 37830 (615-576-0948).

Sincerely,

/s/ Ed DeLaney

John E. Baublitz, Director
Division of Remedial Action Projects
Office of Terminal Waste Disposal
and Remedial Action
Office of Nuclear Energy

bcc:
E. Keller, OR
G. Newtown, OR
W. Bibb, OR
B. Berven, ORNL
A. Whitman, NE-24
Aerospace
NE-73 (4)
NE-24
Whitman

NE-24:AWhitman:ph:353-5439:6/21/85:IBM:172/45:3.32.7

CONCURRENCES

RTG SYMBOL	INITIALS/SIG.	DATE
NE-24	Whitman	6/21/85
NE-24	DeLaney	6/21/85
NE-24	Baublitz	6/21/85

OFFICIAL FILE COPY

Address List

Addressee

1. Mr. William Ebel
   Gray Hawk Development Corp.
   8 Birchtree Road
   Albany, New York 12205

3. Mr. Ralph J. Ricchiuti
   1161 Central Avenue
   Albany, New York 12205

4. Mr. Fred G. Field, Jr., Supervisor
   Town of Colonie
   Memorial Town Hall
   Newtonville, New York 12128

6. Mr. Germaine Miklatish
   5 Yardboro Avenue
   Albany, New York 12205

7. Mr. L. A. Dott
   1185 Central Avenue
   Colonie, New York 12212

8. Mr. John H. Jeram
   1 Reynolds Street
   Colonie, New York 12212

9. Mr. Donald C. Hallenbeck
   1147 Central Avenue
   Colonie, New York 12212

10. Mr. Rudolph K. Paulsen, Sec/Treas.
    Gentiles, 1100 Central Avenue
    Colonie, New York 12212

11. Mr. Sam S. Clevenson, Publisher
    The Jewish World
    1104 Central Avenue
    Colonie, New York 12212

12. Mr. Alberto Conte
    1129 Central Avenue
    Colonie, New York 12212

United States Government

memorandum

Act 77.

Department of Energy

DATE APR 30 1984

REPLY TO ATTN OF: SE-25

SUBJECT: Colonie Vicinity Property Decontamination; Guidance for First Group of Properties

TO: E. T. Keller, Director
Technical Services Division
Oak Ridge Operations Office

As you know, we have been trying to rationalize the basis for cleanup actions at Colonie. I believe we have done this in the attached letter to Rich Guimond, EPA. I want to provide you our views on what should be done on various properties in this first group, because we want to clean up to ALARA but not to an unreasonable level. These comments are made relative to the BNI cleanup drawings 30-8802-C-01, -02, -03, and the BNI property surveys as follows:

27/29 Yardboro--no need to clean up except for two small spots (about 30 pCi/g)
52 Yardboro--no need to clean up areas along west section of property (lots 54 and 56)
68 Yardboro--no need to clean up areas along street where soil contamination is below 35 pCi/g.
74 Yardboro--OK as proposed by BNI.
78 Yardboro--Clean up two small "hot" spots (410 pCi/g and 41 pCi/g).
80 Yardboro--OK as proposed by BNI.
124, 128, 130 Yardboro--No need to clean up.
33 Palmer--OK as proposed by BNI; clean up small area on North side of house.
1144 Central--Need to clean up the first 20-30 feet along street is questionable; please review.
1144A Central--OK as proposed by BNI.

I believe the actions outlined above will fully meet the principle of ALARA, provide ample protection for the public health, and are consistent with the direction of Congress to conduct a decontamination research and development project.

Edward Delaney

Edward G. Delaney, Manager
FUSRAP/Surplus Facilities Group
Division of Remedial Action Projects

Attachment

91298

Exhibit II (3) - Radiological Characterization Reports

The documents listed below address the pre-remedial action status of the 35 subject properties. These documents are included in this docket by reference.

Teledyne Isotopes. A Survey of Uranium in Soils Surrounding The NL Bearings Plant, Westwood, NJ, October 31, 1980.

1984 Properties

Oak Ridge National Laboratory. Results of the Radiological Survey at 1114 Central Avenue (included in report for 1118 Central Avenue), Albany, New York (AL022), Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1144 Central Avenue, Colonie, New York (AL010), Oak Ridge, TN, March 1984.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1144A Central Avenue, Colonie, New York (AL011), Oak Ridge, TN, March 1984.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1159 Central Avenue, Colonie, New York (AL028), ORNL/RASA-84/231, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 33 Palmer Avenue, Albany, New York (AL006), Oak Ridge, TN, March 1984.

Oak Ridge National Laboratory. Results of the Radiological Survey 27/29 Yardboro Avenue, Albany, New York (AL012), Oak Ridge, TN, March 1984.

Oak Ridge National Laboratory. Results of the Radiological Survey at 52 Yardboro Avenue, Albany, New York (AL005), Oak Ridge, TN, March 1984.

Oak Ridge National Laboratory. Results of the Radiological Survey at 68 Yardboro Avenue, Albany, New York (AL004), Oak Ridge, TN, March 1984.

Oak Ridge National Laboratory. Results of the Radiological Survey at 74 Yardboro Avenue, Albany, New York (AL003), Oak Ridge, TN, March 1984.

Oak Ridge National Laboratory. Results of the Radiological Survey at 78 Yardboro Avenue, Albany, New York (AL001), Oak Ridge, TN, March 1984.

Oak Ridge National Laboratory. Results of the Radiological Survey at 80 Yardboro Avenue, Albany, New York (AL002), Oak Ridge, TN, March 1984.

1985 Properties

Oak Ridge National Laboratory. Results of the Radiological Survey at 1100 Central Avenue, Colonie, New York (AL041), ORNL/RASA-84/293, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1104 Central Avenue, Colonie, New York (AL042), ORNL/RASA-84/294, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1118 Central Avenue, Colonie, New York (AL022), ORNL/RASA-84/225, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 52 Yardboro Avenue, Albany, New York (AL005), Oak Ridge, TN, March 1984.

Oak Ridge National Laboratory. Results of the Radiological Survey at 68 Yardboro Avenue, Albany, New York (AL004), Oak Ridge, TN, March 1984.

Oak Ridge National Laboratory. Results of the Radiological Survey at 74 Yardboro Avenue, Albany, New York (AL003), Oak Ridge, TN, March 1984.

Oak Ridge National Laboratory. Results of the Radiological Survey at 78 Yardboro Avenue, Albany, New York (AL001), Oak Ridge, TN, March 1984.

Oak Ridge National Laboratory. Results of the Radiological Survey at 80 Yardboro Avenue, Albany, New York (AL002), Oak Ridge, TN, March 1984.

1985 Properties

Oak Ridge National Laboratory. Results of the Radiological Survey at 1100 Central Avenue, Colonie, New York (AL041), ORNL/RASA-84/293, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1104 Central Avenue, Colonie, New York (AL042), ORNL/RASA-84/294, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1118 Central Avenue, Colonie, New York (AL022), ORNL/RASA-84/225, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1129 Central Avenue, Colonie, New York (AL043), ORNL/RASA-84-295, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1146 Central Avenue, Colonie, New York (AL024), ORNL/RASA-84/227, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1147 Central Avenue, Colonie, New York (AL034), ORNL/RASA-84/286, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1148 Central Avenue - Front, Colonie, New York (AL025), ORNL/RASA-84/228, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1148 Central Avenue - Rear (10 Garden Lane), Colonie, New York (AL023), ORNL/RASA-84/228, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1150 Central Avenue, Colonie, New York (AL026), ORNL/RASA-84/229, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1152 Central Avenue, Colonie, New York (AL027), ORNL/RASA-84-230, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1160 Central Avenue, Colonie, New York (AL021), ORNL/RASA-84/224, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1160/1162 Central Avenue, Colonie, New York (AL020), ORNL/RASA-84/223, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1163/1161 Central Avenue, Colonie, New York (AL056), ORNL/RASA-85/11, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1166 Central Avenue, Colonie, New York (AL053), ORNL/RASA-85/8, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1167 Central Avenue, Colonie, New York (AL054), ORNL/RASA-85/9, Oak Ridge, TN, September 1986.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1168 Central Avenue, Colonie, New York (AL052), ORNL/RASA-85/7, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1170 Central Avenue, Colonie, New York (AL051), ORNL/RASA-85/6, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1185 Central Avenue, Colonie, New York (AL032), ORNL/RASA-84/284, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 1195 Central Avenue, Colonie, New York (AL065), ORNL/RASA-85/20, Oak Ridge, TN, June 1986.

Oak Ridge National Laboratory. Results of the Radiological Survey at 7 Palmer Avenue, Albany, New York (AL017), ORNL/RASA-84/96, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 5 Yardboro Avenue, Albany, New York (AL031), ORNL/RASA-84/283, Oak Ridge, TN, July 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 24 Yardboro Avenue, Albany, New York (AL019), ORNL/RASA-84/222, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 25/27 Yardboro Avenue, Albany, New York (AL016), ORNL/RASA-84/112, Oak Ridge, TN, June 1985.

Oak Ridge National Laboratory. Results of the Radiological Survey at 50 Yardboro Avenue, Albany, New York (AL013), ORNL/RASA-84/111, Oak Ridge, TN, June 1985.

Exhibit II (4) - NEPA Documents

The documents listed below fulfill the NEPA requirements for the subject properties. The first two documents are included in this section by reference. The third document is included on the following pages.

Page

Argonne National Laboratory. Action Description Memorandum, Proposed 1984 Remedial Actions for Vicinity Properties at Colonie, New York, Argonne, Illinois, May 4, 1984.

Argonne National Laboratory. Action Description Memorandum Revision: Proposed 1984 Remedial Actions at Colonie, New York, Argonne, Illinois, June 5, 1984.

Memorandum, F.E. Coffman, Director, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, to NE-24 Distribution. "Review of Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site Relative to NEPA Requirements," June 25, 1984. II-21

United States Government

Department of Energy

memorandum

RECEIVED

JUN 25 1984

STEVE Y. H. TSAI

DATE: JUN 19 1984

REPLY TO ATTN OF: NE-24

SUBJECT: Review of Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site Relative to NEPA Requirements

TO: File

As part of the research and development project authorized by Congress pursuant to the FY 1984 Energy and Water Appropriations Act (U.S. Congress 1983), the U.S. Department of Energy (DOE) proposes to carry out some remedial actions during 1984 at vicinity properties near the former NL Industries, Inc., facility in the town of Colonie, New York. The proposed FY 84 actions include cleanup of nine vicinity properties and interim storage of the contaminated materials inside the building at the NL Industries site, which was recently acquired by DOE (February 1984). The vicinity properties will be decontaminated under DOE's Formerly Utilized Sites Remedial Action Program (FUSRAP). The major proposed actions include:

- Removal of about 200 m^3 (260 yd^3) of radioactively contaminated soils from nine residential properties in the town of Colonie and,
- Removal of about 40 m^3 (50 yd^3) of contaminated soils from seven residential properties on Yardboro/Palmer Avenue in the city of Albany.
- Construction of a vehicle decontamination area and other support facilities on the NL Industries site.
- Placement of the 240 m^3 (310 yd^3) of decontaminated soil materials inside the NL Industries building in bulk.

Details of the various activities are given in the Attachment (Action Description Memorandum for Proposed FY 1984 Remedial Actions for Vicinity Properties at Colonie, N.Y., FUSRAP site).

The proposed FY 84 actions involving cleanup of the nine vicinity properties are the first phase of remedial actions to be implemented at the former NL Industries site. There will be separate future decisions on cleanup of additional properties. Because a disposal site for these radioactive wastes site is not readily available in the state of New York, current decontamination plans call for interim storage of offsite waste in the onsite building in bulk. A future decision will have to be made relative to permanent disposition of the contaminated materials. The proposed remedial actions will not limit the choice of reasonable alternatives for this disposition. Separate environmental analyses will be prepared to support future decisions on cleanup of other vicinity properties, decontamination and release of the

former NL Industries site, and permanent disposition of the contaminated materials.

The radiological impacts of the proposed remedial actions both to the workers and members of the general public, surface and ground water impacts, and traffic impacts are reviewed in the Attachment. The project will clearly have no significant effects on the quality of the human environment within the meaning of Section 102(2)(c) of NEPA. Accordingly, neither an environmental assessment nor an environmental impact statement will be required.

/s/ McCoff

Franklin E. Coffman, Director
Office of Terminal Waste Disposal
and Remedial Action
Office of Nuclear Energy

Attachment

cc w/attachment:
R. Stern, PE-25
S. Miller, GC-34
S. Woodbury, PE-252

bcc w/o attachment:
S. Tsai, ANL
E. Keller, OR
J. Alexander, OR

jam 6/18

NE-24:GTuri:hsy:353-2802:06-11-84 (WP #84-430)
Retyped:NE-24:GTuri:cvw:353-2802:06-13-84 (WP)
Retyped:NE-24:GTuri:cvw:353-2802:06-15-84 (WP)

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OFFICIAL FILE COPY

Exhibit II (5) - Access Agreements

Access agreements were obtained from each property owner before remedial action activities began. The list of properties for which access agreements exist is provided here. The access agreements are included in the docket by reference.

Properties Decontaminated in 1984

1114 Central Avenue
1144 Central Avenue
1144A Central Avenue
1159 Central Avenue
33 Palmer Avenue
27/29 Yarlboro Avenue
52 Yardboro Avenue
68 Yardboro Avenue
74 Yardboro Avenue
78 Yardboro Avenue
80 Yardboro Avenue

Properties Decontaminated in 1985

1100 Central Avenue
1104 Central Avenue
1118 Central Avenue
1129 Central Avenue
1146 Central Avenue
1147 Central Avenue
1148 Central Avenue
1150 Central Avenue
1152 Central Avenue
1160 Central Avenue
1161 Central Avenue
1160/1162 Central Avenue
1166 Central Avenue
1167 Central Avenue
1168 Central Avenue
1170 Central Avenue
1185 Central Avenue
1195 Central Avenue
10 Garden Lane
7 Palmer Avenue
5 Yardboro Avenue
24 Yardboro Avenue
25/27 Yardboro Avenue
50 Yardboro Avenue

Exhibit II (6) - Post-Remedial Action Reports

The following reports document the remedial action activities performed at each of the subject properties and describe their post-remedial action radiological statuses. These post-remedial action reports are included in this docket by reference.

Bechtel National, Inc. Post-Remedial Action Report for the Colonie Interim Storage Site Vicinity Properties - 1984, DOE/OR/20722-72, Oak Ridge, TN, March 1986.

Bechtel National, Inc. Post-Remedial Action Report for the Colonie Interim Storage Site Vicinity Properties - 1985, DOE/OR/20722-92, Oak Ridge, TN, March 1988.

Exhibit II (7) - Interim Verification Letters to Property Owners and Verification Statements and Reports

This exhibit contains the documents related to the successful decontamination of the subject properties. The first two documents are included on the following pages; the remeaining documents are included by reference.

Page

Letter, James D. Berger, Program Manager, Radiological Site Assessment Program, to E.G. DeLaney, Director, Division of Facility and Site Decommissioning Projects, Office of Nuclear Energy. "Independent Verification - 1984 Remedial Action of Colonie Vicinity Properties: Colonie, New York," February 26, 1986. II-26

Letter, James D. Berger, Program Manager, Radiological Site Assessment Program, to E.G. DeLaney, Director, Division of Facility and Site Decommissioning Projects, Office of Nuclear Energy. "Independent Verification - 1985 Remedial Action of Colonie Vicinity Properties: Colonie, New York," November 21, 1986. II-28

Oak Ridge Associated Universities. Verification of 1984 Remedial Action Vicinity Properties Colonie Interim Storage Site, Colonie, New York, Oak Ridge, TN, April 1986.

Oak Ridge Associated Universities. Verification of 1985 Remedial Action Vicinity Properties Colonie Interim Storage Site, Colonie, New York, Oak Ridge, TN, November 1986.

Oak Ridge Associated Universities. Verification of Remedial Actions at 1104 Central Avenue and 50 Yardboro Avenue, Colonie, New York, Oak Ridge, TN, June 1989.

35142

Oak Ridge Associated Universities
Post Office Box 117
Oak Ridge, Tennessee 37831-0117

Manpower Education Research and Training Division

February 26, 1986

Edward G. DeLaney, Director
Division of Facility and Site
Decommissioning Projects
Office of Nuclear Energy
U.S. Department of Energy
Washington, DC 20545

Subject: INDEPENDENT VERIFICATION - 1984 REMEDIAL ACTION OF COLONIE VICINITY PROPERTIES: COLONIE, NEW YORK

Dear Mr. DeLaney:

As Independent Verification Contractor (IVC) for the Colonie Interim Storage Site, the Radiological Site Assessment Program of Oak Ridge Associated Universities has performed an independent assessment of remedial action activities, performed on the following ten vicinity properties by Bechtel National, Inc. during 1984.

1114 Central Avenue
1144/1144A Central Avenue
1159 Central Avenue
33 Palmer Avenue
27/29 Yardboro Avenue
52 Yardboro Avenue
68 Yardboro Avenue
74 Yardboro Avenue
78 Yardboro Avenue
80 Yardboro Avenue

Based on the findings of this assessment, it is ORAU's evaluation that remedial action has been effective in bringing these properties into conformance with the site-specific guidelines established for the Colonie site. It is also ORAU's opinion that the documentation adequately and accurately describes the remedial action activities and the radiological conditions currently present on these properties.

The draft verification report will be provided to your office in approximately one week.

Sincerely,

James D. Berger
Program Manager
Radiological Site Assessment Program

JDB:vol

cc: Jerry Wing (DOE/OR/TSD)
Joe Nemec (BNI)

041611

Oak Ridge Associated Universities
Post Office Box 117
Oak Ridge, Tennessee 37831-0117

Manpower Education, Research, and Training Division

November 21, 1986

Mr. Edward G. DeLaney, Director
Division of Facility and Site
Decommissioning Projects
Office of Nuclear Energy
U.S. Department of Energy
Washington, DC 20545

Subject: INDEPENDENT VERIFICATION - 1985 REMEDIAL ACTION OF COLONIE VICINITY PROPERTIES: COLONIE, NEW YORK

Dear Mr. DeLaney:

As Independent Verification Contractor (IVC) for the Colonie Interim Storage Site, the Radiological Site Assessment Program of Oak Ridge Associated Universities has performed an independent assessment of remedial action activities, performed on the following 22 vicinity properties by Bechtel National, Inc. during 1985.

1100 Central Avenue
1118 Central Avenue
1129 Central Avenue
1146 Central Avenue
1147 Central Avenue
1148 Central Avenue
1148 Central Avenue-Rear (10 Garden Lane)
1150 Central Avenue
1152 Central Avenue
1160 Central Avenue
1160/1162 Central Avenue
1163/1161 Central Avenue
1166 Central Avenue
1167 Central Avenue
1168 Central Avenue
1170 Central Avenue
1185 Central Avenue
1195 Central Avenue
7 Palmer Avenue
5 Yardboro Ave
24 Yardboro Avenue
25/27 Yardboro Avenue

Based on the findings of this assessment, it is ORAU's evaluation that remedial action has been effective in bringing these properties into conformance with the site-specific guidelines established for the Colonie site. It is also ORAU's opinion that the documentation adequately and accurately describes the remedial action activities and the current radiological conditions on these properties.

Received by
NOV 25 1986

The final verification report will be provided to your office in approximately two weeks.

Sincerely,

James D. Berger, Manager
Radiological Site Assessment Program

JDB:mec

cc: L. E. Velazquez, DOE/ORO
S. W. Ahrends, DOE/ORO
G. P. Turi, DOE/NE
[redacted]
R. D. Glenn, BNI
W. C. Borden, BNI
R. J. Cloutier, ORAU

Exhibit II (8) - State, County, and Local Comments on Remedial Action

The State of New York was kept fully informed of all DOE activities conducted at the subject CISS vicinity properties.

Exhibit II (9) - Restrictions

There are no radiologically based restrictions on the future use of the subject properties.

Exhibit II (10) - Federal Register Notice

This section contains the text of the notice that was approved by DOE for publication in the Federal Register. It documents the certification that the 35 properties are in compliance with all applicable decontamination criteria and standards.

[6450-01]

DEPARTMENT OF ENERGY

Certification of the Radiological Condition of Thirty-Five Private Properties Located in Colonie and Albany, New York

AGENCY: Office of Remedial Action and Waste Technology, Office of Nuclear Energy, Department of Energy.

ACTION: Notice of certification.

SUMMARY: The Department of Energy has completed radiological surveys and taken remedial action to decontaminate 35 properties in Colonie and Albany, New York. The properties were found to contain quantities of radioactive material from uranium processing activities conducted at the former National Lead (NL) Industries Plant.

FOR FURTHER INFORMATION CONTACT:

J. J. Fiore, Director
Division of Facility and Site Decommissioning Projects
Office of Remedial Action and Waste Technology
U.S. Department of Energy
Washington, D.C. 20545
(301) 353-5272

SUPPLEMENTARY INFORMATION:

The Department of Energy (DOE), Office of Nuclear Energy, Office of Remedial Action and Waste Technology, Division of Facility and Site Decommissioning Projects, has implemented a remedial action project in the Albany and Colonie, New York, area as part of a specially authorized research and development project (The Energy and Water

Appropriations Act for FY 1984). The ultimate objective of the program is to ensure that any properties contaminated as a result of activities at the former National Lead (NL) Industries can be certified to be within applicable decontamination criteria and standards established for the project and consistent with current radiological guidelines for protection of the general public.

The Colonie Interim Storage Site (CISS) is a U.S. DOE FUSRAP site located in the Town of Colonie, New York, at 1130 Central Avenue. It is approximately 4 miles northwest of downtown Albany and about 3 miles southeast of the Village of Colonie. Central Avenue runs along the northeastern side of the CISS property; the Conrail main line and a railroad siding border it on the southern side. Residential properties lie beyond the railroad. Most of the 11.2-acre CISS was occupied by the former NL Industries, Inc. property and buildings formerly used by NL to manufacture a variety of products from depleted uranium. The remaining 2 acres of the site, donated to DOE by the Niagara Mohawk Electric Company in 1985, lie to the west of the original property. Land use in the vicinity of the CISS is primarily industrial and residential.

During the 1950s, NL Industries began manufacturing uranium products at the Colonie plant, operating under a license issued by the Atomic Energy Commission (AEC), predecessor of DOE. Between 1958 and 1968, NL Industries held numerous AEC contracts for fabricating slightly enriched (in the uranium-235 isotope) uranium fuel elements and chemical processing of nonirradiated, slightly enriched uranium scrap.

After termination of the AEC contracts, work at the NL plant was limited to fabrication of shielding components, ballast weights, and projectiles from depleted uranium.

On February 15, 1980, the New York State Supreme Court issued an order temporarily restraining NL Industries from operating its Colonie facility on the basis that the facility emitted contaminants

as airborne releases of uranium compounds. The temporary restraining order was amended on May 12, 1980, to allow NL Industries to continue operating on a limited basis. The amended order also required the company to initiate an independent investigation to assess all adverse environmental conditions in soils and on properties in the vicinity of the facility that may have been caused by the airborne discharge of radioactive particulates from the plant. Operations at the plant were halted in the spring of 1984. Although the contamination at the Colonie properties did not result from the atomic energy program, they were included as part of the FUSRAP by the DOE after Congress gave responsibility for the site to DOE under the 1984 Energy and Water Appropriations Act, which authorized DOE to conduct a decontamination research and development project at four sites, including the site of the former NL Industries plant and its vicinity properties.

Following plant closure, the DOE took possession of the plant to begin the cleanup process. Most of the radioactive contamination on the vicinity properties is from airborne releases of uranium from the processing operations at the plant. FUSRAP is currently being managed by DOE's Oak Ridge Operations Office. Bechtel National, Inc. (BNI) is the Project Management Contractor (PMC) and acts as DOE's representative in the planning, management, and implementation of FUSRAP. BNI acting as the PMC has responsibility for conducting remedial action at the CISS as well as at the off-site or vicinity properties.

Teledyne Isotopes surveyed the neighborhood surrounding the NL plant for radioactivity in 1980 and determined that uranium released into the air through the emission stacks had deposited on residential and commercial properties and structures. Teledyne's findings also showed that the majority of the contamination was in the direction of the area's prevailing winds.

In October 1983, more detailed radiological surveys of the individual properties surrounding the NL plant (including private residences) were performed by the Oak Ridge National Laboratory (ORNL). These surveys were designed to locate all properties on which uranium contamination exceeded DOE guidelines. The DOE guidelines for these properties were established by the DOE in conjunction with the State of New York.

DOE developed a remedial action plan to remove the contamination in these areas. The first priority for the remedial action was to remove contaminated materials from residential properties, and then from commercial properties. These materials were to be stored at the Colonie Interim Storage Site.

In 1984, 11 residential/commercial properties were decontaminated, and in 1985, 24 residential/commercial properties were decontaminated. Post-remedial action surveys have demonstrated and DOE has certified that radiological conditions on the affected properties are consistent with applicable criteria and standards, and the use of the 35 properties presents no radiological hazard to the general public or to site occupants. These findings are supported by the DOE Certification Docket for the Remedial Action Performed at the Colonie Interim Storage Site Vicinity Properties in Colonie and Albany, New York, in 1984 and 1985. Accordingly, these properties are released from the Formerly Utilized Sites Remedial Action Program.

The certification docket will be available for review between 9:00 a.m. and 4:00 p.m., Monday through Friday (except Federal holidays), in the U.S. Department of Energy Public Reading Room located in Room 1E-190 of the Forrestal Building, 1000 Independence Avenue, S.W., Washington, D.C. Copies will also be available at the in the Public Document Room, U.S. Department of Energy, OaK Ridge Operations Office, Oak Ridge, Tennessee, and the Colonie Library, 629 Albany-Shaker Road, Loudonville, New York 12210.

The Department of Energy, through the Oak Ridge Operations Office, Technical Services Division, has issued the following statement:

STATEMENT OF CERTIFICATION: THIRTY-FIVE PROPERTIES ASSOCIATED WITH THE FORMER NATIONAL LEAD INDUSTRIES

The Oak Ridge Operations Office, Technical Services Division, has reviewed the radiological data obtained following remedial action at the 35 subject properties. Based on this review, DOE has certified that the properties listed below are in compliance with applicable decontamination criteria and standards established for the project. This certification of compliance provides assurance that future use of the properties will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

The properties are listed by their addresses, as identified in the radiological characterization survey reports prepared by ORNL. The eleven properties which were included in the 1984 remedial action are listed first, followed by the 24 properties included in the 1985 remedial action. Accordingly, the following properties are released from the Formerly Utilized Sites Remedial Action Program:

Parcel 1 located on 27/29 Yardboro Avenue, City of Albany, identified as Block 1, Lot 36 (per tax map; no identification per access agreement).

Parcel 2 located on 52 Yardboro Avenue, City of Albany, identified as Block 1, Lot 13 (per tax map); as Block 1, Lots 11, 12, and 13 (per access agreement).

Parcel 3 located on 68 Yardboro Avenue, City of Albany, identified as Block 1, Lots 4, 5, and 6 (per tax map); as Block 1, Lots 4, 5, 6, 7, and 8 (per access agreement).

Parcel 4 located on 74 Yardboro Avenue, City of Albany, identified as Block 1, Lot 3 (per tax map); as Block 1, Lot 3 (per access agreement).

Parcel 5 located on 78 Yardboro Avenue, City of Albany, identified as Block 1, Lot 2 (per tax map); as Block 1, Lot 2 (per access agreement).

Parcel 6 located on 80 Yardboro Avenue, City of Albany, identified as Block 1, Lot 1 (per tax map); as Block 1, Lot 1 (per access agreement).

Parcel 7 located on 33 Palmer Avenue, City of Albany, identified as Block 1, Lot 37 (per tax map); as Block 1, Lot 37 (per access agreement).

Parcel 8 located on 1114 Central Avenue, Town of Colonie, identified as Block 0806 (per tax map; no identification per access agreement).

Parcel 9 located on 1144 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 10 located on 1144A Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 11 located on 1159 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 12 located on 5 Yardboro Avenue, City of Albany, identified as Block 1, Lot 26 (per tax map; no identification per access agreement).

Parcel 13 located on 24 Yardboro Avenue, City of Albany, identified as Block 1, Lot 17 (per tax map; no identification per access agreement).

Parcel 14 located on 25/27 Yardboro Avenue, City of Albany, identified as Block 1, Lot 36 (per tax map; no identification per access agreement).

Parcel 15 located on 50 Yardboro Avenue, City of Albany, identified as Block 1, Lot 14 (per tax map) as Block 1, Lots 18, 19, 20, 21, 22, and 23 (per access agreement).

Parcel 16 located on 1100 Central Avenue, City of Albany, identified as Block 1, Lot 24 (per tax map; no identification per access agreement).

Parcel 17 located on 1104 Central Avenue, City of Albany, identified as Block 0806 (per tax map; no identification per access agreement).

Parcel 18 located on 1118 Central Avenue, Town of Colonie, identified as Block 0806 (per tax map; no identification per access agreement).

Parcel 19 located on 1129 Central Avenue, Town of Colonie, identified as Block 0905 (per tax map; no identification per access agreement).

Parcel 20 located on 1146 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 21 located on 1147 Central Avenue, Town of Colonie, identified as Block 0905 (per tax map; no identification per access agreement).

Parcel 22 located on 1148 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 23 located on 1150 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 24 located on 1152 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 25 located on 1160 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 26 located on 1160/62 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 27 located on 1161/63 Central Avenue, Town of Colonie, identified as Block 0905 (per tax map; no identification per access agreement).

Parcel 28 located on 1166 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 29 located on 1167 Central Avenue, Town of Colonie, identified as Block 0905 (per tax map; no identification per access agreement).

Parcel 30 located on 1168 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 31 located on 1170 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 32 located on 1185 Central Avenue, Town of Colonie, identified as Block 0905 (per tax map; no identification per access agreement).

Parcel 33 located on 1195 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 34 located on 7 Palmer Avenue, City of Albany, identified as Block 1, Lot 35 (per tax map; no identification per access agreement).

Parcel 35 located on 10 Garden Lane, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

J. E. Baublitz

J.E. Baublitz, Acting Director
Office of Remedial Action
and Waste Technology
Office of Nuclear Energy
U.S. Department of Energy

Dated: JUL 13 1989

Exhibit II (11) - Approved Certification Statements

The following statements document the certification of the 35 subject properties.

ited States Government

Department of Energy

nemorandum

DATE JUL 7 1989

TO

N OF NE-23

JECT RECOMMENDATION FOR CERTIFICATION OF REMEDIAL ACTION FOR 35 PROPERTIES ASSOCIATED WITH THE FORMER NATIONAL LEAD INDUSTRIES IN COLONIE, NEW YORK

TO J. E. Baublitz, Acting Director
Office of Remedial Action and Waste Technology, NE-20

I am attaching for your signature the Federal Register Notice for 35 properties associated with the former National Lead Industries in Colonie, New York.

During the 1950s, National Lead (NL) Industries began manufacturing uranium products at the Colonie plant, operating under a license issued by the Atomic Energy Commission (AEC), predecessor of the Department of Energy (DOE). Between 1958 and 1968, NL Industries held numerous AEC contractor for fabrication of slightly enriched (in the uranium-235 isotope) uranium fuel elements and chemical processing of nonirradiated, slightly enriched uranium scrap.

After termination of the AEC contracts, work at the NL plant was limited to fabrication of shielding components, ballast weights, and projectiles from depleted uranium.

On February 15, 1980, the New York State Supreme Court issued an order temporarily restraining NL Industries from operating its Colonie facility on the basis that the facility emitted contaminants as airborne releases of uranium compounds. The temporary restraining order was amended on May 12, 1980, to allow some limited operation with the condition that NL Industries begin an assessment of soils in the vicinity of the plant. Operations at the plant were halted in the spring of 1984. Although the releases associated with the operation of this plant were not regulated under DOE authority, the site was included in the DOE Formerly Utilized Sites Remedial Action Program after Congress, through the 1984 Energy and Water Appropriations Act, authorized DOE to conduct a decontamination research and development project.

Teledyne Isotopes surveyed the neighborhood surrounding the NL plant for radioactivity in 1980 and determined that uranium released into the air had deposited on residential and commercial properties and structures during the course of the plant's operations.

In October 1983, more detailed radiological surveys of the individual properties surrounding the NL plant (including private residences) were performed by the Oak Ridge National Laboratory. These surveys were designed to further characterize the site and identify contamination at residential and commercial properties.

During 1984 and 1985, the Office of Nuclear Energy performed remedial actions at 35 properties associated with the former NL Industries. These properties are:

Parcel 1 located on 27/29 Yardboro Avenue, City of Albany, identified as Block 1, Lot 36 (per tax map; no identification per access agreement).

Parcel 2 located on 52 Yardboro Avenue, City of Albany, identified as Block 1, Lot 13 (per tax map); as Block 1, Lots 11, 12, and 13 (per access agreement).

Parcel 3 located on 68 Yardboro Avenue, City of Albany, identified as Block 1, Lots 4, 5, and 6 (per tax map); as Block 1, Lots 4, 5, 6, 7, and 8 (per access agreement).

Parcel 4 located on 74 Yardboro Avenue, City of Albany, identified as Block 1, Lot 3 (per tax map); as Block 1, Lot 3 (per access agreement).

Parcel 5 located on 78 Yardboro Avenue, City of Albany, identified as Block 1, Lot 2 (per tax map); as Block 1, Lot 2 (per access agreement).

Parcel 6 located on 80 Yardboro Avenue, City of Albany, identified as Block 1, Lot 1 (per tax map); as Block 1, Lot 1 (per access agreement).

Parcel 7 located on 33 Palmer Avenue, City of Albany, identified as Block 1, Lot 37 (per tax map); as Block 1, Lot 37 (per access agreement).

Parcel 8 located on 1114 Central Avenue, Town of Colonie, identified as Block 0806 (per tax map; no identification per access agreement).

Parcel 9 located on 1144 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 10 located on 1144A Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 11 located on 1159 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 12 located on 5 Yardboro Avenue, City of Albany, identified as Block 1, Lot 26 (per tax map; no identification per access agreement).

Parcel 13 located on 24 Yardboro Avenue, City of Albany, identified as Block 1, Lot 17 (per tax map; no identification per access agreement).

Parcel 14 located on 25/27 Yardboro Avenue, City of Albany, identified as Block 1, Lot 36 (per tax map; no identification per access agreement).

Parcel 15 located on 50 Yardboro Avenue, City of Albany, identified as Block 1, Lot 14 (per tax map) as Block 1, Lots 18, 19, 20, 21, 22, and 23 (per access agreement).

Parcel 16 located on 1100 Central Avenue, City of Albany, identified as Block 1, Lot 24 (per tax map; no identification per access agreement).

Parcel 17 located on 1104 Central Avenue, City of Albany, identified as Block 0806 (per tax map; no identification per access agreement).

Parcel 18 located on 1118 Central Avenue, Town of Colonie, identified as Block 0806 (per tax map; no identification per access agreement).

Parcel 19 located on 1129 Central Avenue, Town of Colonie, identified as Block 0905 (per tax map; no identification per access agreement).

Parcel 20 located on 1146 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 21 located on 1147 Central Avenue, Town of Colonie, identified as Block 0905 (per tax map; no identification per access agreement).

Parcel 22 located on 1148 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 23 located on 1150 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 24 located on 1152 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 25 located on 1160 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 26 located on 1160/62 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 27 located on 1161/63 Central Avenue, Town of Colonie, identified as Block 0905 (per tax map; no identification per access agreement).

Parcel 28 located on 1166 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 29 located on 1167 Central Avenue, Town of Colonie, identified as Block 0905 (per tax map; no identification per access agreement).

Parcel 30 located on 1168 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 31 located on 1170 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Parcel 32 located on 1185 Central Avenue, Town of Colonie, identified as Block 0905 (per tax map; no identification per access agreement).

Parcel 33 located on 1195 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

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7/11/89

Parcel 34 located on 7 Palmer Avenue, City of Albany, identified as Block 1, Lot 35 (per tax map; no identification per access agreement).

Parcel 35 located on 10 Garden Lane, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

Based on a review of all documents related to these properties, we have concluded that they should be certified to be in compliance with criteria and standards established for the remedial action conducted at Colonie. These criteria were established in conjunction with the state of New York, with review by the Environmental Protection Agency.

The Division of Facility and Site Decommissioning Projects has provided the attached docket to effect the certification of the subject properties.

Following your approval of the certification, this office and/or the Oak Ridge Operations Office, Technical Services Division, will notify interested state and local agencies, the public, local land offices, and the specific property owners of the certification actions by correspondence and local newspaper announcements, as appropriate. The documents transmitted with the Statement of Certification and the Federal Register notice will be compiled in final docket form by the Division of Facility and Site Decommissioning Projects for retention in accordance with DOE Order 1324.2 (Disposal Schedule 25).

J. J. Fiore, Director
Division of Facility and Site
Decommissioning Projects
Office of Nuclear Energy
U.S. Department of Energy

Attachments:
As Stated

bcc:
G. Turi, NE-23
OTS

NE-23 RF
Wallo RF
NEG (4)

NE-23:AWallo:ph:353-5439:7/5/89

STATEMENT OF CERTIFICATION: VICINITY PROPERTY ASSOCIATED WITH THE FORMER NATIONAL LEAD INDUSTRIES ACTIVITIES

The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 1 located on 27/29 Yardboro Avenue, City of Albany, identified as Block 1, Lot 36 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Cross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

STATEMENT OF CERTIFICATION: VICINITY PROPERTY ASSOCIATED WITH THE FORMER NATIONAL LEAD INDUSTRIES ACTIVITIES

The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 2 located on 52 Yardboro Avenue, City of Albany, identified as Block 1, Lot 13 (per tax map; as Block 1, Lots 11, 12, and 13 (per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

STATEMENT OF CERTIFICATION: VICINITY PROPERTY ASSOCIATED WITH THE FORMER NATIONAL LEAD INDUSTRIES ACTIVITIES

The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 3 located on 68 Yardboro Avenue, City of Albany, identified as Block 1, Lots 4, 5, and 6 (per tax map); as Block 1, Lots 4, 5, 6, 7, and 8 (per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

STATEMENT OF CERTIFICATION: VICINITY PROPERTY ASSOCIATED WITH THE FORMER NATIONAL LEAD INDUSTRIES ACTIVITIES

The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 4 located on 74 Yardboro Avenue, City of Albany, identified as Block 1, Lot 3 (per tax map); as Block 1, Lot 3 (per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

STATEMENT OF CERTIFICATION: VICINITY PROPERTY ASSOCIATED WITH THE FORMER NATIONAL LEAD INDUSTRIES ACTIVITIES

The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 5 located on 78 Yardboro Avenue, City of Albany, identified as Block 1, Lot 2 (per tax map); as Block 1, Lot 2 (per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

STATEMENT OF CERTIFICATION: VICINITY PROPERTY ASSOCIATED WITH THE FORMER NATIONAL LEAD INDUSTRIES ACTIVITIES

The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 6 located on 80 Yardboro Avenue, City of Albany, identified as Block 1, Lot 1 (per tax map); as Block 1, Lot 1 (per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

STATEMENT OF CERTIFICATION: VICINITY PROPERTY ASSOCIATED WITH THE FORMER NATIONAL LEAD INDUSTRIES ACTIVITIES

The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 7 located on 33 Palmer Avenue, City of Albany, identified as Block 1, Lot 37 (per tax map); as Block 1, Lot 37 (per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

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The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 8 located on 1114 Central Avenue, Town of Colonie, identified as Block 0806 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

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The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 9 located on 1144 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

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The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 10 located on 1144A Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

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The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 11 located on 1159 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

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The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 12 located on 5 Yardboro Avenue, City of Albany, identified as Block 1, Lot 26 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

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The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 13 located on 24 Yardboro Avenue, City of Albany, identified as Block 1, Lot 17 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

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The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 14 located on 25/27 Yardboro Avenue, City of Albany, identified as Block 1, Lot 36 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

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The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 15 located on 50 Yardboro Avenue, City of Albany, identified as Block 1, Lot 14 (per tax map); as Block 1, Lots 18, 19, 20, 21, 22, and 23 (per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ **Date:** JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

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The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 16 located on 1100 Central Avenue, City of Albany, identified as Block 1, Lot 24 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

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The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 17 located on 1104 Central Avenue, City of Albany, identified as Block 0806 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

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The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 18 located on 1118 Central Avenue, Town of Colonie, identified as Block 0806 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ **Date:** JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

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The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 19 located on 1129 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

STATEMENT OF CERTIFICATION: VICINITY PROPERTY ASSOCIATED WITH THE FORMER NATIONAL LEAD INDUSTRIES ACTIVITIES

The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 20 located on 1146 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

STATEMENT OF CERTIFICATION: VICINITY PROPERTY ASSOCIATED WITH THE FORMER NATIONAL LEAD INDUSTRIES ACTIVITIES

The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 21 located on 1147 Central Avenue, Town of Colonie, identified as Block 0905 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

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The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 22 located on 1148 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

STATEMENT OF CERTIFICATION: VICINITY PROPERTY ASSOCIATED WITH THE FORMER NATIONAL LEAD INDUSTRIES ACTIVITIES

The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 23 located on 1150 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

STATEMENT OF CERTIFICATION: VICINITY PROPERTY ASSOCIATED WITH THE FORMER NATIONAL LEAD INDUSTRIES ACTIVITIES

The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 24 located on 1152 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

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The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 25 located on 1160 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

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The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 26 located on 1160/62 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

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The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 27 located on 1161/63 Central Avenue, Town of Colonie, identified as Block 0905 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

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The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 28 located on 1166 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

STATEMENT OF CERTIFICATION: VICINITY PROPERTY ASSOCIATED WITH THE FORMER NATIONAL LEAD INDUSTRIES ACTIVITIES

The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 29 located on 1167 Central Avenue, Town of Colonie, identified as Block 0905 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

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Parcel 30 located on 1168 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

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Parcel 31 located on 1170 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

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Parcel 32 located on 1185 Central Avenue, Town of Colonie, identified as Block 0905 (per tax map; no identification per access agreement).

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Parcel 33 located on 1195 Central Avenue, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

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Parcel 34 located on 7 Palmer Avenue, City of Albany, identified as Block 1, Lot 35 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter S. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

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The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at 35 properties that were contaminated by material similar to that processed at the former National Lead (NL) Industries in Colonie, New York. Based on this analysis of all data collected the Department of Energy certifies that the following property is in compliance with applicable decontamination criteria and standards:

Parcel 35 located on 10 Garden Lane, Town of Colonie, identified as Block 0805 (per tax map; no identification per access agreement).

This certification of compliance provides assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants.

By: _____ Date: JUN 19 1989

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

Exhibit III

Diagrams of the Remedial Action at the Colonie Interim Storage Site Vicinity Properties in Colonie and Albany, New York, in 1984 and 1985.

EXHIBIT III

DIAGRAMS OF THE REMEDIAL ACTION AT THE

COLONIE INTERIM STORAGE SITE

VICINITY PROPERTIES IN COLONIE AND ALBANY,

NEW YORK, IN 1984 AND 1985

The figures provided on the following pages are taken from the post-remedial action reports; they illustrate the extent and the types of remedial action performed at the subject properties.

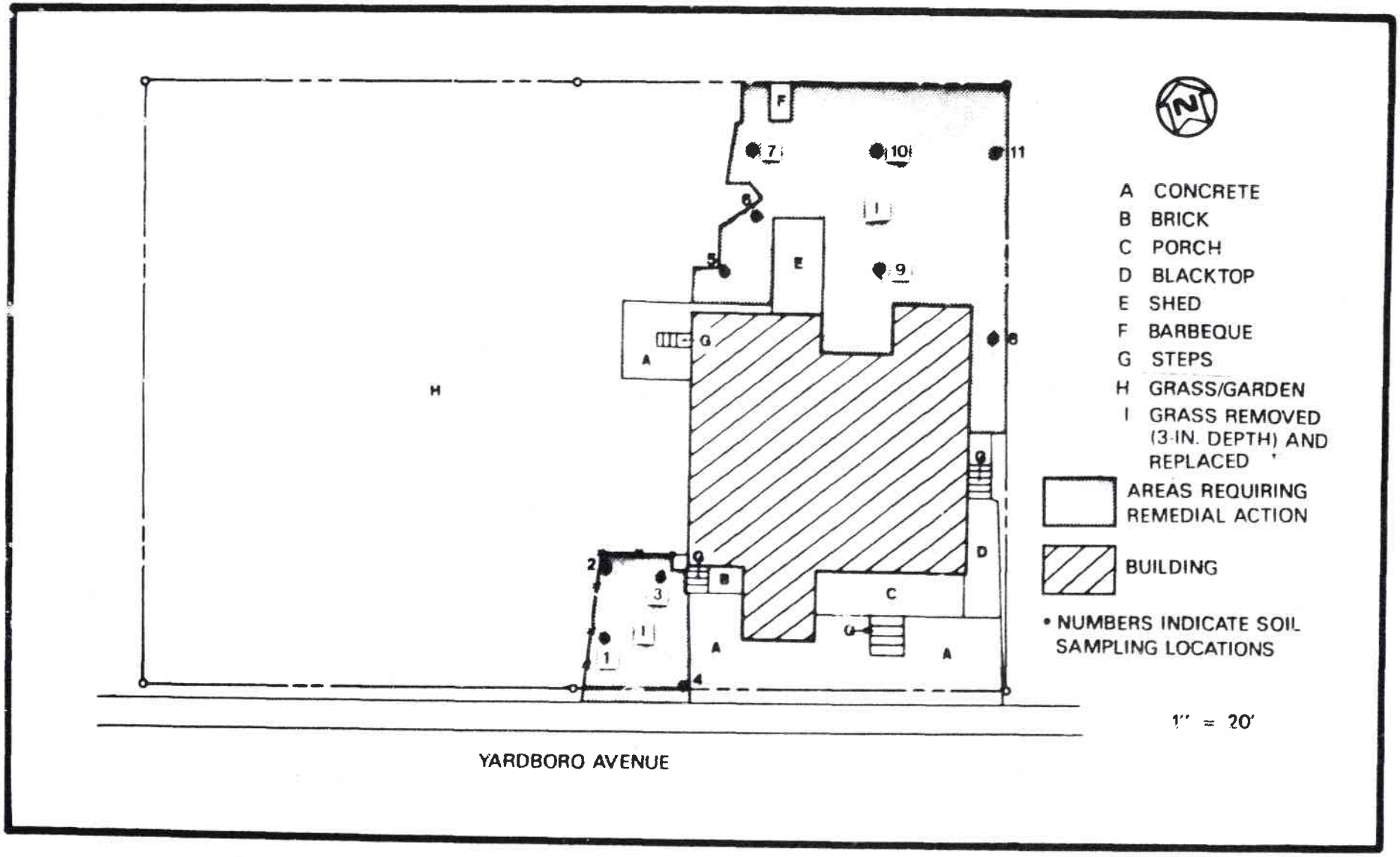
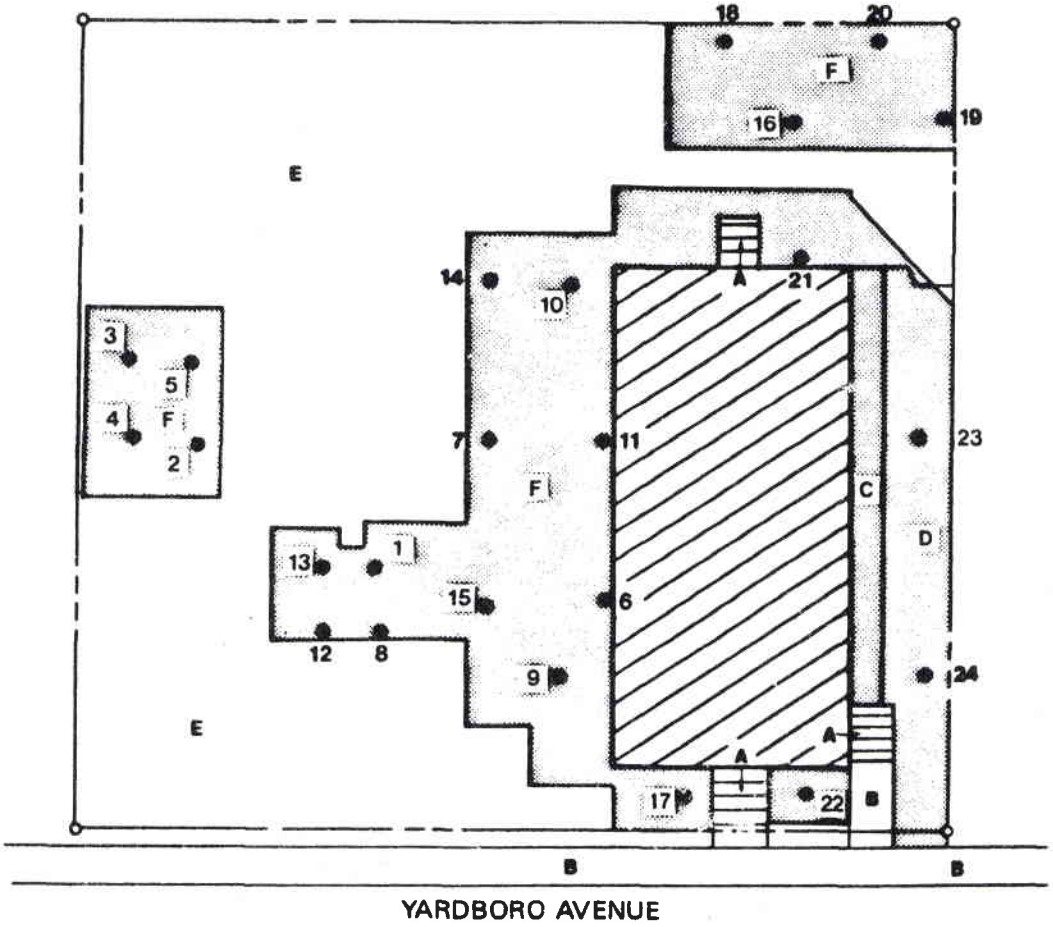


FIGURE 1 REMEDIAL ACTION AT 27/29 YARDBORO AVENUE



A STEPS
B CONCRETE WALK
C CONCRETE WALK CLEANED
D GRAVEL EXCAVATED AND REPLACED
E GRASS
F GRASS REMOVED (3-IN. DEPTH) AND REPLACED

AREAS REQUIRING REMEDIAL ACTION

BUILDING

• NUMBERS INDICATE SOIL SAMPLING LOCATIONS

1" = 20'

FIGURE 2 REMEDIAL ACTION AT 52 YARDBORO AVENUE

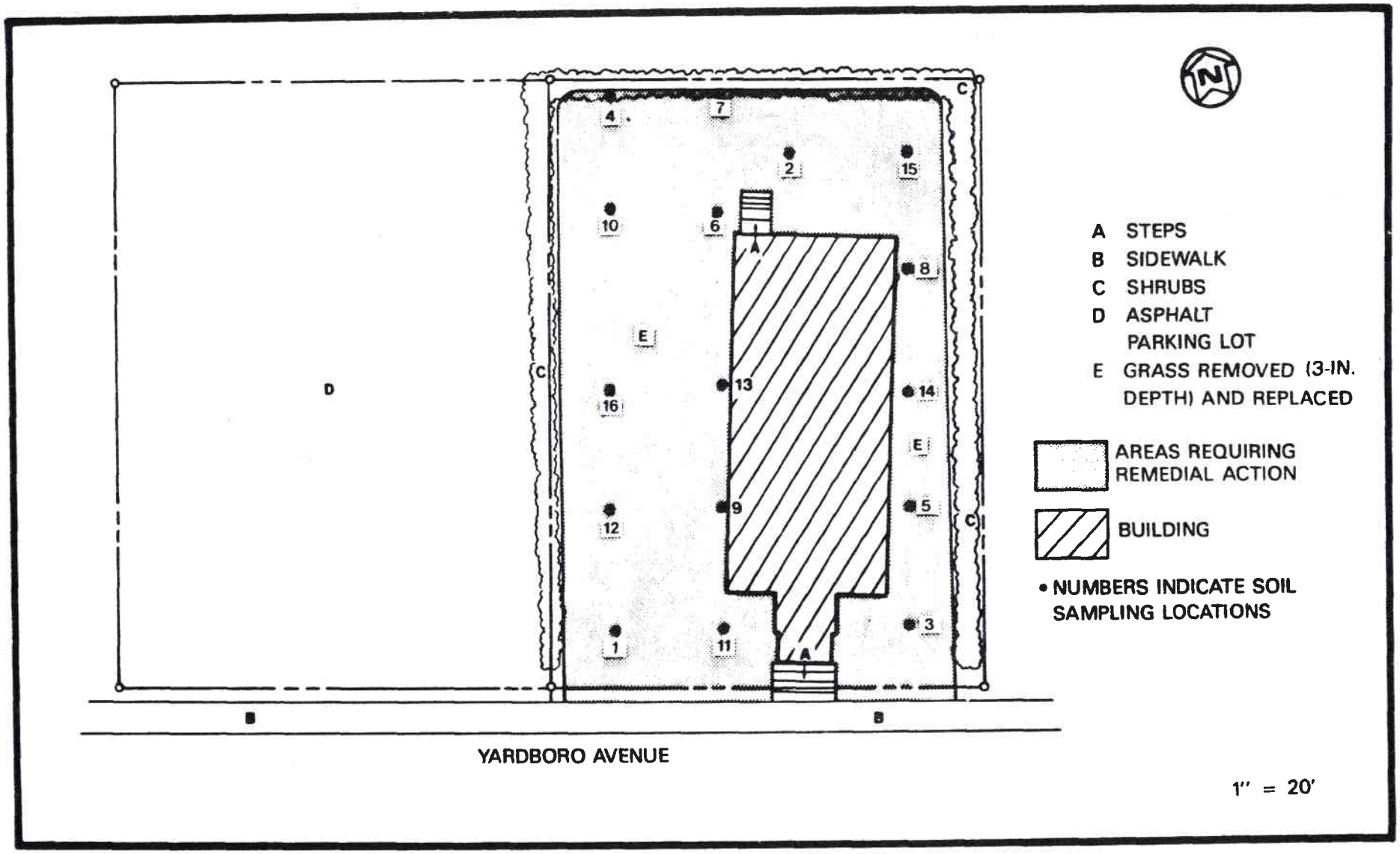
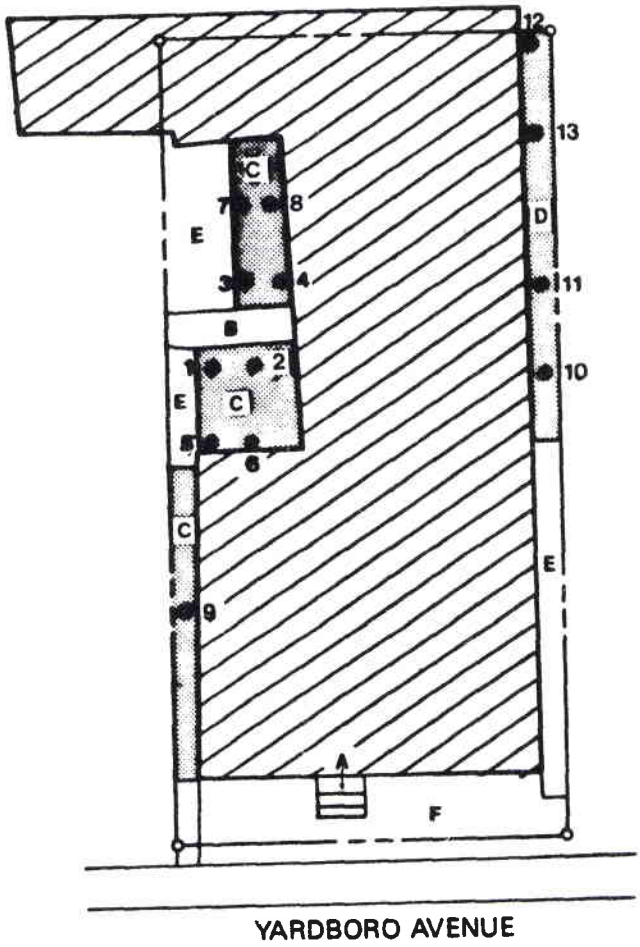


FIGURE 3 REMEDIAL ACTION AT 68 YARDBORO AVENUE



A STEPS
B CONCRETE WALK
C GRASS REMOVED (3-IN. DEPTH) AND REPLACED
D GRAVEL REMOVED (3-IN. DEPTH) AND REPLACED
E GRAVEL
F ASPHALT

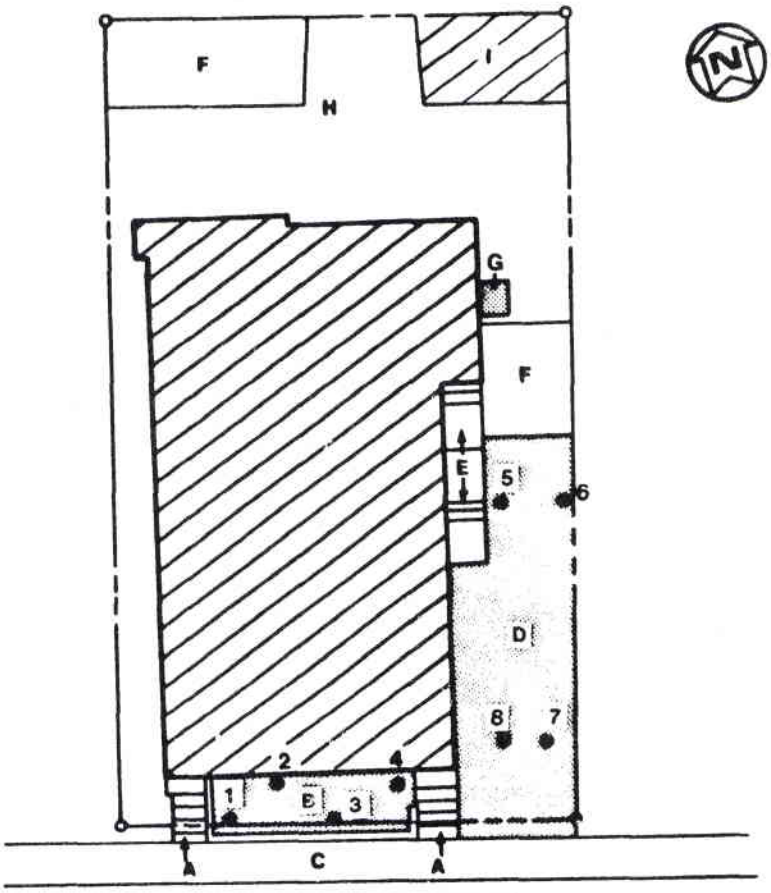
AREAS REQUIRING REMEDIAL ACTION

BUILDING

• NUMBERS INDICATE SOIL SAMPLING LOCATIONS

1" = 20'

FIGURE 4 REMEDIAL ACTION AT 74 YARDBORO AVENUE



A STEPS
B GRASS REMOVED (3-IN. DEPTH) AND REPLACED
C SIDEWALK
D STONE DRIVEWAY REMOVED, REPLACED WITH CONCRETE
E CONCRETE PORCH AND STEPS
F GRAVEL
G COAL CHUTE DOOR WAS REPLACED
H CONCRETE
I WOOD SHED

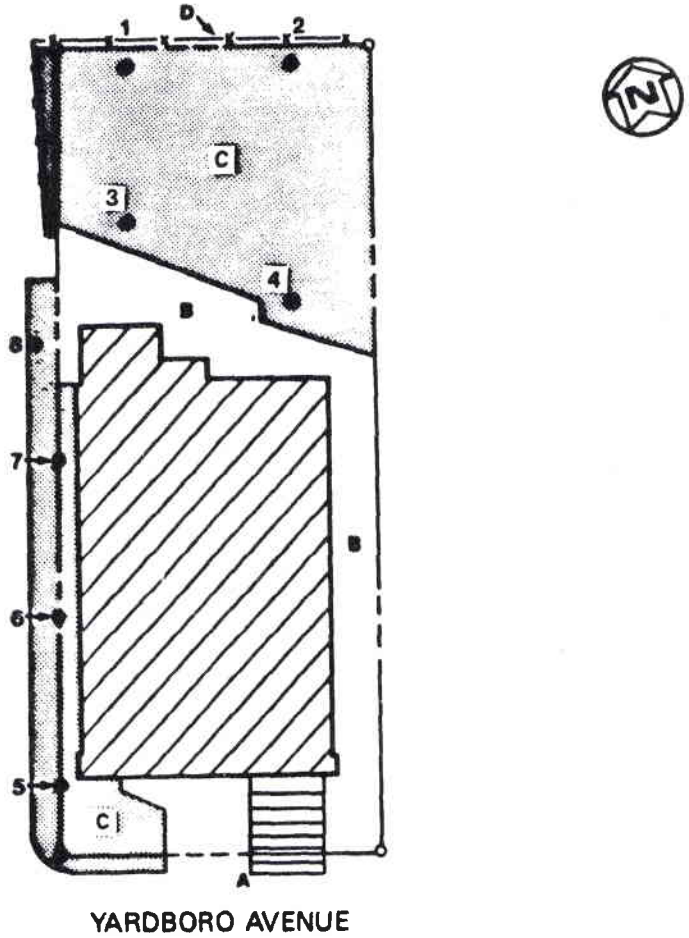
AREAS REQUIRING REMEDIAL ACTION

BUILDING

• NUMBERS INDICATE SOIL SAMPLING LOCATIONS

1" = 20'

FIGURE 5 REMEDIAL ACTION AT 78 YARDBORO AVENUE



A STEPS
B CONCRETE
C GRASS REMOVED (3-IN. DEPTH) AND REPLACED
D FENCE

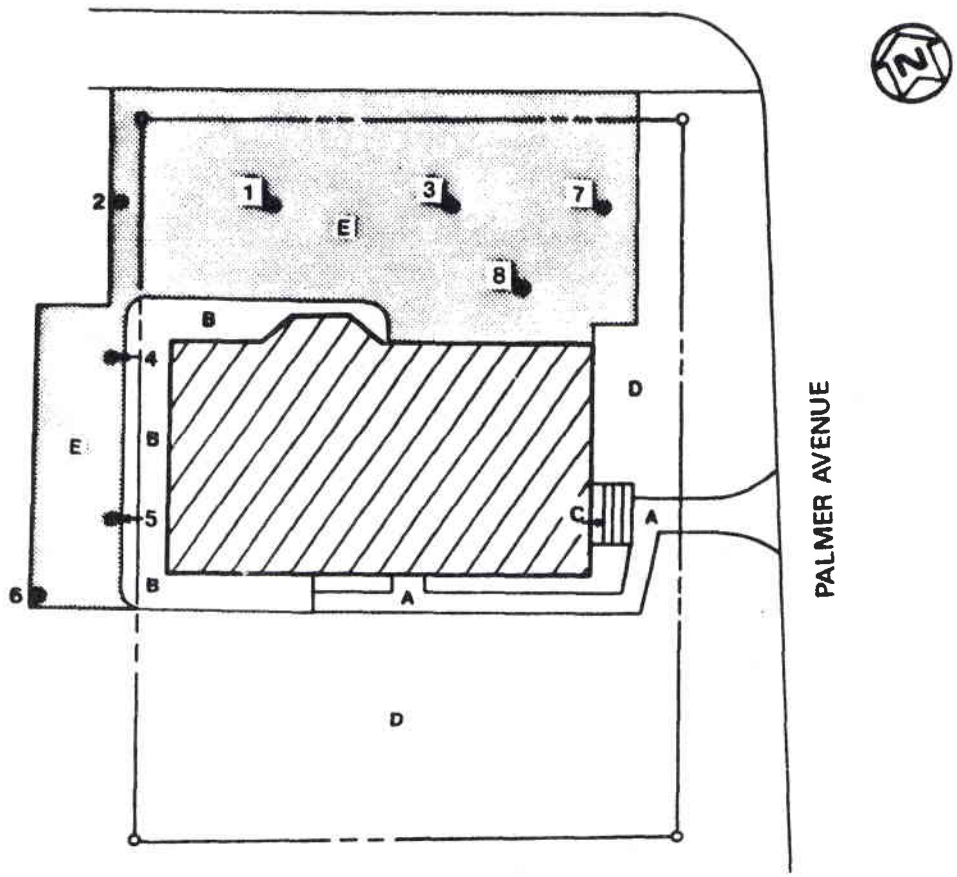
AREAS REQUIRING REMEDIAL ACTION

BUILDING

• NUMBERS INDICATE SOIL SAMPLING LOCATIONS

1" = 20'

FIGURE 6 REMEDIAL ACTION AT 80 YARDBORO AVENUE



A CONCRETE WALK
B ASPHALT WALK
C STEPS
D GRASS
E GRASS REMOVED (3-IN. DEPTH) AND REPLACED

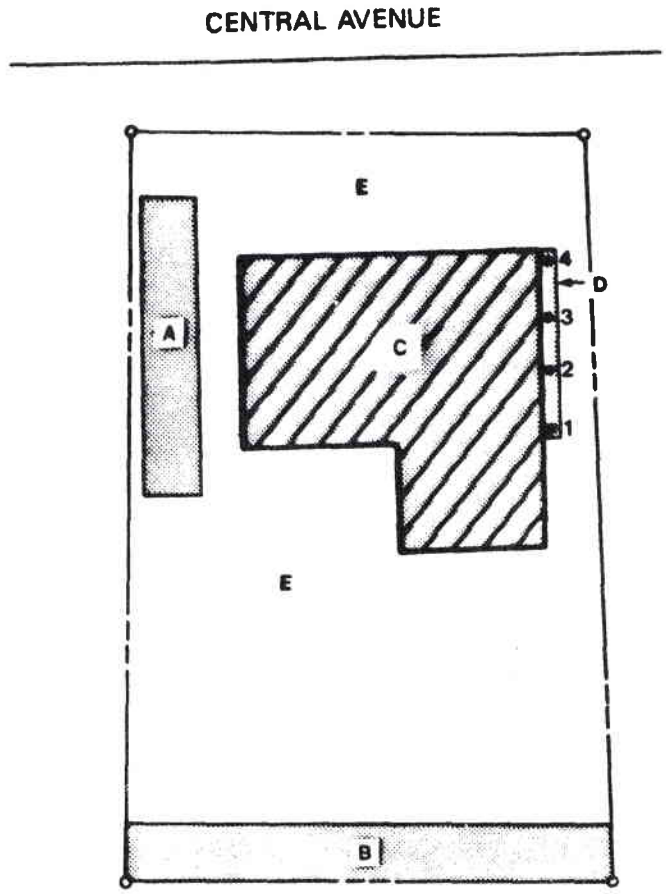
AREAS REQUIRING REMEDIAL ACTION

BUILDING

• NUMBERS INDICATE SOIL SAMPLING LOCATIONS

1" = 20'

FIGURE 7 REMEDIAL ACTION AT 33 PALMER AVENUE



A ASPHALT SCABBLED
B ROCKS/DIRT ON TOP OF ASPHALT EXCAVATED - ASPHALT SCABBLED
C TAR PAPER ROOF REMOVED
D SMALL GRASS STRIP REMOVED (3-IN. DEPTH) AND REPLACED
E ASPHALT

AREAS REQUIRING REMEDIAL ACTION

BUILDING

• NUMBERS INDICATE SOIL SAMPLING LOCATIONS

1" = 20'

FIGURE 8 REMEDIAL ACTION AT 1114 CENTRAL AVENUE

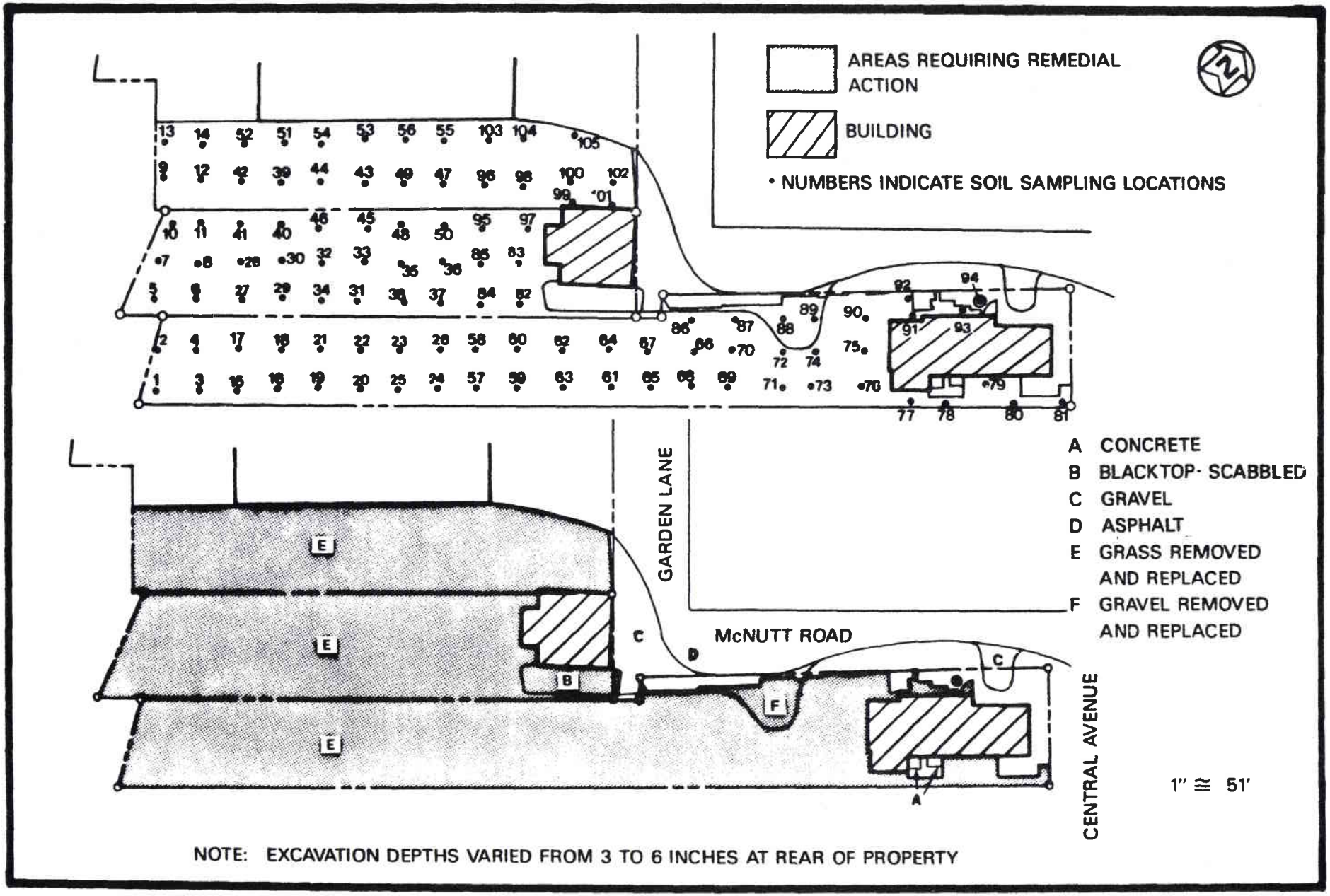
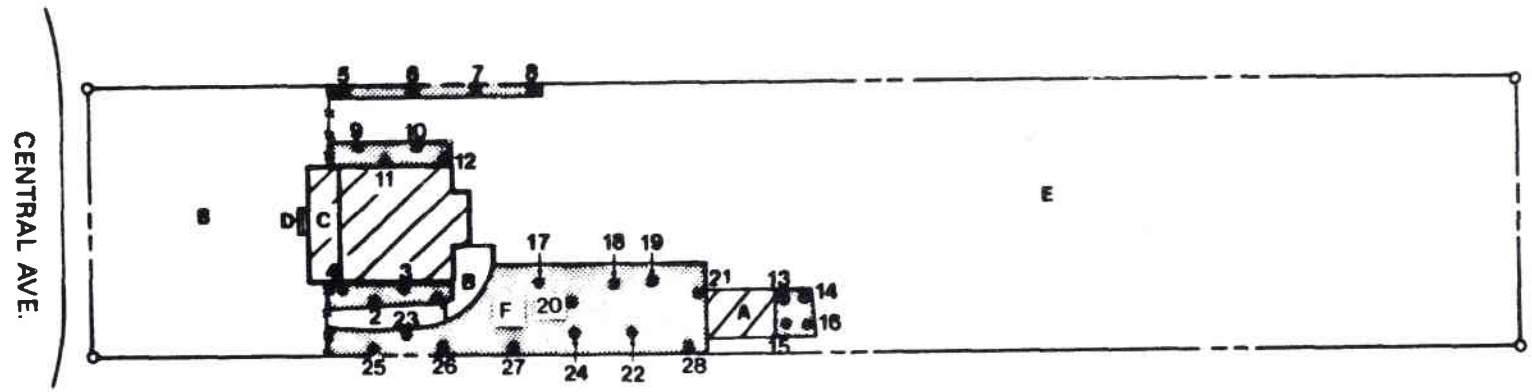


FIGURE 9 REMEDIAL ACTION AT 1144/1144A CENTRAL AVENUE



A GARAGE
B GRAVEL
C PORCH
D STEPS
E GRASS
F GRASS REMOVED (3-IN. DEPTH) AND REPLACED

AREAS REQUIRING REMEDIAL ACTION

BUILDING

• NUMBERS INDICATE SOIL SAMPLING LOCATIONS

1" ≅ 45'

FIGURE 10 REMEDIAL ACTION AT 1159 CENTRAL AVENUE

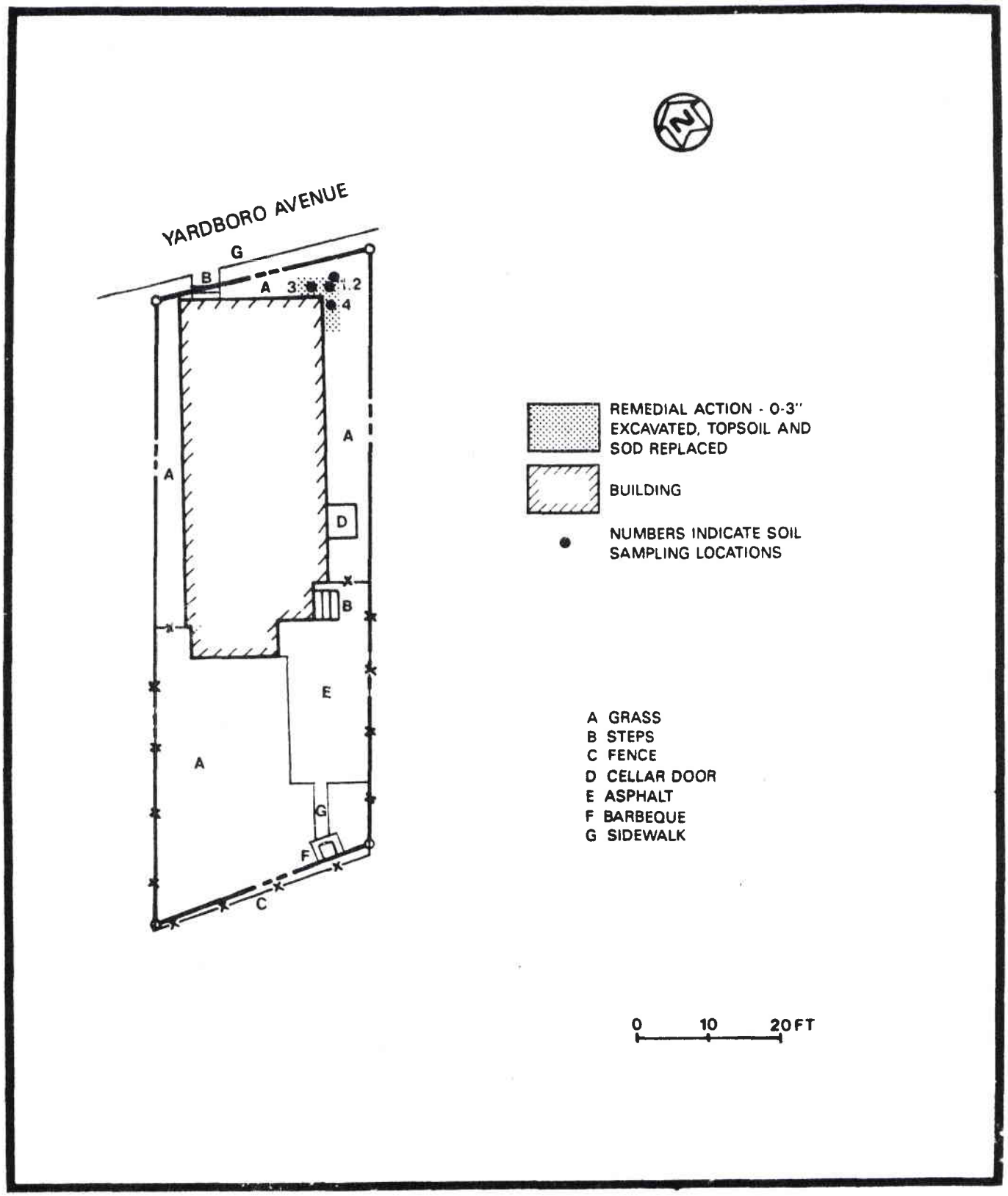


FIGURE 11 REMEDIAL ACTION AT 5 YARDBORO AVENUE

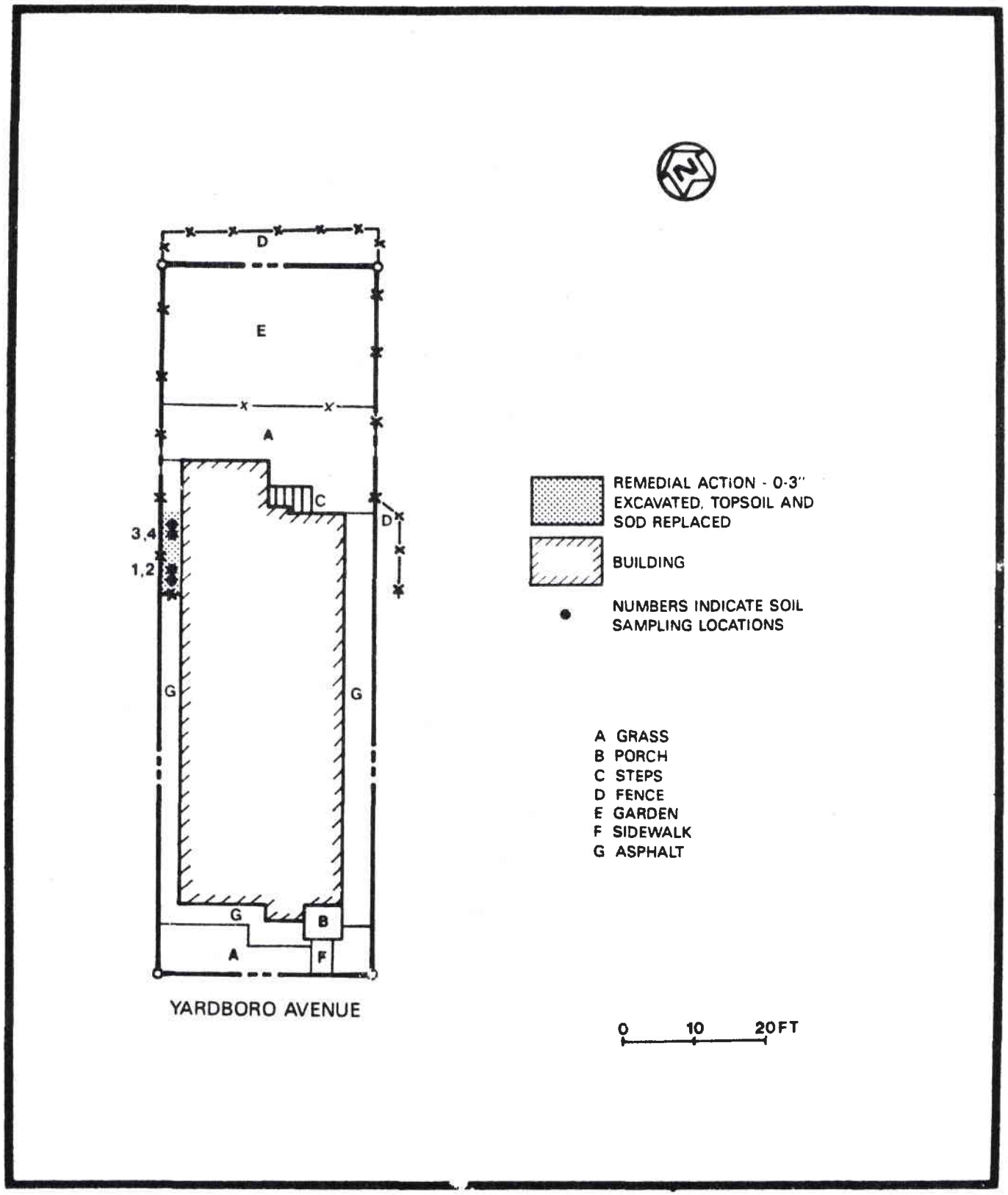


FIGURE 12 REMEDIAL ACTION AT 24 YARDBORO AVENUE

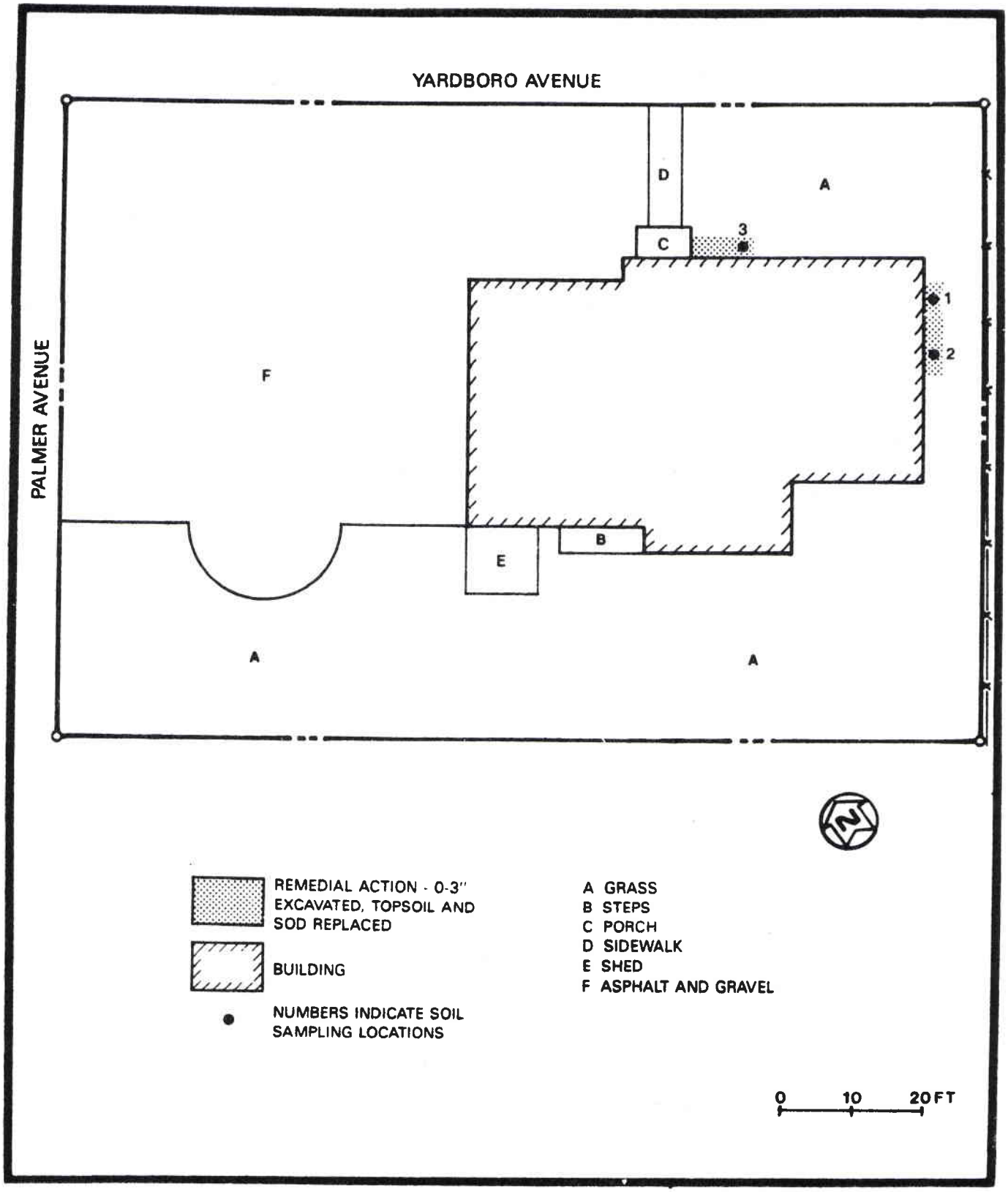


FIGURE 13 REMEDIAL ACTION AT 25/27 YARDBORO AVENUE

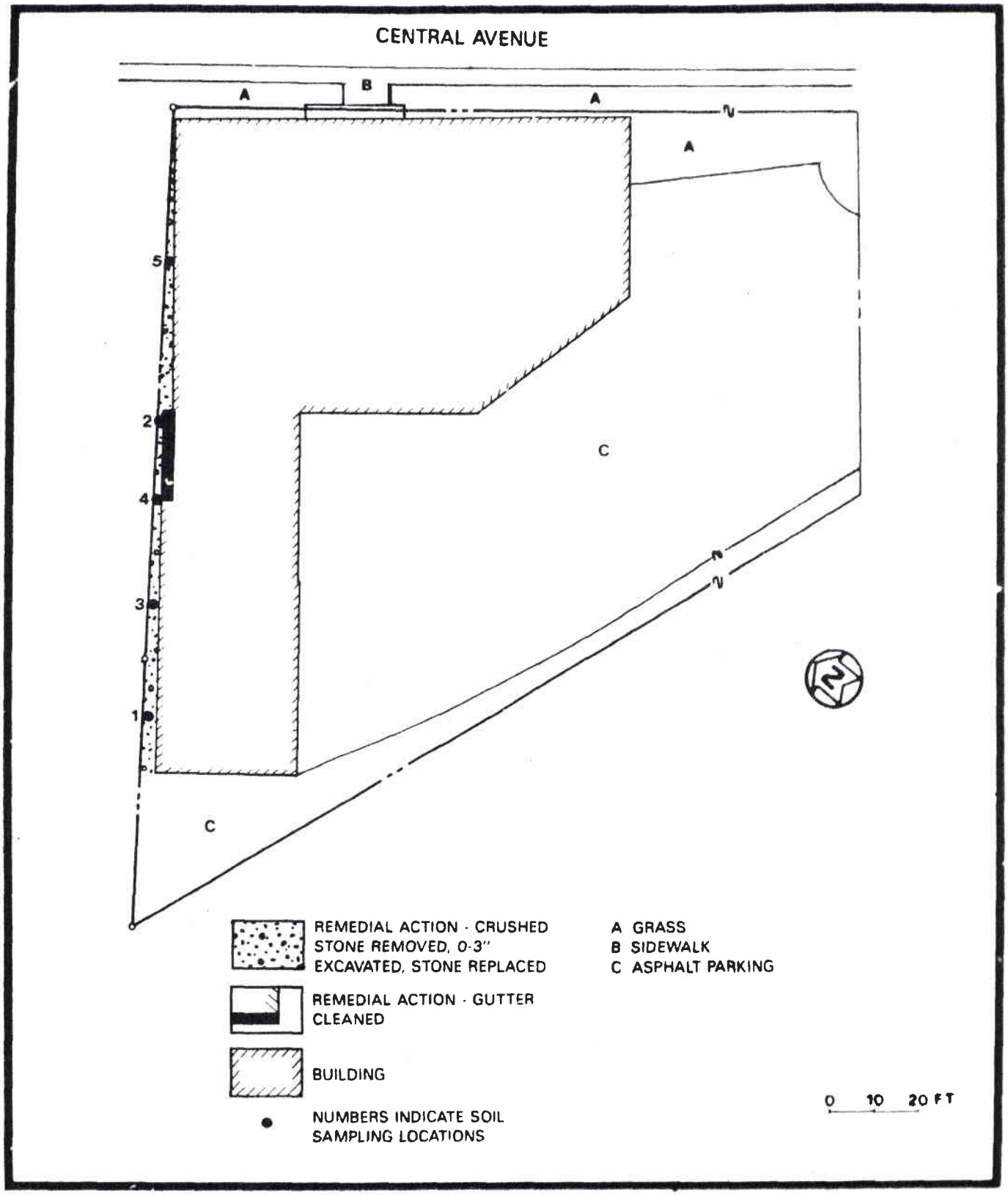


FIGURE 14 REMEDIAL ACTION AT 1100 CENTRAL AVENUE

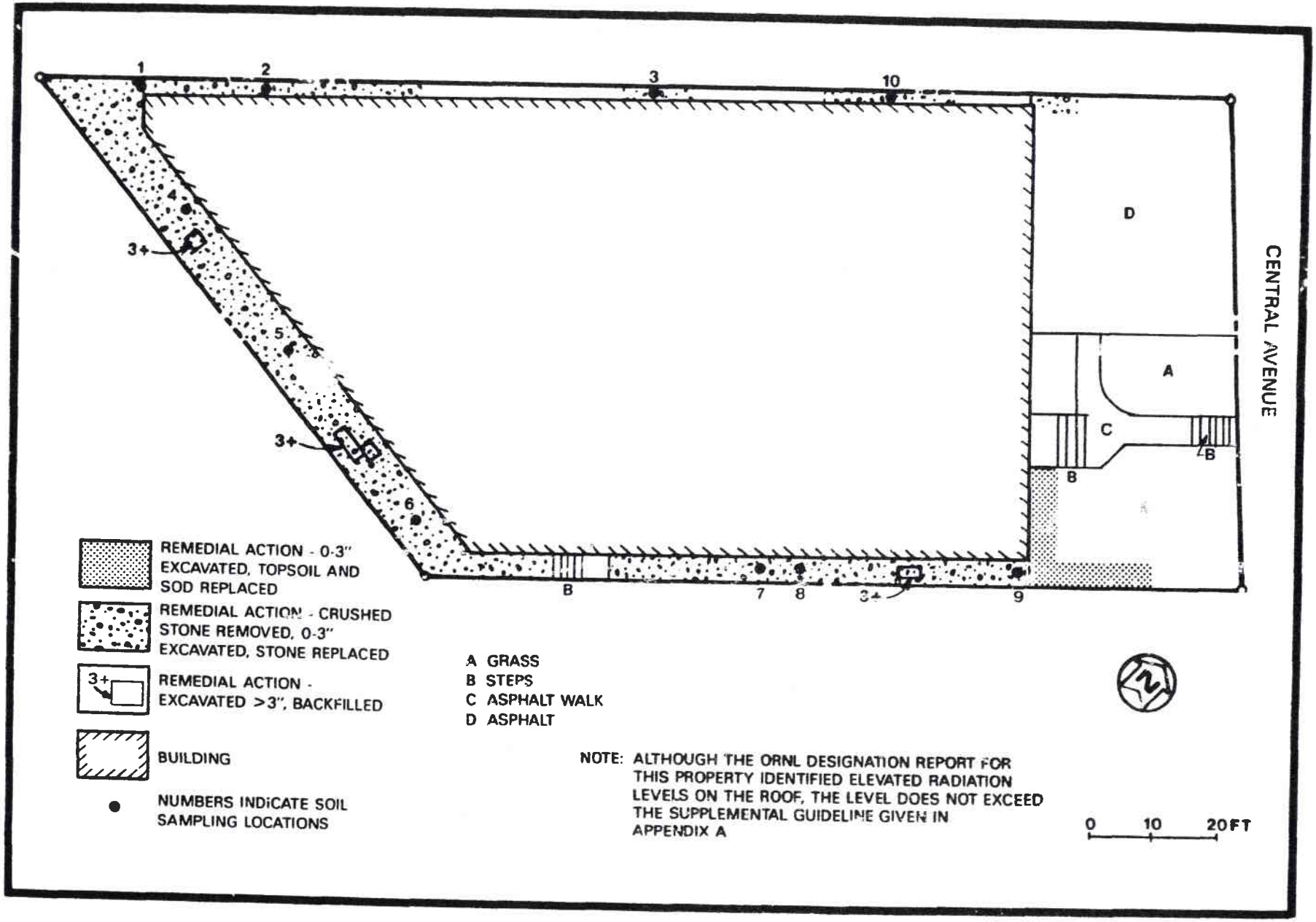


FIGURE 15 REMEDIAL ACTION AT 1104 CENTRAL AVENUE

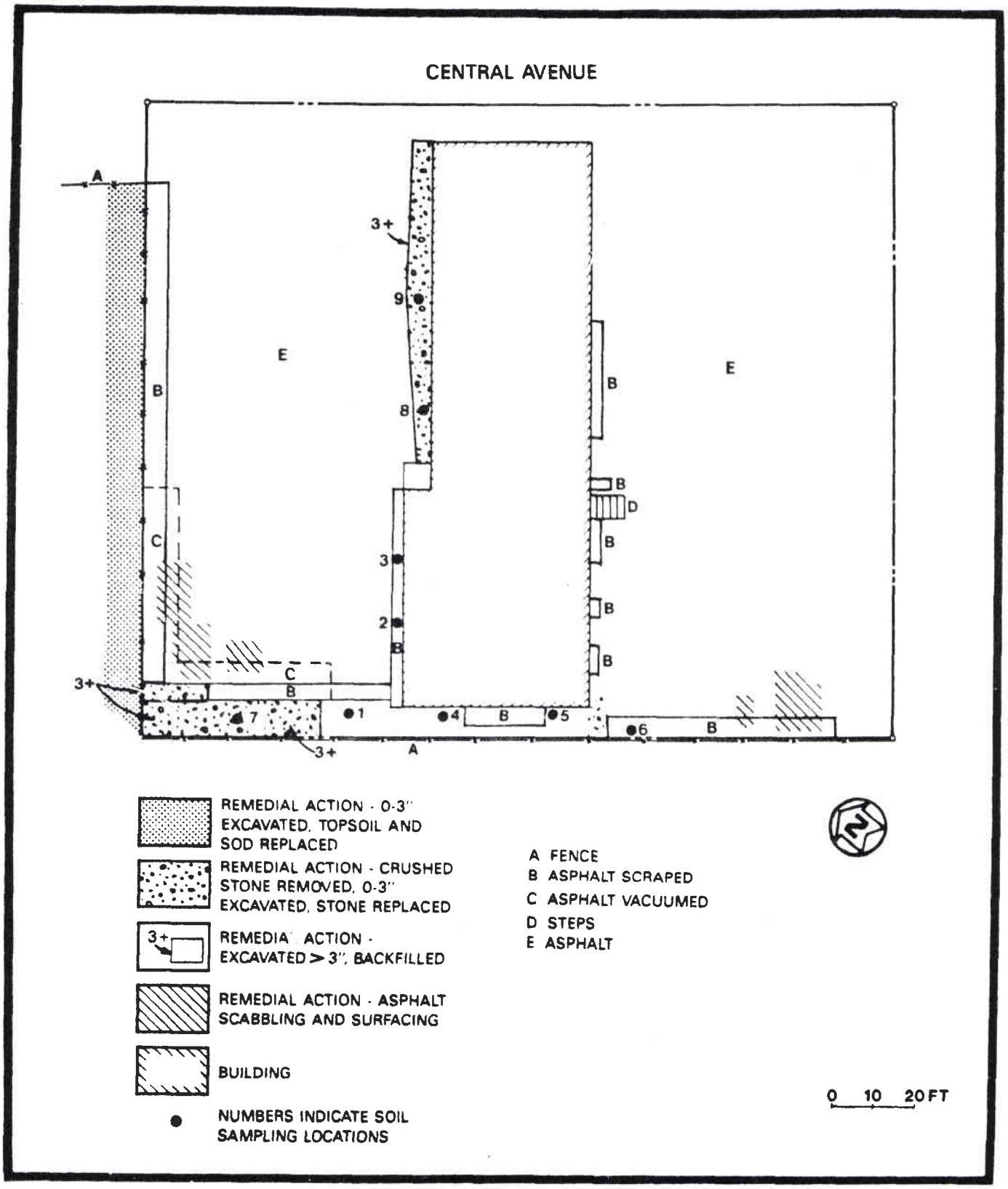


FIGURE 16 REMEDIAL ACTION AT 1118 CENTRAL AVENUE

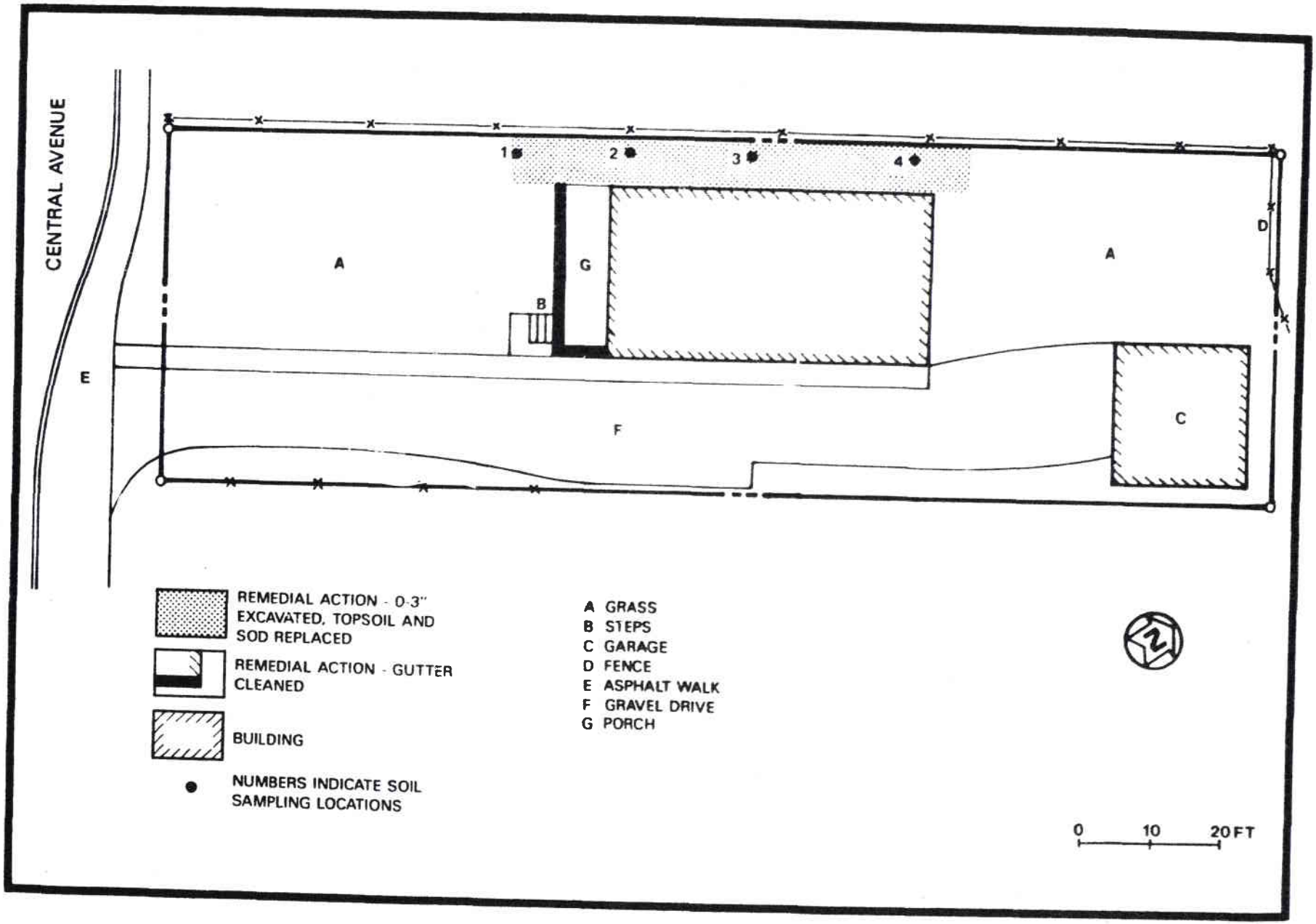


FIGURE 17 REMEDIAL ACTION AT 1129 CENTRAL AVENUE

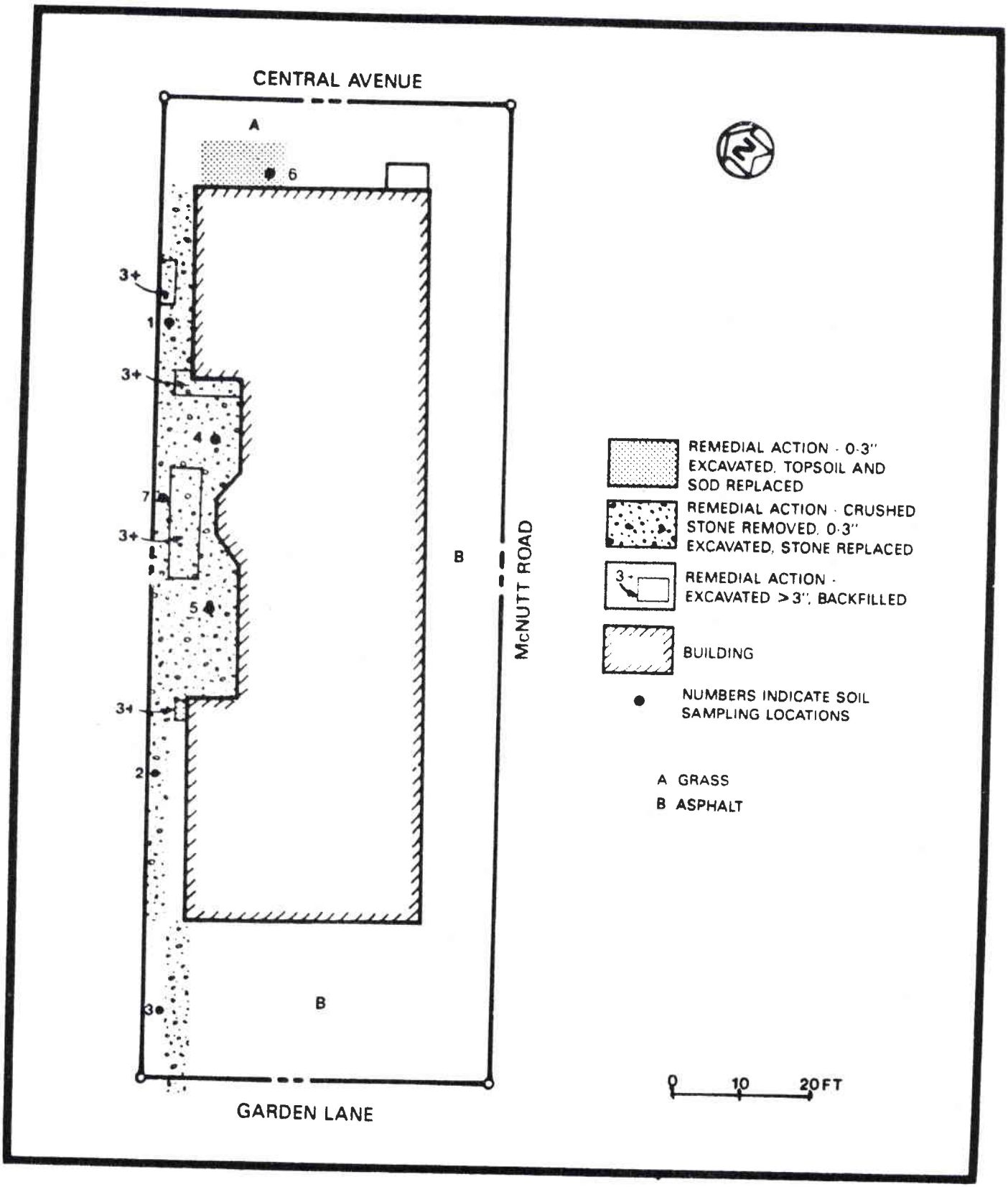


FIGURE 18 REMEDIAL ACTION AT 1146 CENTRAL AVENUE

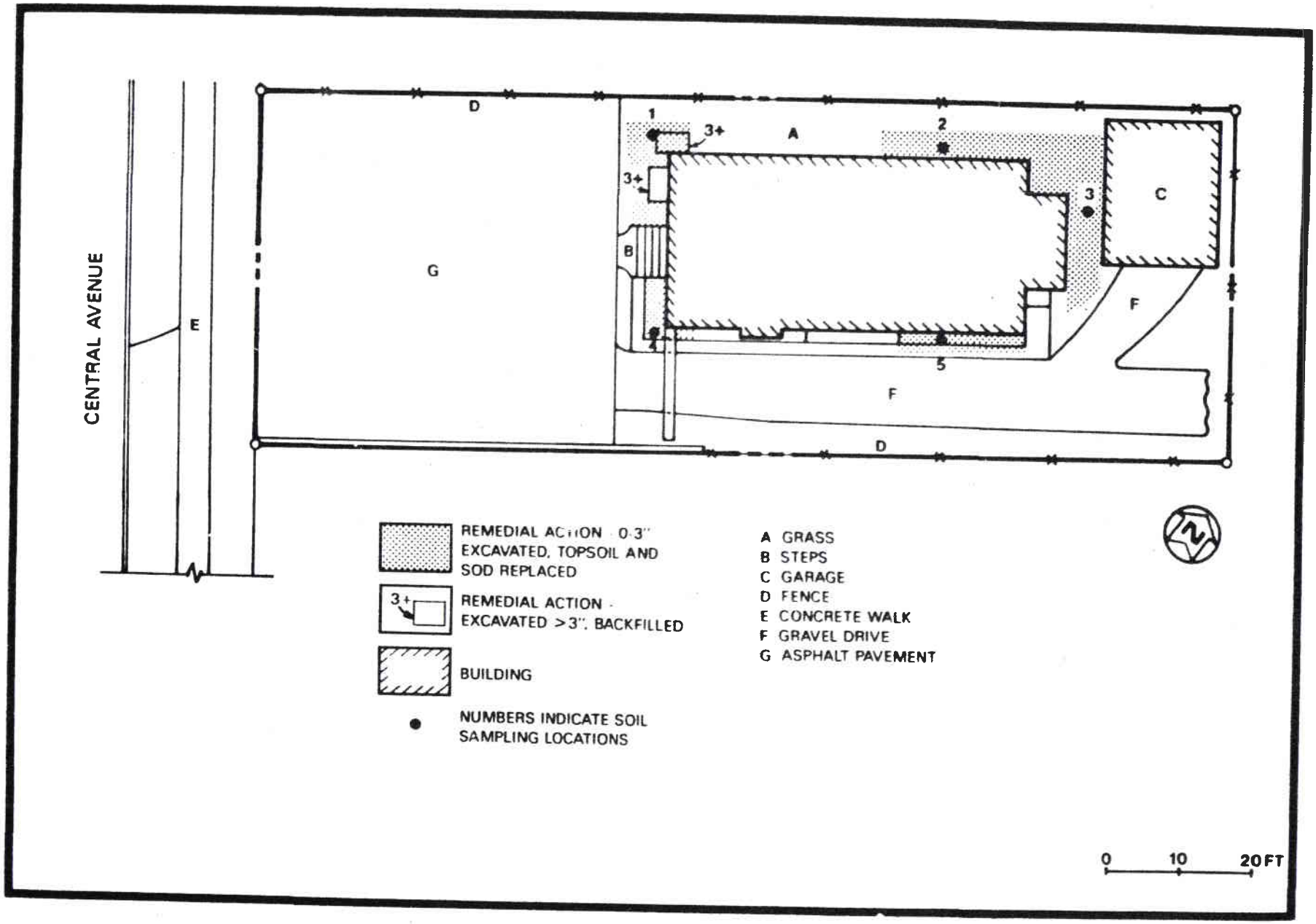


FIGURE 19 REMEDIAL ACTION AT 1147 CENTRAL AVENUE

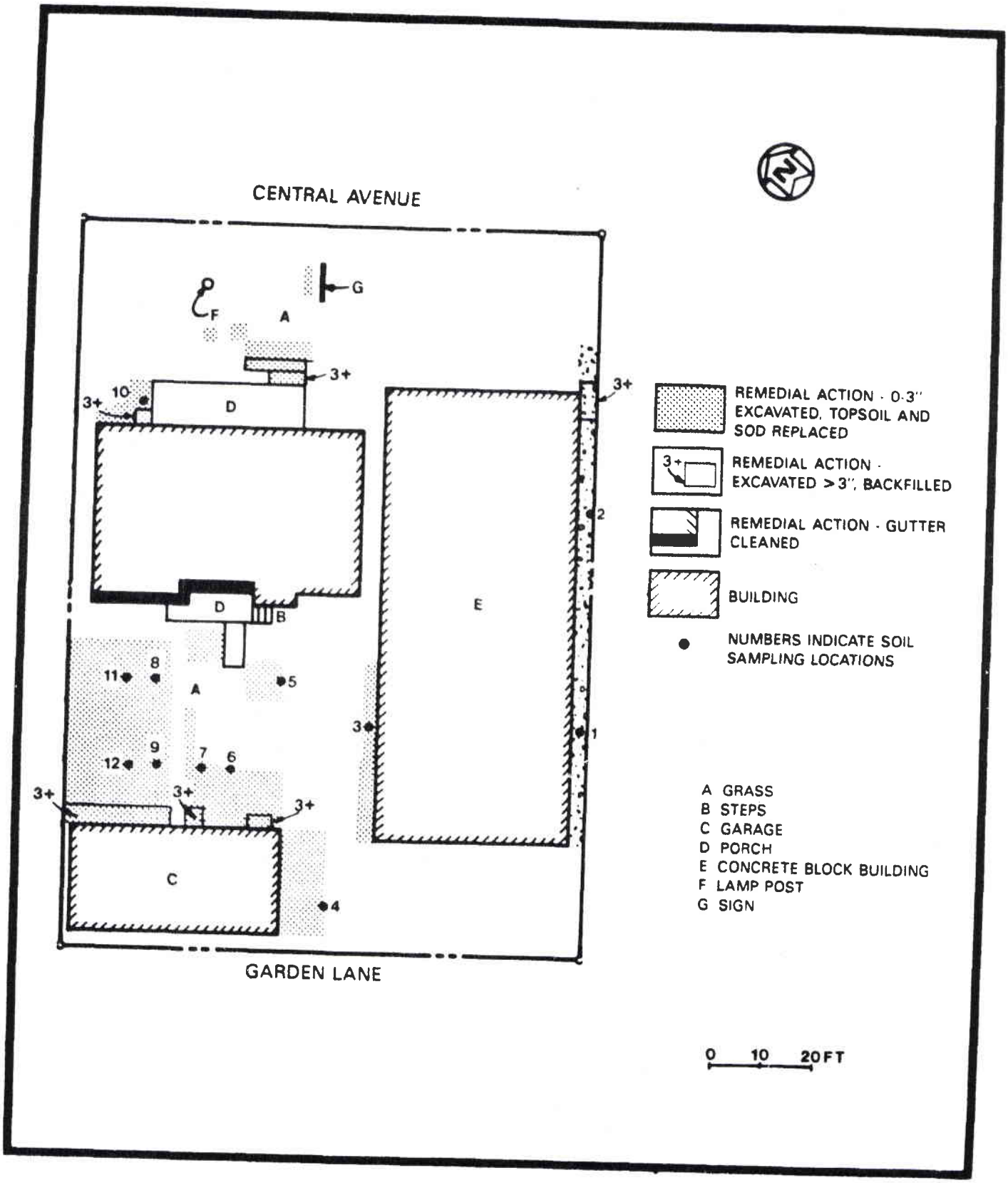


FIGURE 20 REMEDIAL ACTION AT 1148 CENTRAL AVENUE

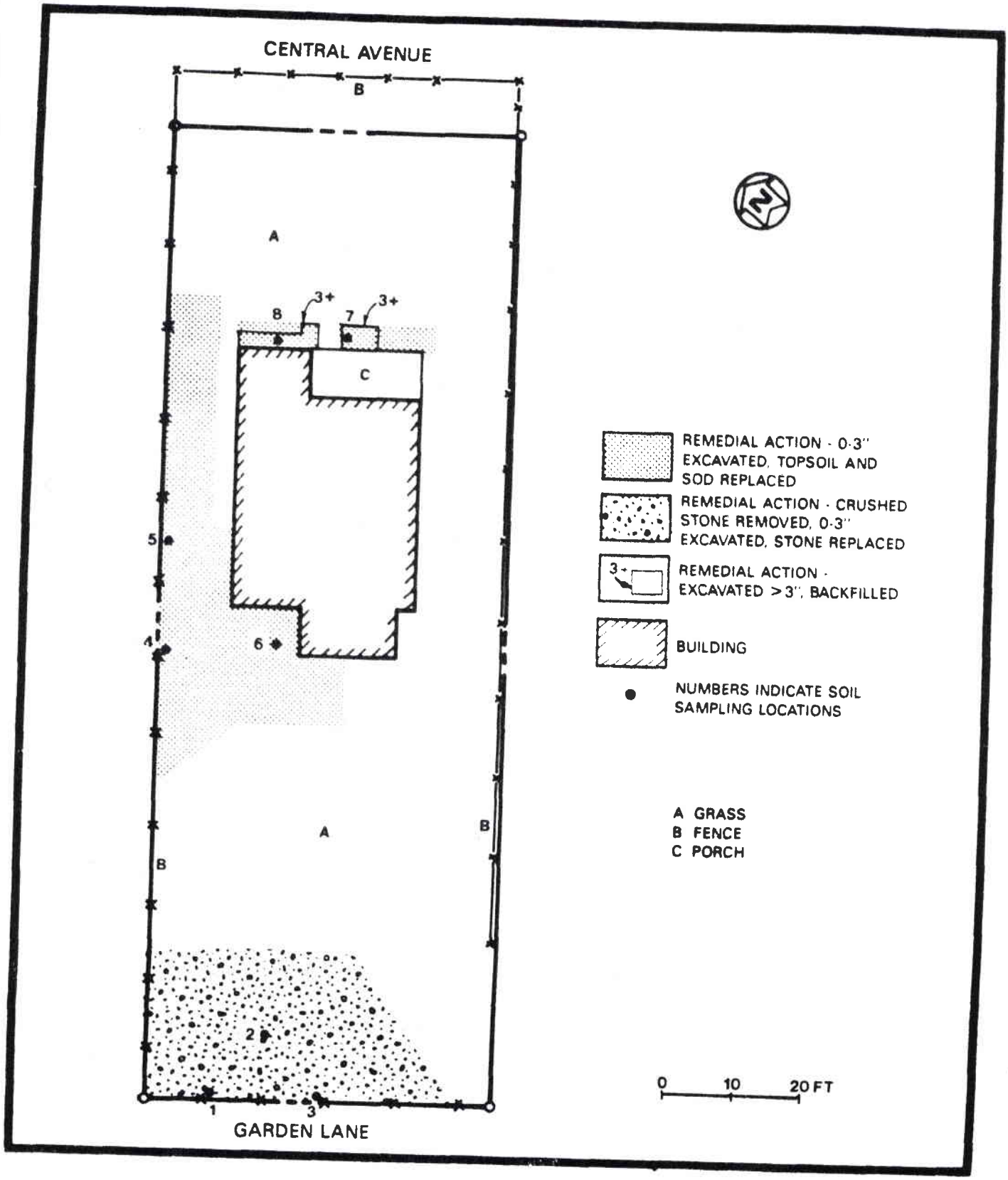


FIGURE 21 REMEDIAL ACTION AT 1150 CENTRAL AVENUE

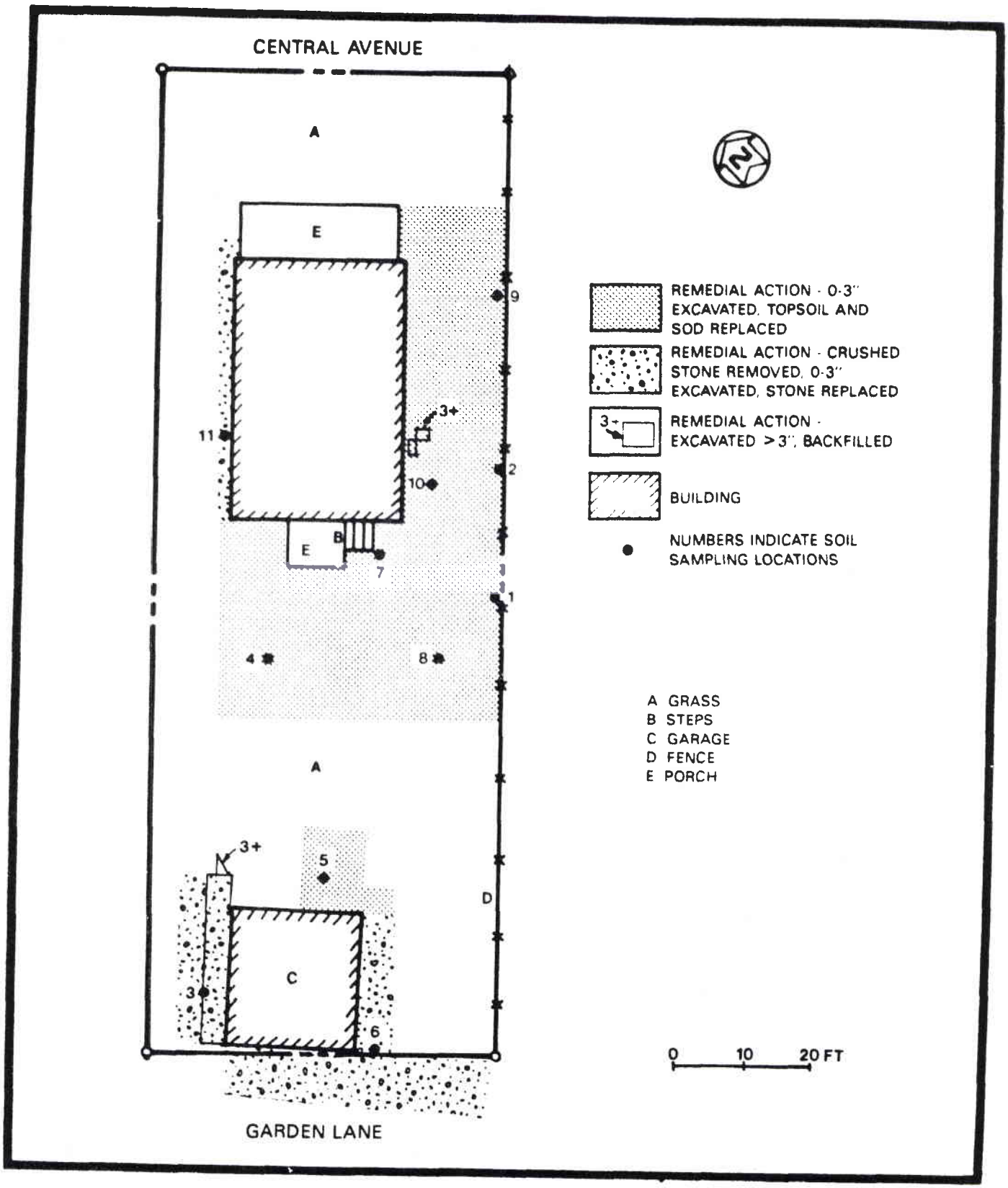


FIGURE 22 REMEDIAL ACTION AT 1152 CENTRAL AVENUE

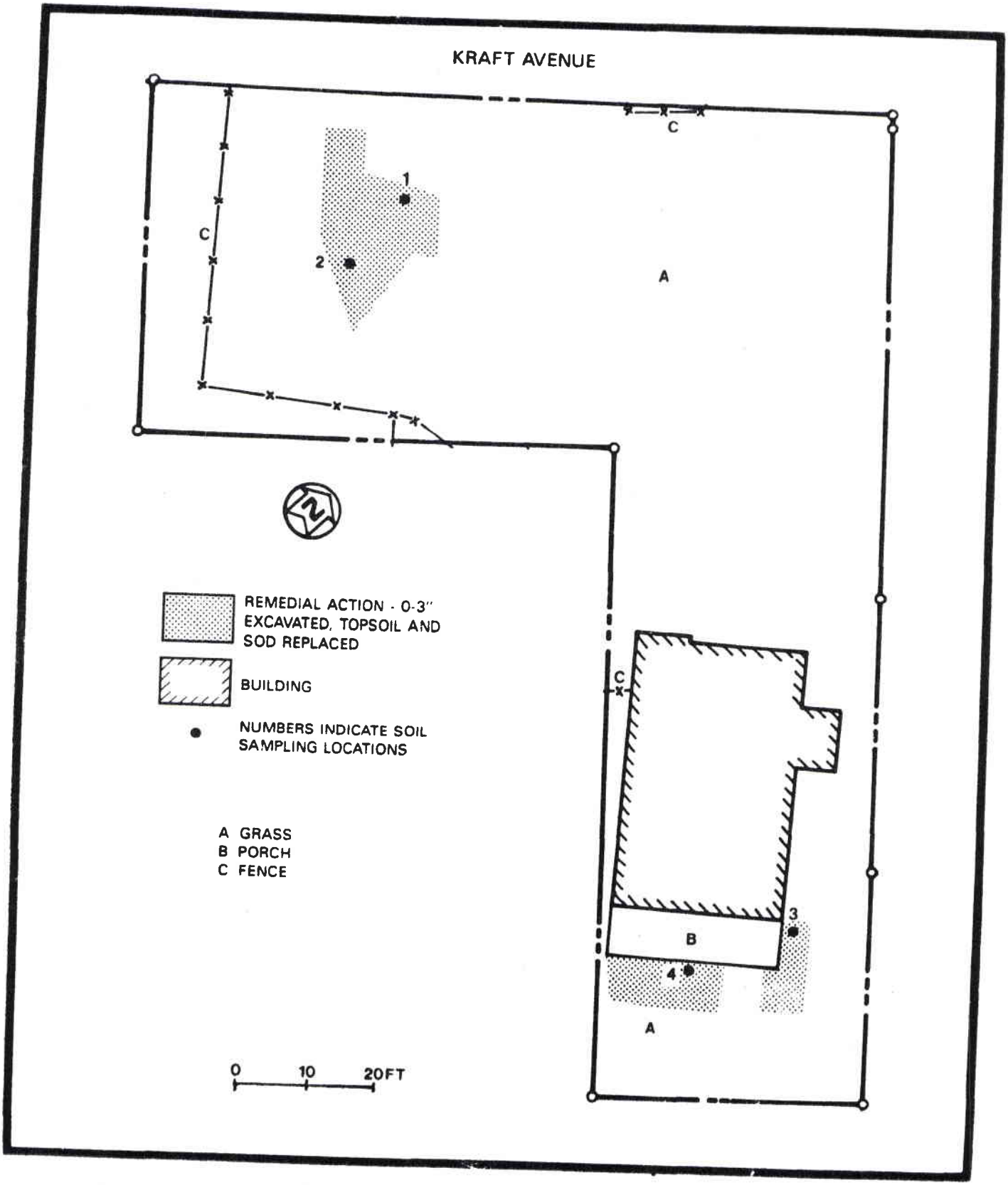


FIGURE 23 1160 (AL021) CENTRAL AVENUE

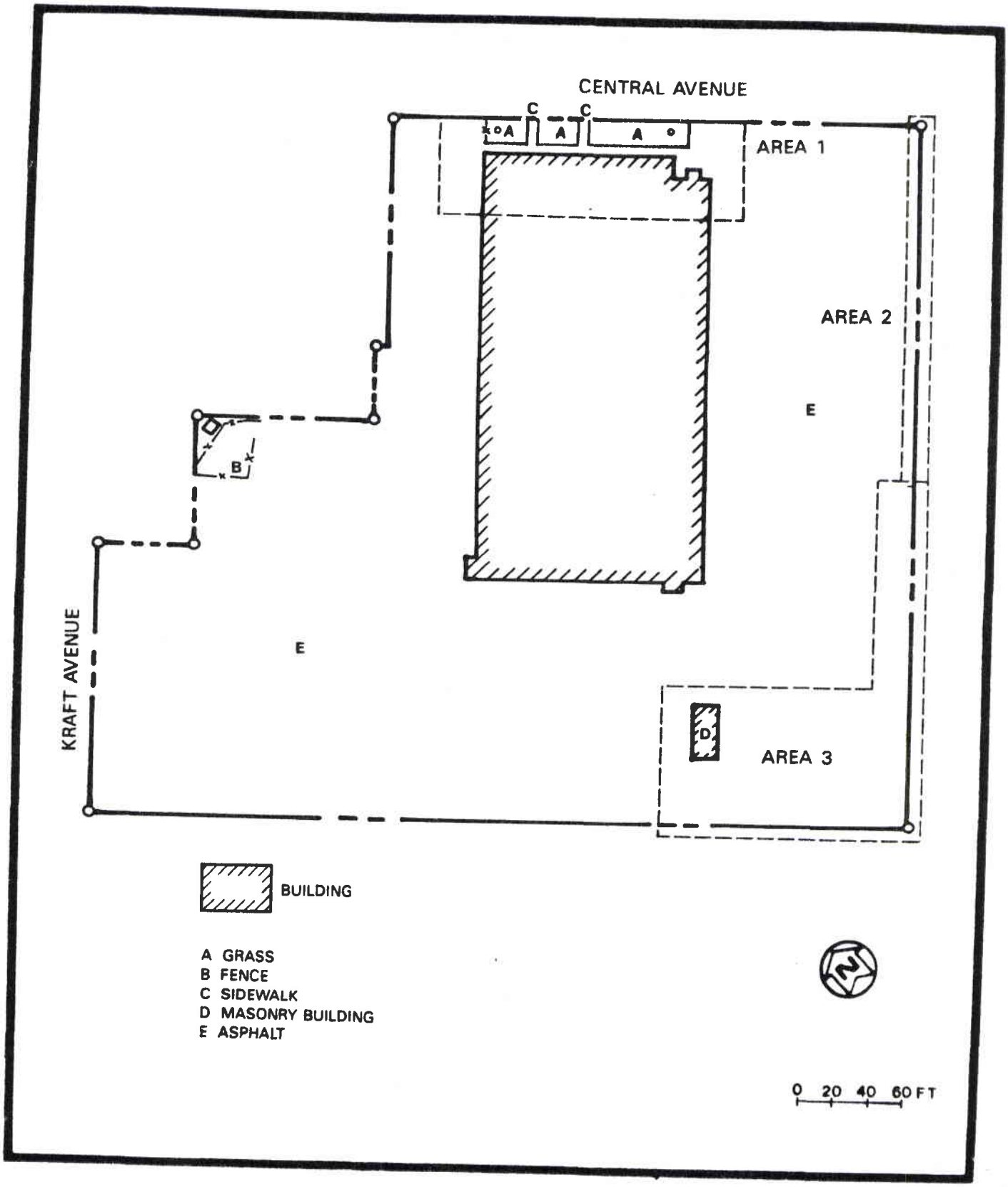


FIGURE 24 *PROPERTY LAYOUT AT 1160/1162 (AL020) CENTRAL AVENUE*

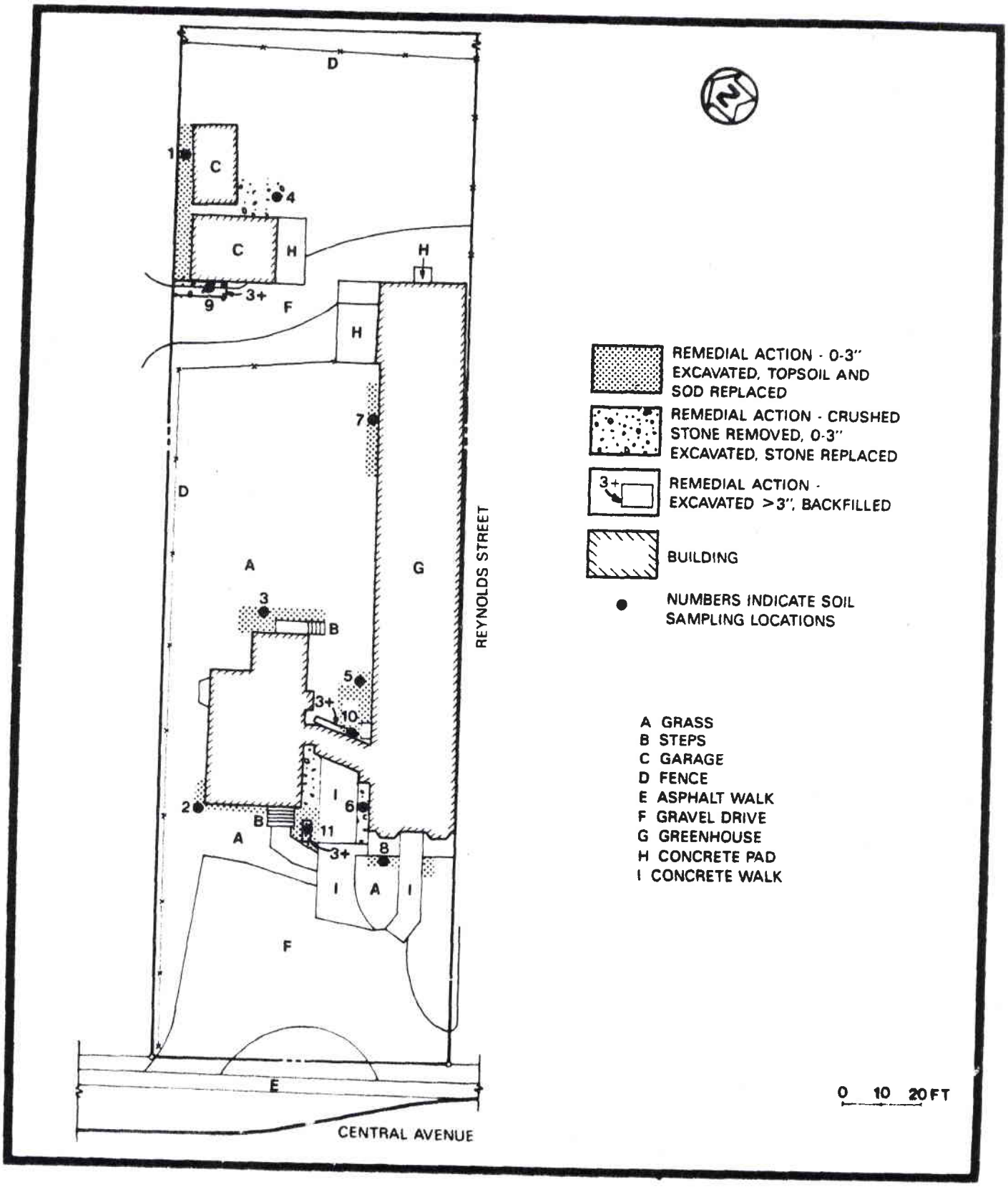


FIGURE 25 REMEDIAL ACTION AT 1161 CENTRAL AVENUE

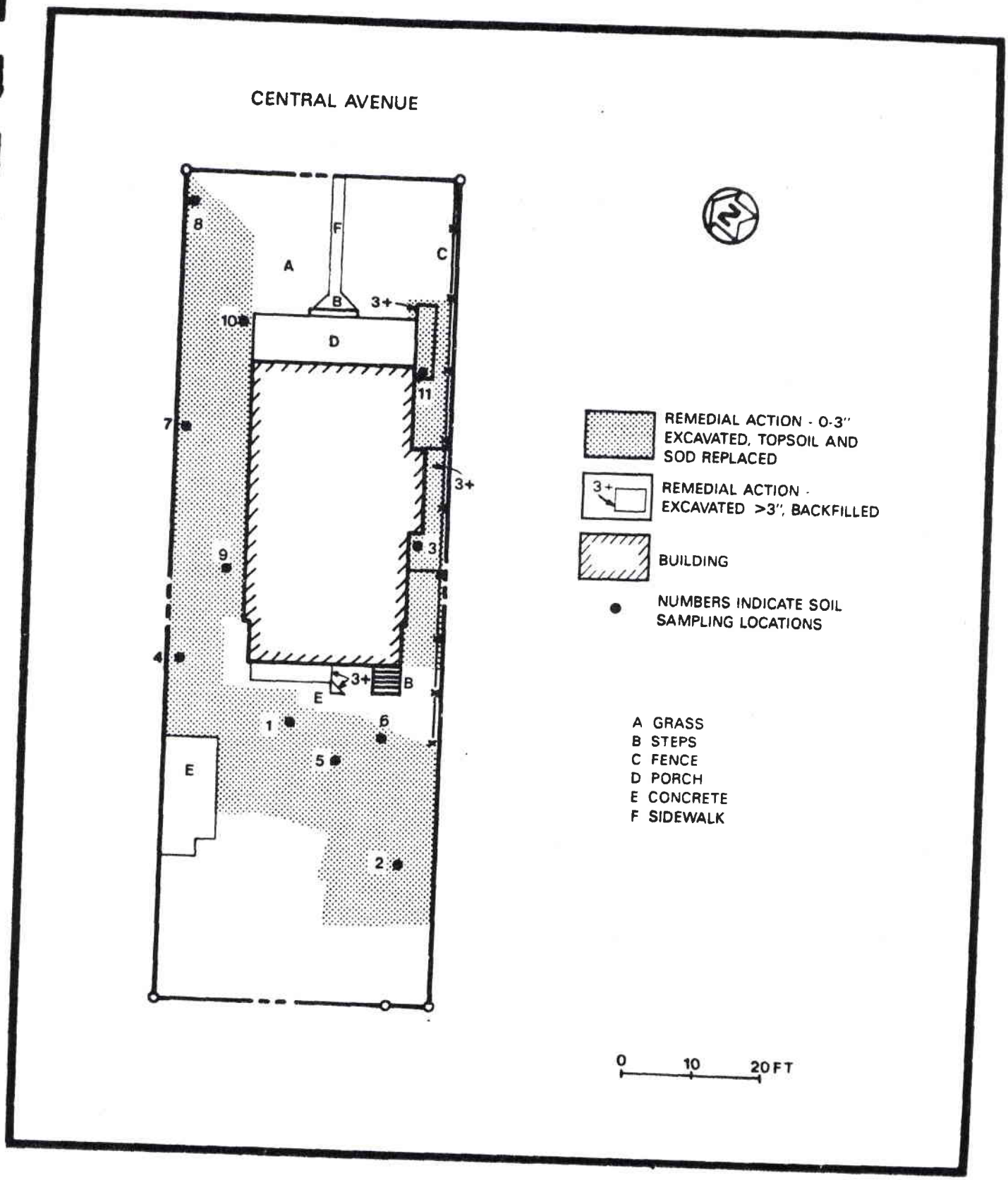


FIGURE 26 REMEDIAL ACTION AT 1166 CENTRAL AVENUE

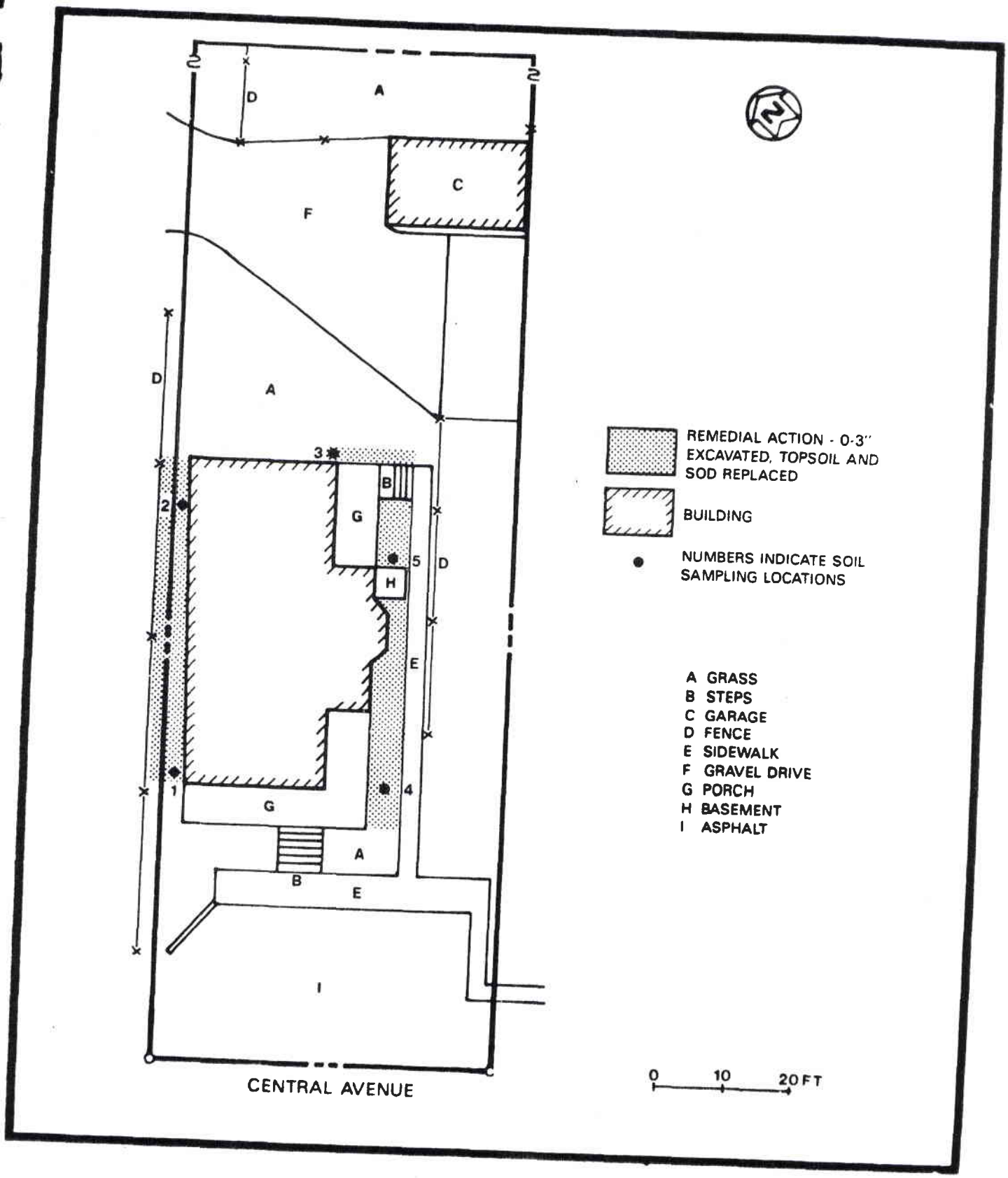


FIGURE 27 REMEDIAL ACTION AT 1167 CENTRAL AVENUE

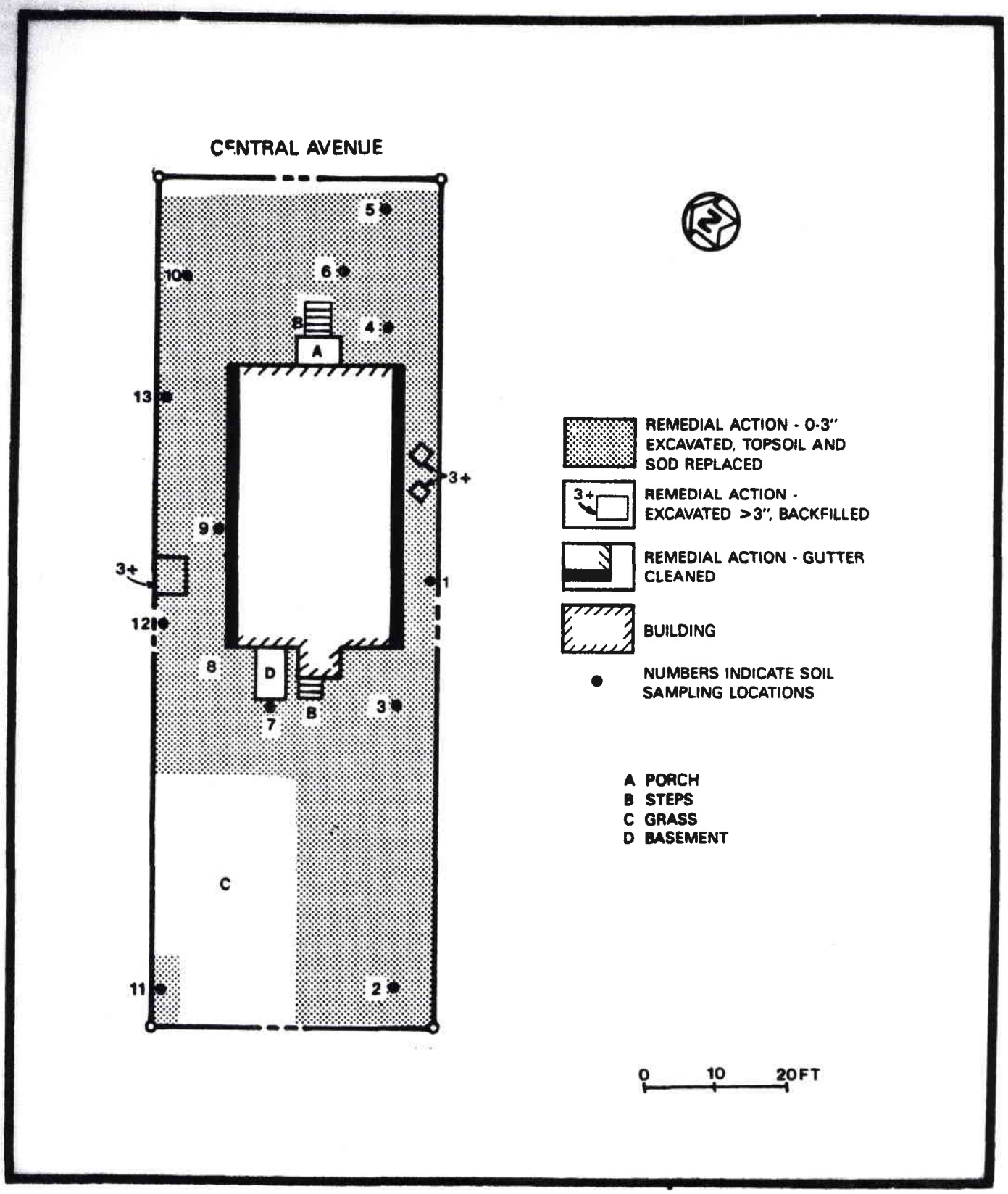


FIGURE 28 REMEDIAL ACTION AT 1168 CENTRAL AVENUE

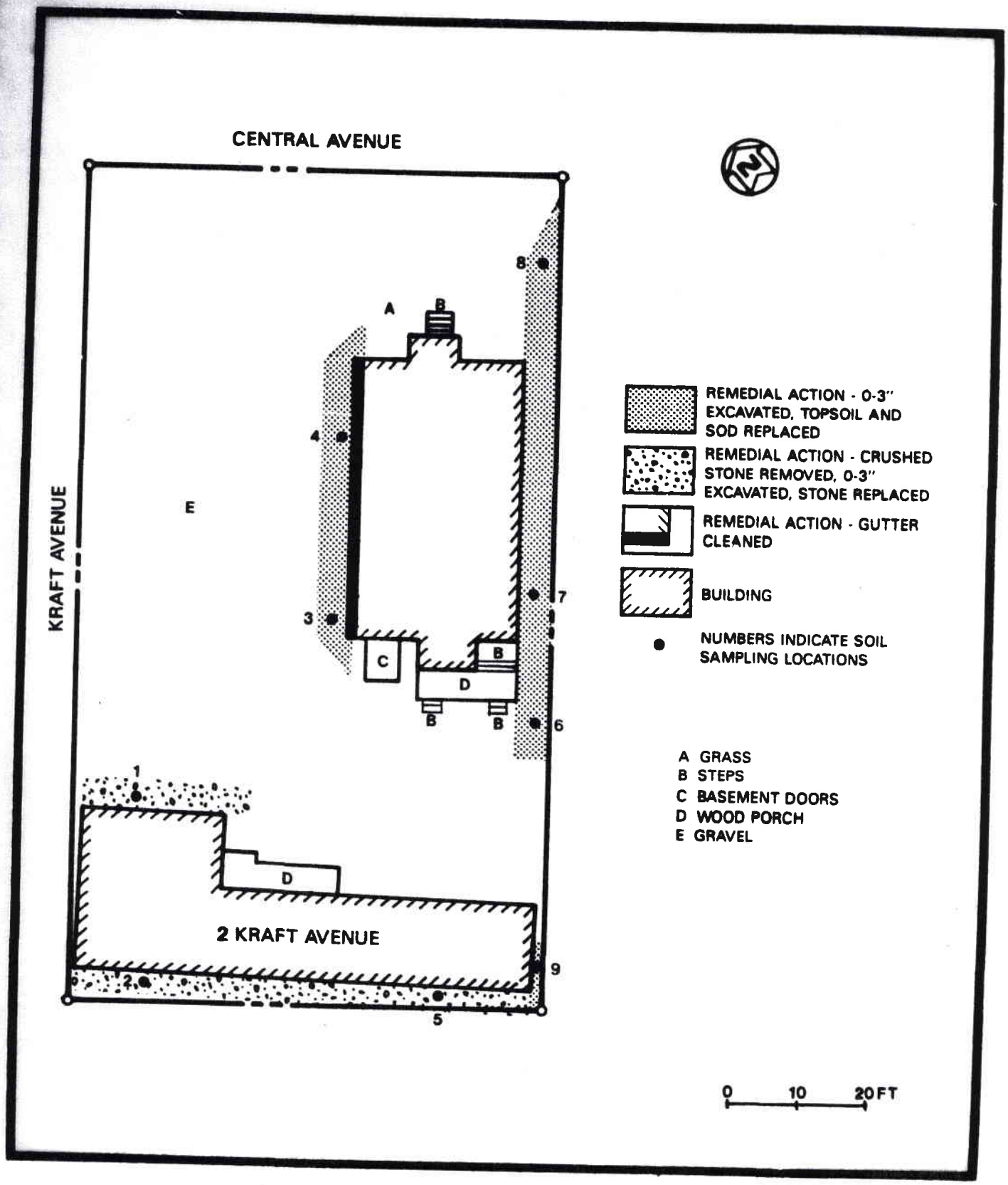


FIGURE 29 REMEDIAL ACTION AT 1170 CENTRAL AVENUE

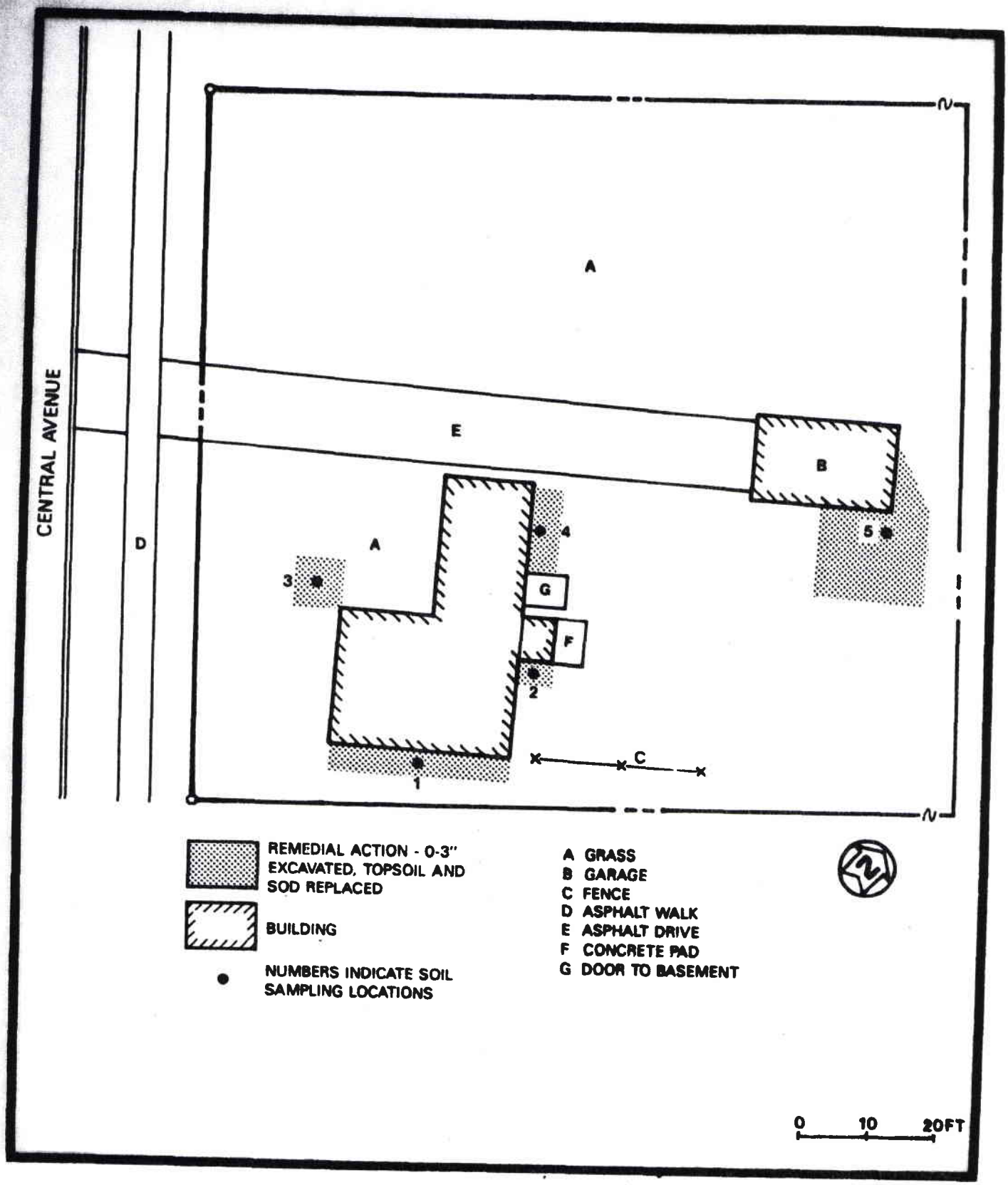


FIGURE 30 REMEDIAL ACTION AT 1185 CENTRAL AVENUE

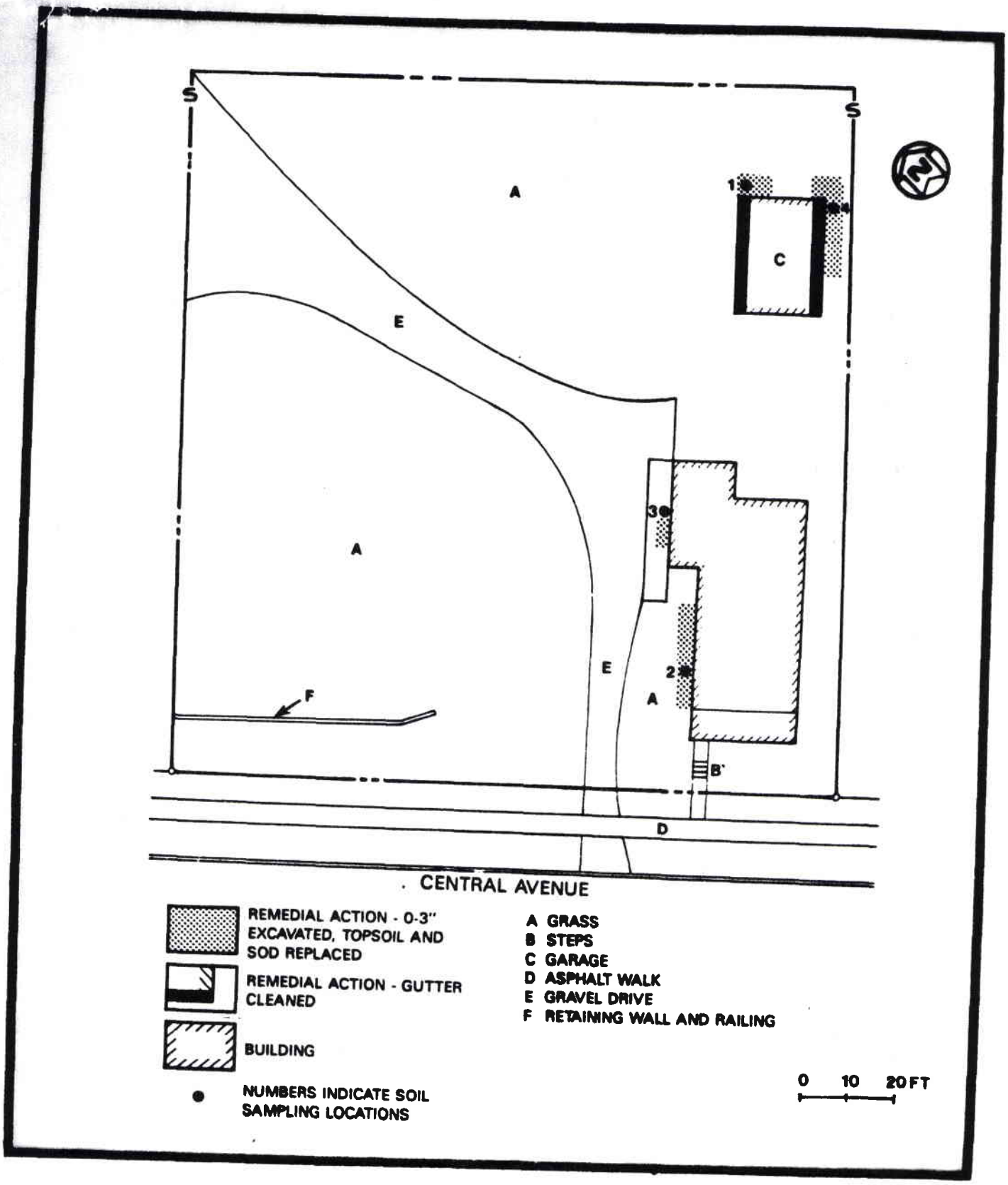


FIGURE 31 REMEDIAL ACTION AT 1195 CENTRAL AVENUE

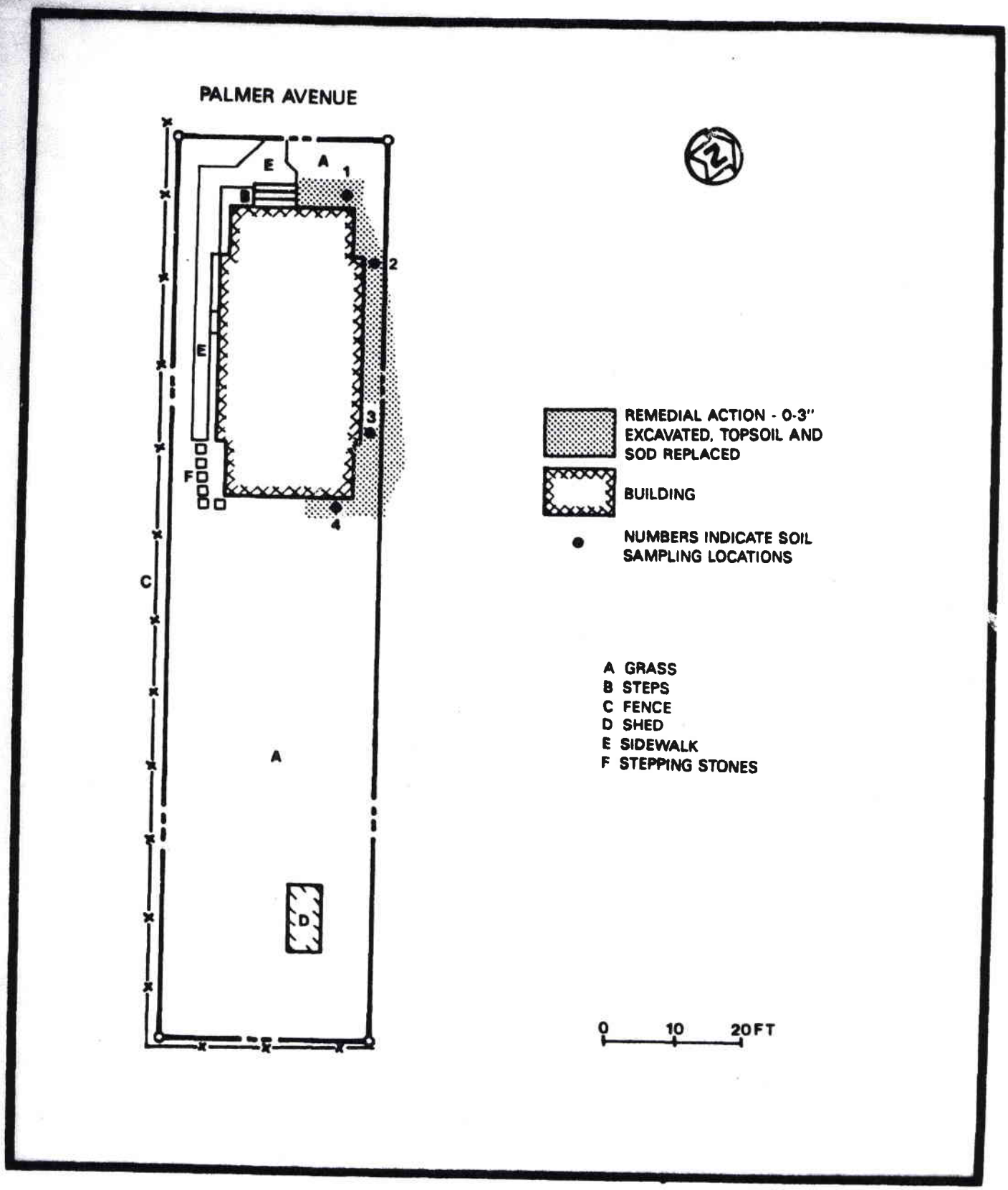


FIGURE 32 REMEDIAL ACTION AT 7 PALMER AVENUE

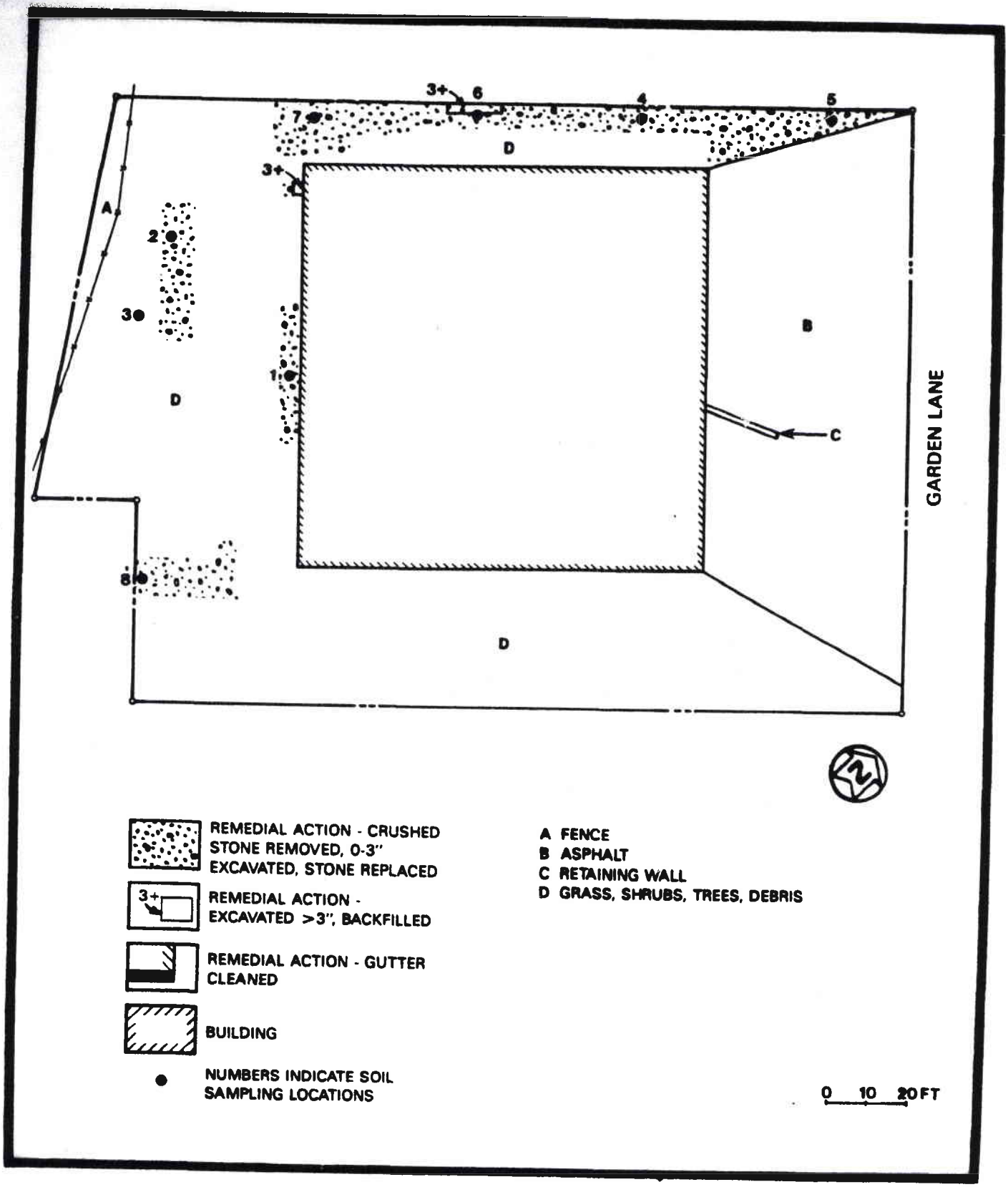


FIGURE 33 REMEDIAL ACTION AT 10 GARDEN LANE

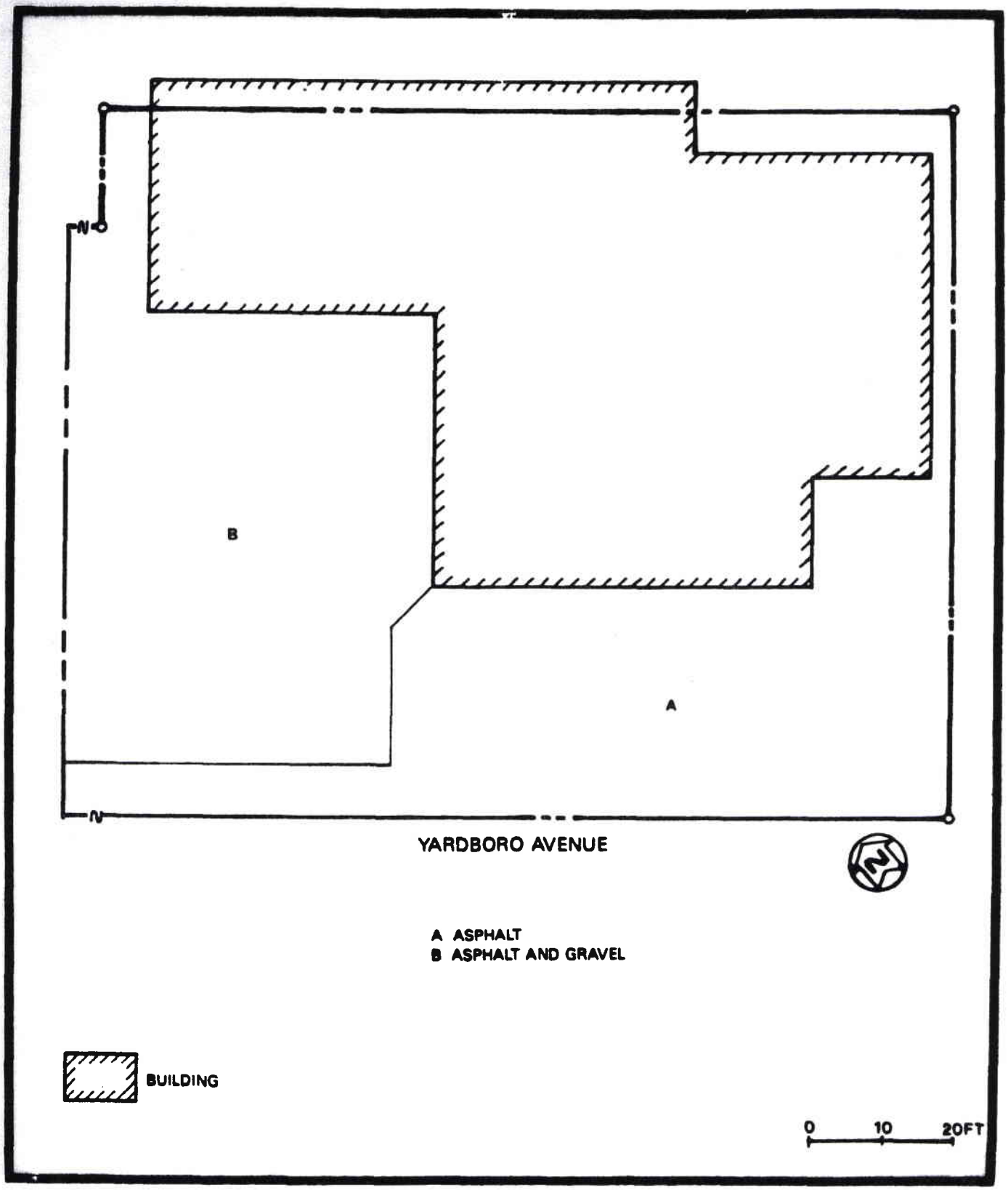


FIGURE 34 50 YARDBORO AVENUE

TELEDYNE ISOTOPES

SAFETY & LICENSING

IWL-9488-461

A SURVEY OF URANIUM IN SOILS SURROUNDING THE NL BEARINGS PLANT

by

Hewitt W. Jeter
Douglas M. Eagleson

TELEDYNE ISOTOPES
50 VAN BUREN AVENUE
WESTWOOD, NEW JERSEY 07675

31 October 1980

Prepared for NL Bearings/NL Industries, Inc.
1130 Central Avenue
Albany, New York 12205

TELEDYNE ISOTOPES

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1.0 INTRODUCTION

The radioactivity environment of the NL Bearings plant in Albany has been discussed in a status report prepared by the N.Y.S. Department of Health (1979). That report traces the history of permits issued to the company for possession of uranium and thorium, and for releases of uranium compounds into the air from converter (burner) stacks. Measurements of uranium concentrations in dust, soils, smears, and air particulate filters were performed at various locations in the neighborhood. The results showed measurable deposition primarily to the northwest and southeast of the plant.

This report documents a systematic survey of the uranium concentration in soils surrounding the NL building to a distance of 600 m (0.37 mi). Measurements of both bulk and areal radioactivity have been performed to determine the patterns and levels of deposition. Depth-dependence of concentration is investigated by analysis of 2 successive soil plug samples at each location. Results are presented in the form of maps and tables. Measurements include a high-resolution areal survey of the NL Bearings plant roof.

The relationship of areal to bulk activity is discussed based on laboratory and field data. Measured radioactivity is compared to regulatory levels for purposes of recommending corrective action. Radiological pathway analysis and dose assessment are beyond the scope of this study.

2.0 METHODS

In order to characterize a large area for radioactivity it is necessary to have an efficient sampling plan. This study is intended to identify all areas having high uranium content, but not to conduct detailed surveys within those areas. Care was taken in project design to accomplish these objectives without superfluous sampling.

In any field program it is desirable to use a portable instrument which can be read on location. For quality-control purposes, however, it is necessary to relate field results to standard laboratory measurements. Consequently, both field and laboratory measurements have been taken in this study. The relationship between the two can be used in further programs where it will be expedient to use only field instruments.

2.1 Design of Sampling Grids

Airborne emissions from stacks take the form of plumes which spread both horizontally and vertically downwind from the source. Because of this dispersion, soil samples can be less densely spaced with increasing distance from the emission point. This argument is developed more quantitatively below for purposes of designing sampling grids.

It is common practice to simulate emission plumes using Gaussian mathematical models (Turner, 1970; ASME, 1973). These methods are generally applied to compounds which are lighter than uranium oxides and which settle less rapidly, but the methods are used here as a first approximation. At short distances from a stack, ground-level concentration can exhibit abrupt changes and patchy behavior because of changing patterns of plume descent from the emission level. This is especially true when there are obstacles to air flow such as buildings. In order to resolve nearby patterns of

deposition, therefore, sampling must be closely spaced. Variation in concentration becomes more systematic at greater distances from the stack. For a given emission condition, wind speed and atmospheric stability, the Gaussian plume models describe downwind concentrations which vary inversely as the product of σ_y and σ_z (horizontal and vertical standard deviations of concentration, respectively). These parameters, which are also called dispersion coefficients, may be read from plots in the workbook of Turner (1970). Analytical expressions may also be used such as presented by McMullen (1975) or by Martin (1976). In the latter case, σ_y is found to vary as the 0.894 power of distance from the emission point, while σ_z is found to vary as the 0.911 power (under intermediate stability conditions). Taking the product of σ_y and σ_z, then, yields a decrease in plume concentration inversely as the 1.8 power of distance.

The amounts of uranium in soil around the NL Bearings plant represent an accumulation derived from long-term deposition under varying meteorological and emission conditions. Although the above analysis does not consider these conditions separately, the plume model suggests that concentrations in a given direction would vary inversely as the 1.8 power of distance from the plant. It is expected, of course, that amounts will be highest in the prevailing wind directions.

The dispersion of activity indicated above can be related to the area over which deposition takes place. The horizontal spread of a plume (σ_y) has been noted to vary as the 0.894 power of distance. The vertical spread (σ_z) also varies approximately as distance to the 0.9 power, such that material is carried farther downwind before deposition. These two factors act together such that the area of unit deposition increases approximately as the 1.8 power of distance from the source. This argument is the

basis for designing a sampling grid in which the areas of sectors vary approximately as the square of distance from the plant.

A radial grid system is shown in Figures 1 and 2. The center of the system was chosen to be within the building perimeter such that a 100 m radius circle would approximate the plant grounds (Figure 1). An off-site grid which is concentric with the interior system is shown in Figure 2. This grid is superimposed on a Department of Transportation map although it is recognized that some changes in roads and construction are not represented. Larger scale portions of this map are presented in section 2.2.

Radial lines (rays) in Figures 1 and 2 are drawn at 15° angle increments from true north. Concentric circles are drawn at increasing distances from the center in order to define sampling sectors. Table 1 summarizes the radii and the resulting areas of sectors which were chosen to vary as described above.

Numbering of sectors is indicated on Figures 1 and 2, accomplished separately for on-site and off-site locations. Numbering proceeds clockwise at each radial distance, beginning from north and increasing outward from the center. The site map shows that many sectors are occupied by rooftop or pavement, preventing soil sampling.

The roof of the NL Bearings plant was divided into a simple rectangular grid, each element measuring 3m x 3m (see section 3.2). This system was chosen because high resolution is desirable if any corrective action is to be taken. Grid elements can be identified simply by row number and column number. ?

2.2 Soil Sampling and Bulk Radioactivity Measurements

The primary objective of this study is to obtain high quality measurements of U-238 and U-235 in soils surrounding the NL Bearings plant. In order to characterize each sector in the grid system, samples were taken from 3 randomly selected locations (ASTM, 1965). The samples were physically composited (mixed) before laboratory analysis, with the exception of a few which exhibited large variation in surface gamma measurements as described later. Two successive soil plug samples were taken at each location, the "shallow" (0-0.5 in; 0-1.3 cm) and the "deep" (0.5-2.0 in; 1.3-5.1 cm). These samples were separately composited and analysed within each sector to provide information on depth-dependence.

A computerized random number generator was used to choose sample locations beyond the 400 m radius. At closer distances, the small size of sectors and the interference of buildings and pavement required choosing locations by the judgement of the field team. Soil sampling guidelines of HASL 300 (Health and Safety Laboratory, 1972) were followed where possible:

1. Areas should appear to be undisturbed for a long period of time.
2. Large, open, flat areas are preferred.
3. Areas should be vegetated (well kept lawns or similar areas are ideal).

In some cases, samples were taken from roof driplines or low areas which are expected to collect and concentrate radioactivity. Such sample locations are noted in the data tables of Appendices I and II. Figures 3 and 4 are detailed maps showing where samples were taken within each sector. Triangles refer to site "A", squares to site "B", and circles to site "C".

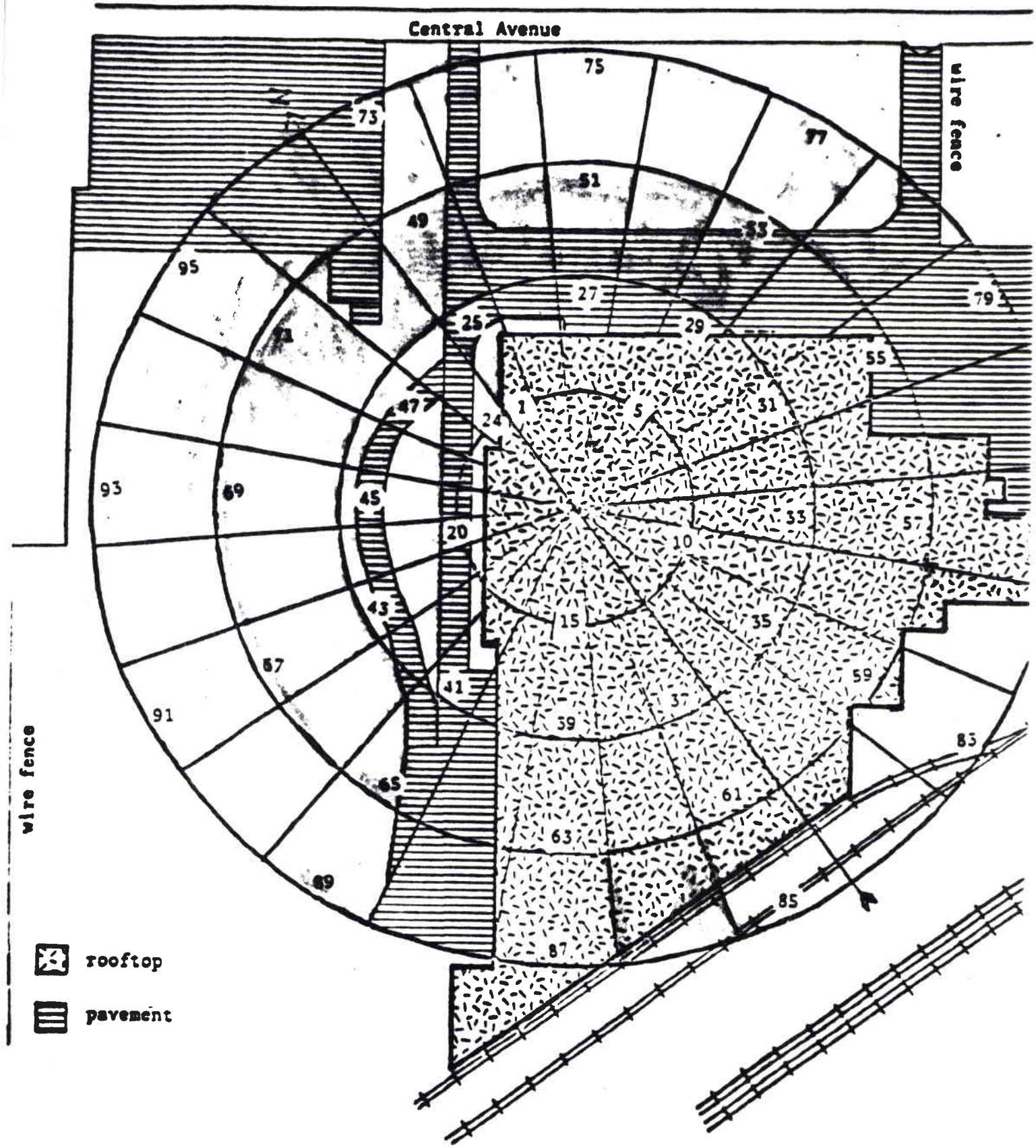

FIGURE 1

ON-SITE GRID SYSTEM

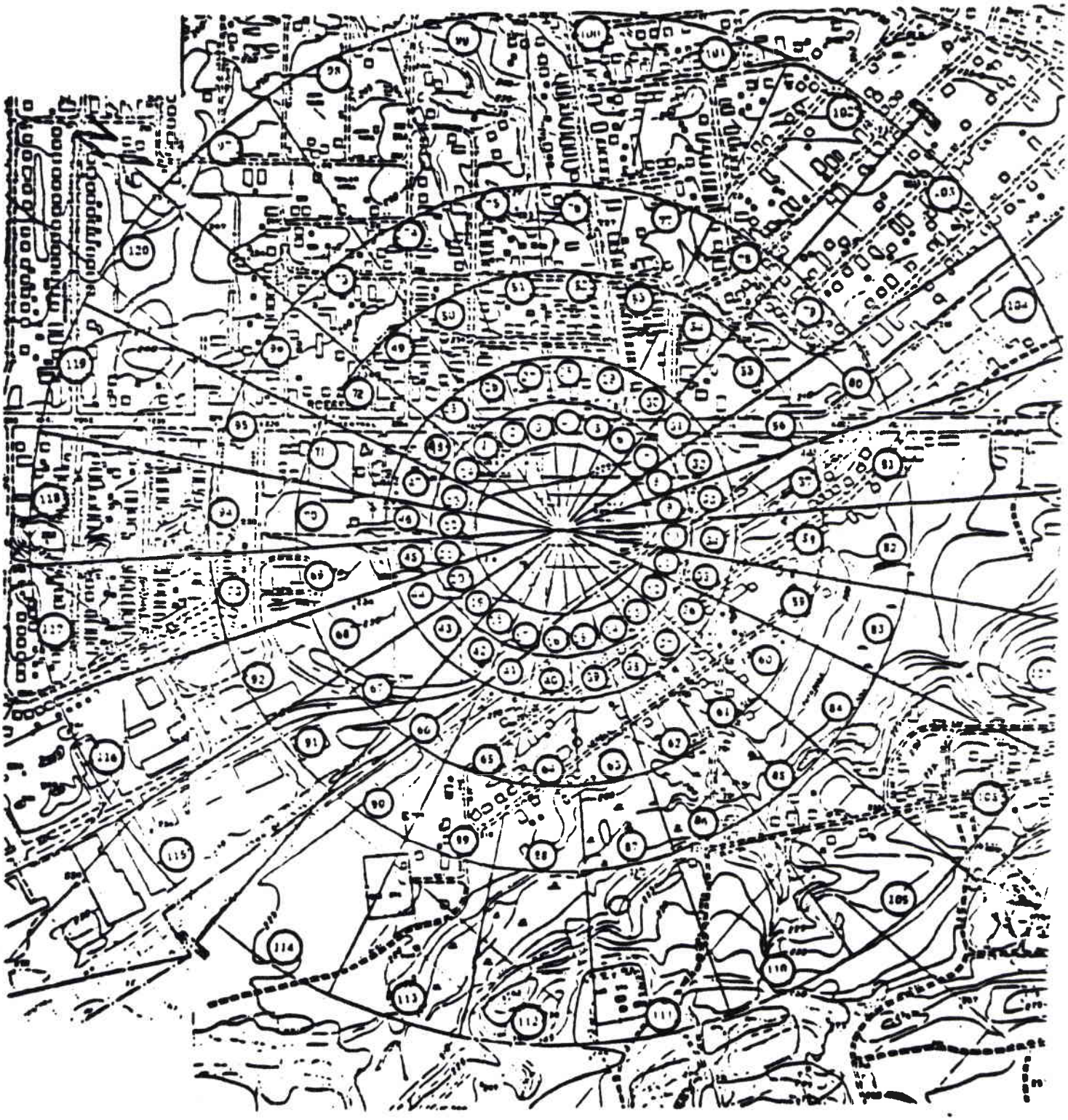

FIGURE 2

OFF-SITE GRID SYSTEM

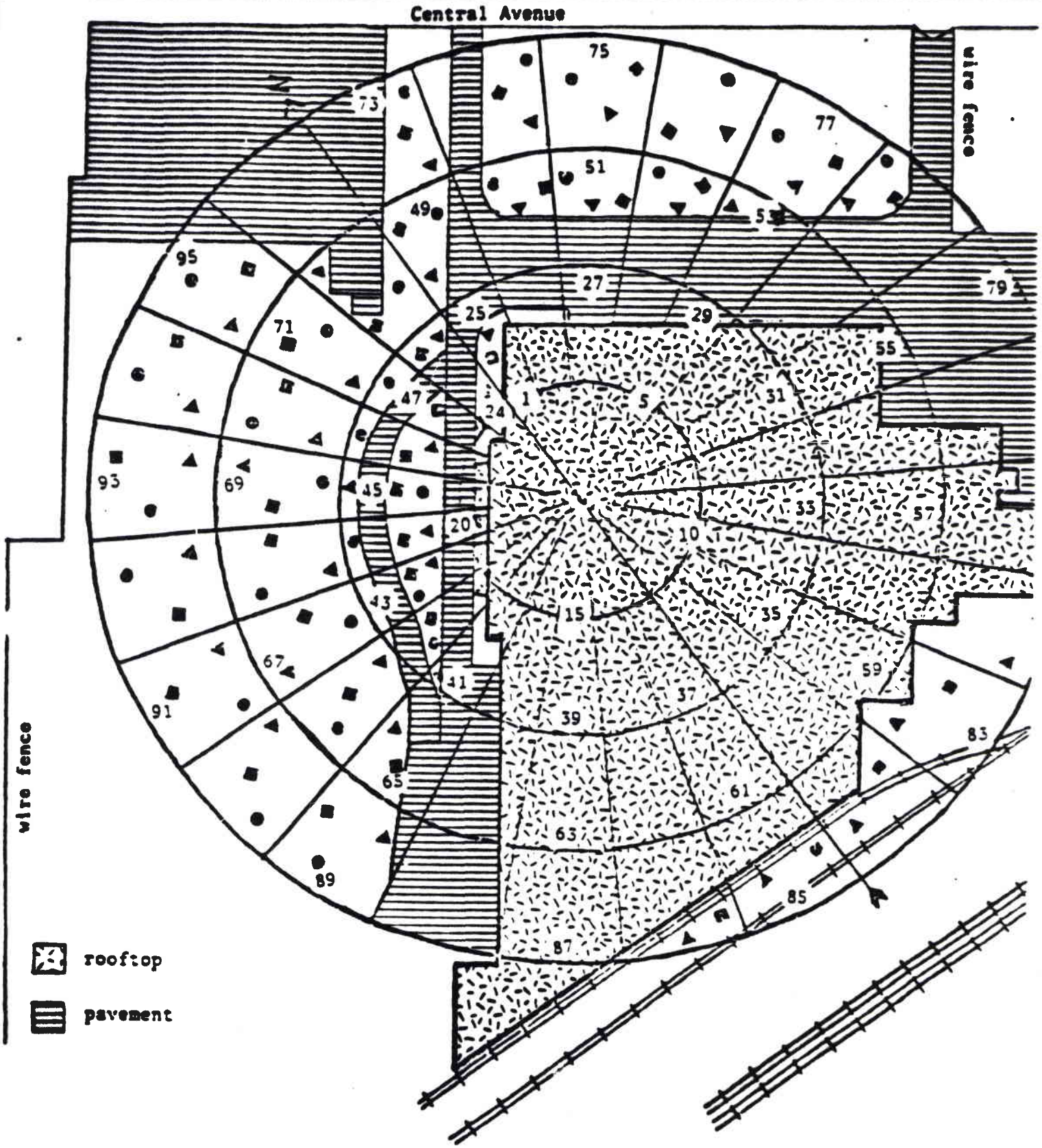

FIGURE 3

ON-SITE SAMPLE LOCATIONS

FIGURE 4
OFF-SITE SAMPLE LOCATIONS
(NORTHEAST QUADRANT)

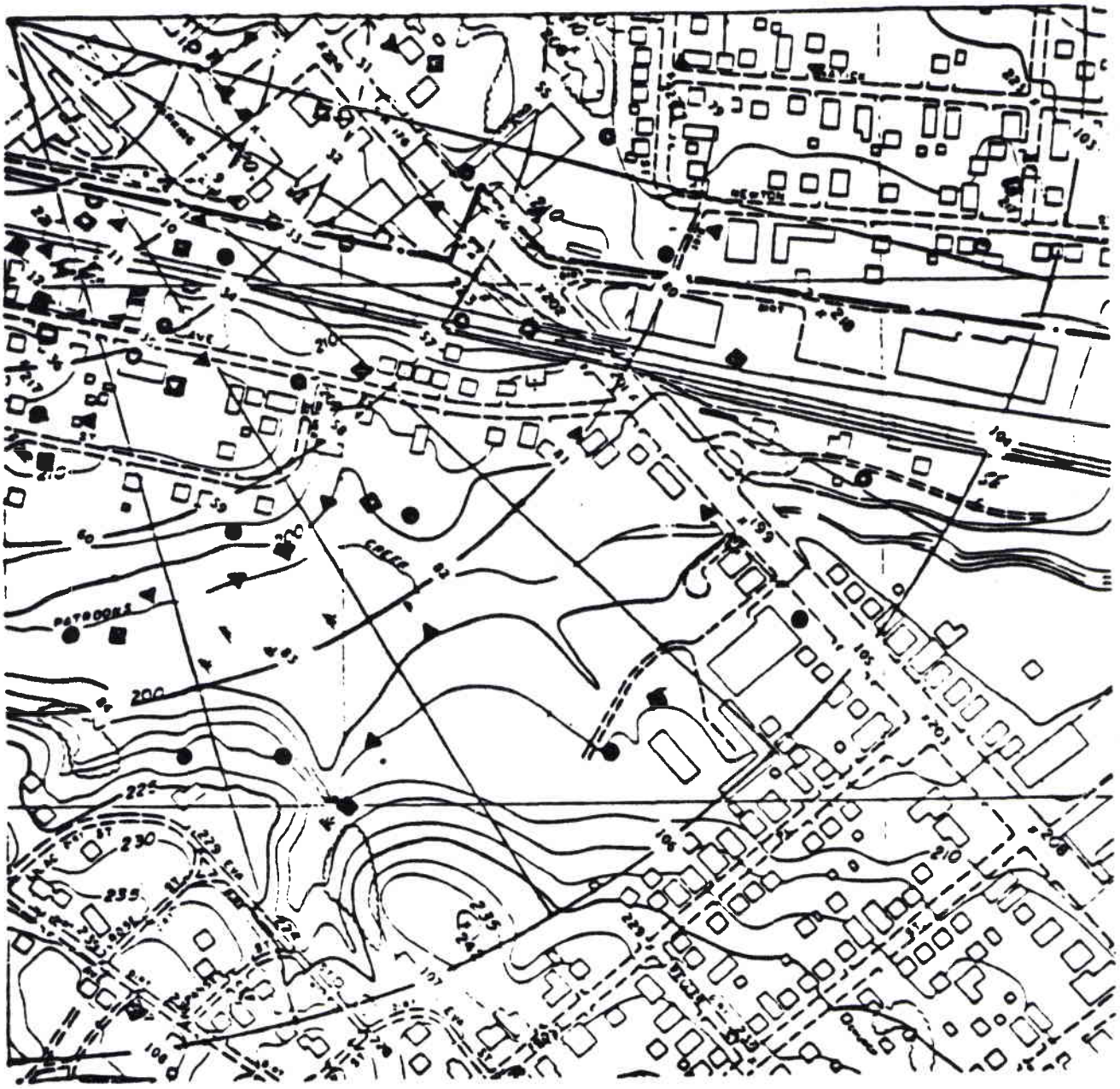

FIGURE 4 (con't)
OFF-SITE SAMPLE LOCATIONS
(SOUTHEAST QUADRANT)

FIGURE 4 (con't)
OFF-SITE SAMPLE LOCATIONS
(SOUTHWEST QUADRANT)

FIGURE 4 (con't)
OFF-SITE SAMPLE LOCATIONS
(NORTHWEST QUADRANT)

TABLE 1

CHARACTERISTICS OF RADIAL SECTORS

	Radius (m)	Sector No.	Sector Area (m^2)
plant site	25-50		245
	50-75		409
	75-100		573
off site	100-150	1-24	1,636
	150-200	25-48	2,291
	200-300	49-72	6,545
	300-400	73-96	9,163
	400-600	97-120	26,180

Soil sampling tools consisted of two 6 inch diameter hole saws, modified to penetrate 0.5 inch and 1.5 inch, respectively. The shallow sampler was twisted by means of an attached handle until it penetrated to 0.5 inch depth. A flat aluminum spade was then driven beneath it using a mallet to remove a 0.5 inch thick soil sample, 6 inches in diameter. This was placed in a plastic bag marked with the sector number and location code (A, B, or C). The deep sample was taken with the other tool by lowering it into the previous hole and twisting it to penetrate an additional 1.5". The aluminum spade was again used to remove the deep sample, measuring 1½ inches thick by 6 inches diameter.

Samples from locations A, B, and C within a sector were mixed in aluminum pans at Teledyne Isotopes (the shallow and deep samples being processed separately). They were then dried overnight at 105°C in an oven. The dried and mixed samples were loaded into tared 150 mL polyethylene bottles and reweighed to determine the soil weight. Portions of vegetation were included in the sample but rocks greater than ¼ inch in size were excluded.

Uranium-238 and 235 were measured by gamma spectral analysis of the bulk soil samples. Activity of the former isotope was inferred by measuring the 93 keV emission of its daughter product, Th-234 ($T_{½}$=24 days) assuming secular equilibrium. Activity of U-235 was measured by its 185 keV emission. Four Princeton Gamma Tech, Inc. lithium-drifted germanium Ge(Li) detectors were used having nominal efficiencies of 20% relative to sodium iodide. The detectors are connected to a Nuclear Data, Inc. ND6620 computer system for data acquision and reduction. Peak search and spectral analysis were performed using Nuclear Data software. Samples were counted for 1 to 2 hours giving detection limits near 1 pCi/gram for U-238 and 0.1 pCi/gram for U-235.

Calibration of the Ge(Li) detectors was performed specially for uranium isotopes in the 150 ml bottle geometry. One gram of NBS standard uranium oxide was mixed with soil and loaded into one of the bottles. This standard was counted in each detector to determine efficiencies for the various spectral lines. Stability and quality control of the detectors are monitored by counting a mixed NBS standard in a planar geometry each week and by plotting the results on a control chart.

2.3 Areal Radioactivity Measurements

As introduced in section 2.0, a field instrument was used at each sampling location to provide correlative areal data. Measurements from this instrument, expressed in pCi/cm^2, are presented in Appendices I and II. The relationship to bulk activity (expressed in pCi/gr-m) is discussed in section 3.4.

The field instrument employs a Teledyne Isotopes sodium iodide NaI (Tl) detector measuring 5 inches in diameter by 0.5 inch thickness. The crystal is surrounded by a 3/16 inch thick cylinder of stainless steel to provide shielding against low energy radiation from the sides. In operation, the rim of the cylinder was placed directly on the soil. The detector face is recessed 1 cm from the cylinder rim, however. Two readings were taken at each site, one at the soil surface and another after removing 0.5 inch of soil.

The sodium iodide detector was coupled to a Canberra Series 30 multichannel analyser. Gain was adjusted to 0.25 keV per channel allowing a viewing range of 5 to 250 keV for the 1024 channels. The instrument package was mounted on a large-wheeled hand truck. A 12 volt automobile battery and a 115 volt AC inverter were used as a power supply. Each spectrum obtained was recorded on magnetic tape cassette and catalogued for future reference.

Measurements of U-238 were obtained by spectral analysis of the 93 keV Th-234 peak. U-235 was not analysed using this instrument. Spectral information were written on a data form as 3 regions: the peak region having a constant width of 101 channels and two adjacent shoulder regions including approximately 20 channels each. Data reduction was performed on a programmed calculator. Integrated counts in the two shoulder regions were expressed on a per-channel basis and averaged to give the background in the peak region. Subtracting this background from the integrated counts in the peak yields a net count rate for purposes of calculating activity. A 200 second interval was used for data acquisition, resulting in a detection limit near 35 pCi/cm^2.

Calibration was performed 3 times a day in the field by reading a uranium sub-standard obtained from a converter at the NL Bearings plant. This sample was previously analysed both by its gamma spectrum and by isotope dilution mass spectrometry at Teledyne Isotopes, giving results which agree within 0.4%. The compound was found to contain 0.212 μCi/gm U-238 and 0.0031 μCi/gm U-235. By comparison, NBS natural U_3O_8 contains 0.280 μCi/gm U-238 and 0.0131 μCi/gm U-235. The NL sub-standard is thus 76% pure based on its U-238 ratio to the standard. Depletion of the NL sample is evidenced by its U-235 activity of 1.5% with respect to U-238. This compares to a level of 4.7% for natural uranium.

The field calibrator consisted of 1 gram of the uranium sub-standard spread uniformly over a 5 inch diameter circle in a flat pan. A thin layer of epoxy covered the uranium to keep it in place. Attenuation of radiation by the epoxy was compensated through use of a factor determined by counting an identical sub-standard without the epoxy coating. Efficiency of the sodium iodide system was found to average 0.245 over the 2 month sampling period with

Missing p.17

a standard deviation of 0.009. A new efficiency was derived from each calibration run for reducing subsequent data.

Survey of the NL Bearings plant roof was performed with an Eberline PC-1 low-energy gamma detector (NaI (Tl); 3.17 cm diameter by 1 mm thickness). The probe was coupled to an Eberline PAC-1Sa countrate meter which provides readings from 0 to 2,000,000 counts per minute. The instrument allows gamma detection of depleted uranium while exhibiting a low background because of poor efficiency for high energy gamma radiation. A brass shield around the detector excludes low-energy radiation from the sides.

A 3-meter-square grid system was employed on the roof (section 2.1). The probe was held within 3 inches (7.6 cm) of the surface and moved over the grid element until a maximum response point was located. This process was facilitated by a headset connected to the meter which provided an audible countrate signal. The probe was then lowered to within ¼ inch (0.6 cm) of the surface to obtain the meter reading.

A check source for the system was made by spreading 1 gram of NL sub-standard uranium oxide uniformly over a gel in the bottom of a flat pan. The source was then sealed with a 1 mm thick layer of plastic. Readings of the check source were made several times per day during the survey to determine instrument stability. Calibration was performed at Teledyne Isotopes using the sub-standard apparatus previously described for the soil survey instrument. A detection limit of 100 pCi/cm^2 was assigned to the roof survey device based on readability of the meter.

3.0 RESULTS AND DISCUSSION

This study involves a large number of measurements which must be associated with geographical locations. Stippling patterns on maps are used to convey information simply. The individual measurements are reported in appendices.

Depth-dependence of uranium concentration and the relationship of areal to bulk activity are analysed in this section. Such information is useful for planning any further surveys or corrective action. Finally, regulatory limits are presented for comparison to the data obtained.

3.1 Soil Survey Results

The U-238 content of soil on the NL Bearings plant site is shown in Figures 5 and 6. The former exhibits a shallow sample (0-0.5 inch depth) and the latter exhibits a deep sample (0.5-2.0 inch). Identity of sectors may be found by referring to Figure 1. Areas occupied by rooftop or pavement are designated by contrasting patterns because soil sampling was excluded.

Individual measurements of soil on the plant site are displayed in Appendix I. This includes laboratory analyses of U-238 and U-235 in the composited bulk samples as well as areal measurements of U-238 at all three locations within a sector. Conventions for reporting tolerances are explained on the appendix flyleaf.

In a similar manner, data for the off-site grid are presented in map form on Figures 7 and 8. Sectors are identified by referring to Figures 2 and 4. Individual measurements are listed in Appendix II.

The deposition patterns are strongly dependent upon direction. Uranium concentrations above 20 pCi/gm extend to the 600 m radius NNW of the plant. This corresponds to predominant summer winds from the S and SSE

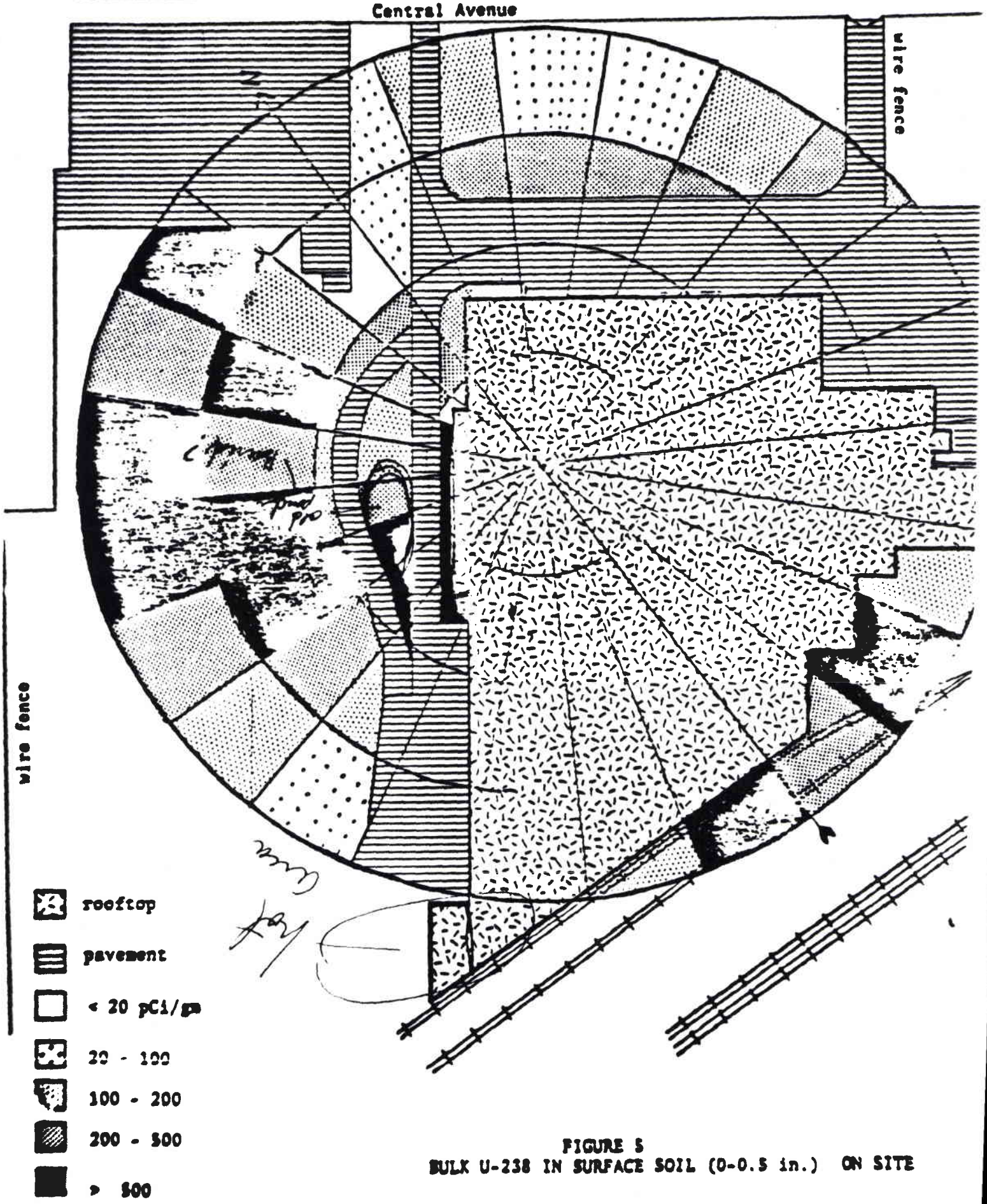

FIGURE 5
BULK U-238 IN SURFACE SOIL (0-0.5 in.) ON SITE

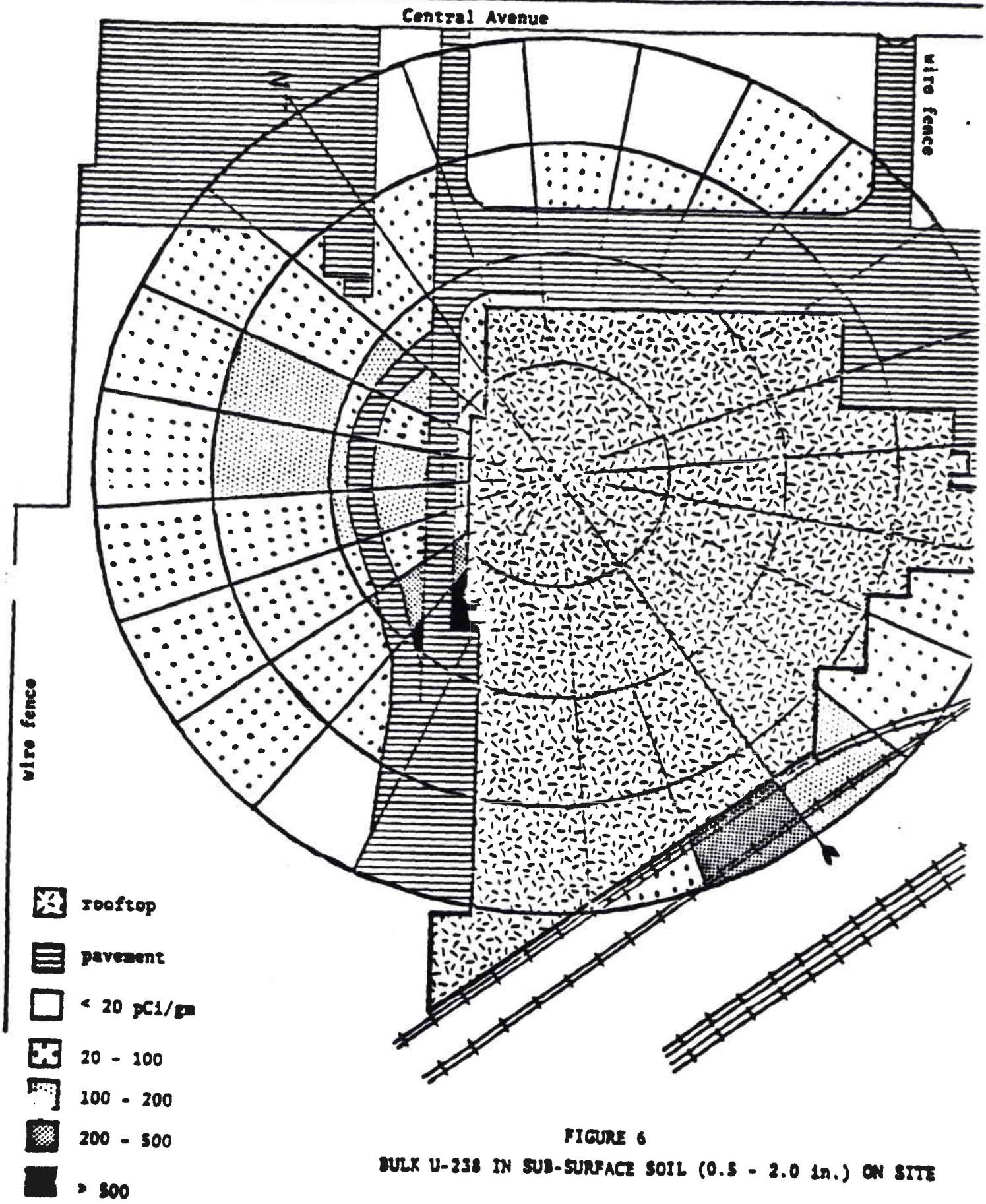

FIGURE 6

BULK U-238 IN SUB-SURFACE SOIL (0.5 - 2.0 in.) ON SITE

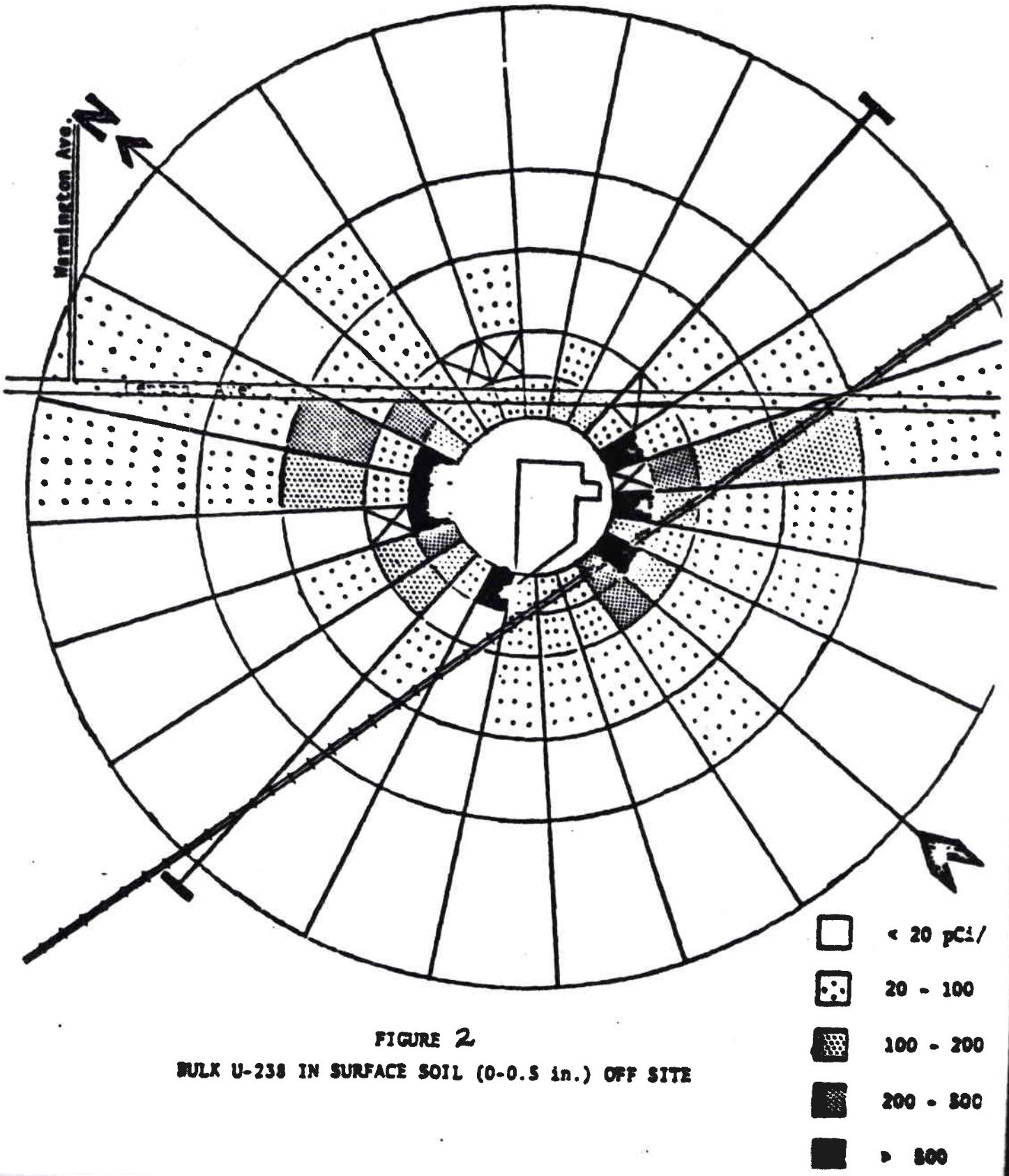

FIGURE 2

BULK U-238 IN SURFACE SOIL (0-0.5 in.) OFF SITE

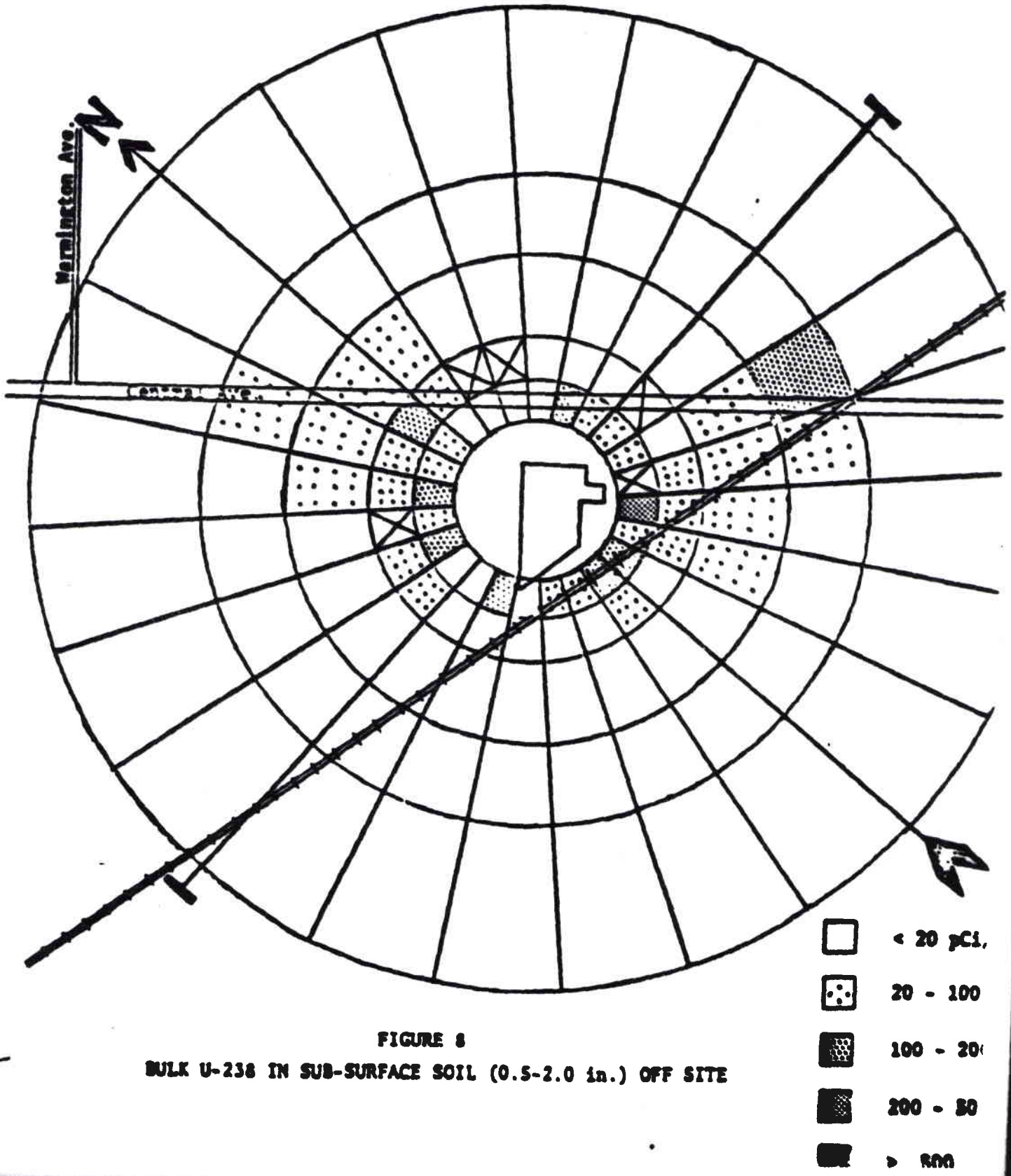

FIGURE 8

BULK U-238 IN SUB-SURFACE SOIL (0.5-2.0 in.) OFF SITE

as well as a secondary peak in winter winds from these directions. Similarly, extended deposition to the SE reflects prevailing NNW winds in winter as well as a secondary peak in summer wind from this direction. There is a tertiary northern component in both summer and winter winds which accounts for broader deposition to the south of the plant.

Depletion of U-235 is evident from the data in both Appendices I and II. The activity ratio of U-235 to U-238 is generally in the vicinity of 0.015. Natural uranium, by contrast, has a ratio of 0.047 (section 2.3). In many sectors having low concentrations, however, it is impossible to distinguish between natural and depleted uranium because the tolerance of measurement does not allow sufficient precision in determining the isotope ratio. As indicated by the N.Y.S. Department of Health (1979), natural soils are estimated to contain 2 pCi/gm of U-238. Sectors showing results of this magnitude are probably unaffected by the plant.

3.2 Roof Survey Results

Areal U-238 measurements from the NL Bearings plant roof are shown schematically in Figure 9. Readings for each 3m x 3m grid element are given in Appendix III, indexed by row number and by column number. Deposition patterns are related to stack locations and roof topography.

3.3 Depth-Dependence of U-238 in Soil

Uranium concentrations in shallow samples (0-0.5 inch depth) are plotted against those of deep samples (0.5-2.0 inch) in Figure 10. Separate graphs are shown for on-site and off-site locations.

Regression lines in Figure 10 show good correlation for the off-site sectors (correlation coefficient $r = 0.86$). The shallow/deep ratio is near 7

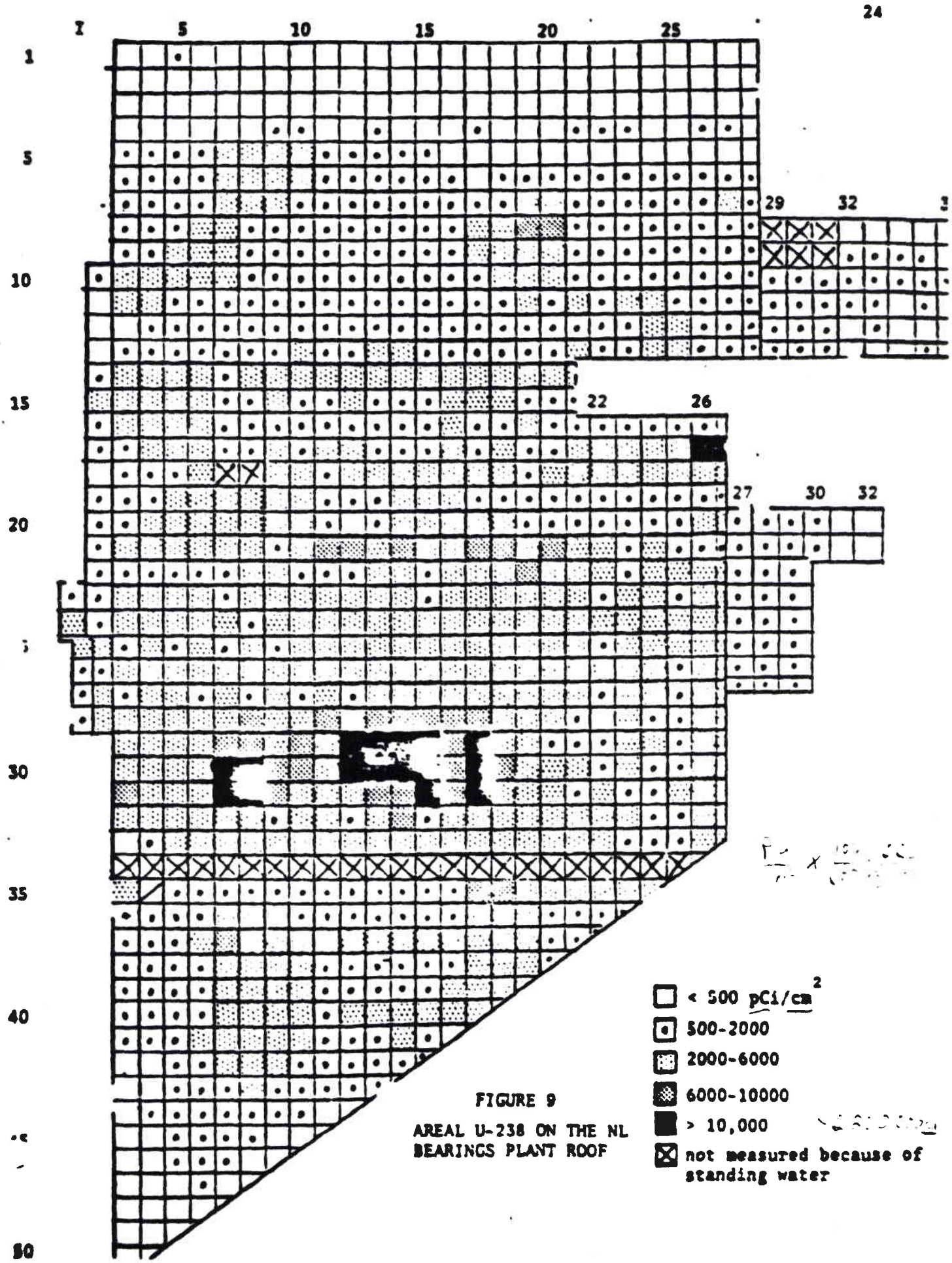

FIGURE 9

AREAL U-238 ON THE NL BEARINGS PLANT ROOF

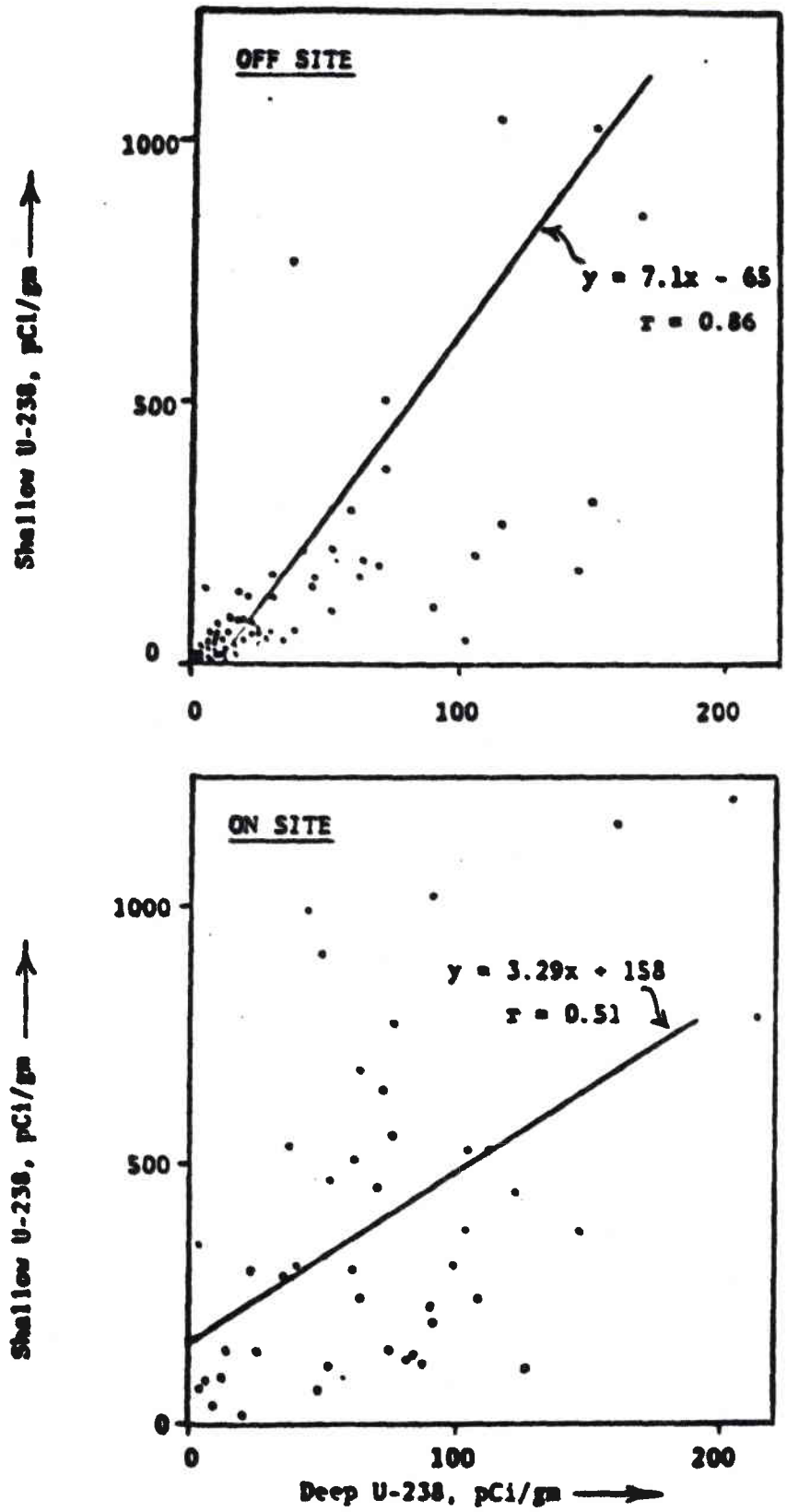

FIGURE 10
DEPTH-DEPENDENCE OF
U-238 IN SOIL

for this data. It appears that lower concentrations often exhibit a smaller ratio, however, and that the overall slope is increased by high concentrations which are shallow.

The on-site plot in Figure 10 shows poorer correlation ($r = 0.51$). The regression line has a low slope and an intercept far from zero. This contrasting behavior could be related to distance from the release point. Variation in particle size, differences in the character of soils, and the chronology of releases may also be factors.

Rapid decrease in concentration with depth implies that corrective action can be accomplished by removing a shallow layer of soil.

3.4 The Relationship of Areal to Bulk Activity

One purpose of this study is to relate areal field measurements of U-238 (pCi/cm^2) to bulk laboratory measurements (pCi/gm). Such relationships will be useful in future surveys where it will be expedient to use field measurements alone.

A laboratory study was performed at Teledyne Isotopes in which measured amounts of NL substandard uranium oxide were added to soil. Concentrations of 216, 427, and 649 pCi/gm were made using 10 kg of soil. The material was mixed by tumbling for several hours on a mechanical roller.

Aliquots of the active soils were distributed evenly in the bottom of an 11-inch (28 cm) diameter cardboard cylinder. Thicknesses of 1, 2, 4, 6, 8, and 10 cm were separately prepared and then measured for areal U-238. Each measurement employed the field spectroscopy instrument as described in section 2.3.

Straight lines in Figure 11 were derived by plotting the laboratory data. Areal activity (pCi/cm^2) is linearly related to bulk activity (pCi/gm)

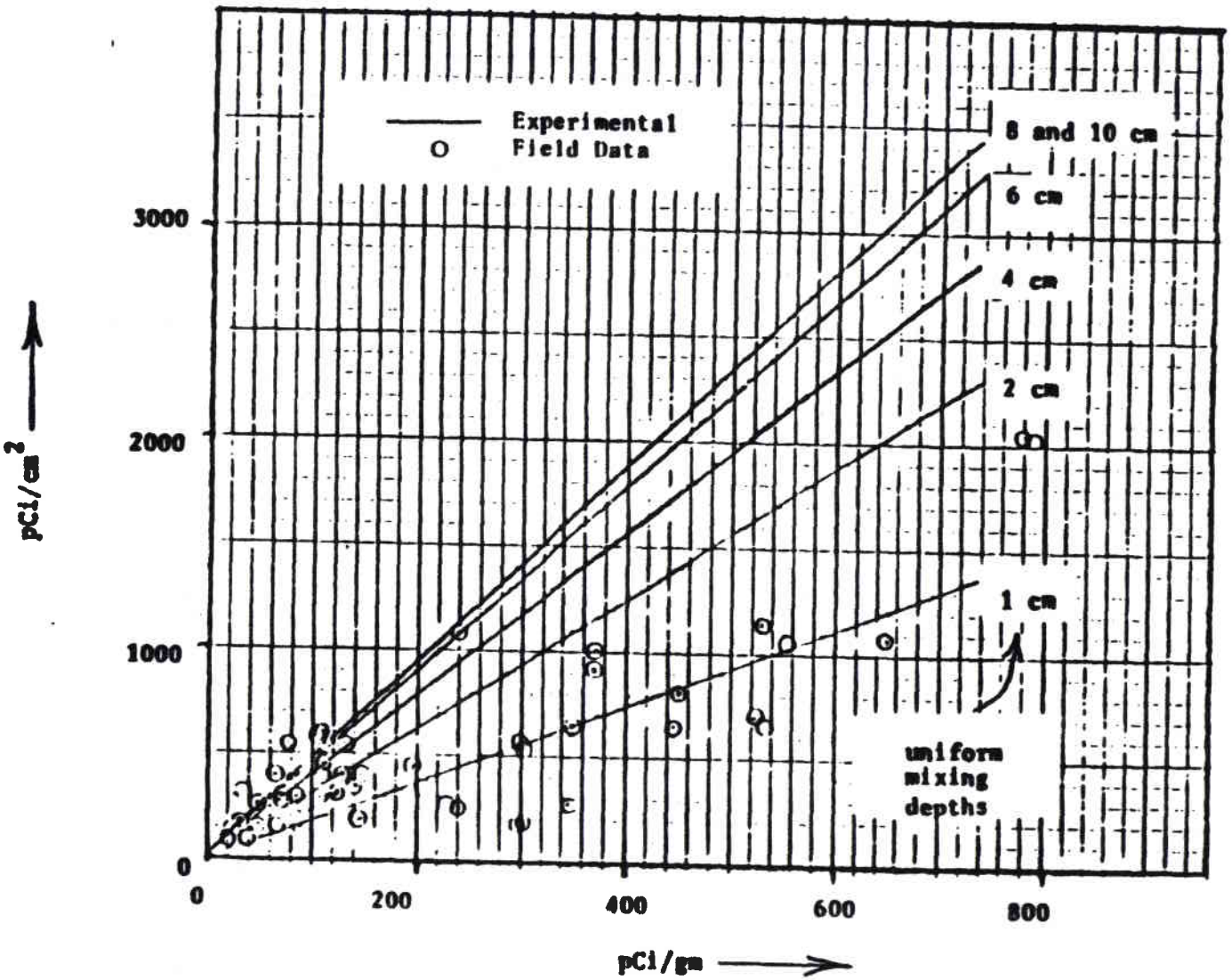

FIGURE 11

Experimental and Field Comparisons of
Surface to Bulk Activity (Th-234, 93 keV)

for any given mixing depth. Greater depths yield higher ratios of areal to bulk activity. A limiting ratio of 4.7 was found at a depth of 8 cm. Greater thicknesses of active soil produce no change in areal activity because of absorption of the 93 keV gamma emission by the soil itself. Other plots of the laboratory data indicate that variation of areal activity with mixing depth is logarithmic (not shown).

Circles in Figure 11 are a portion of the field data from Appendices I and II. Concentrations above 200 pCi/gm exhibit an areal-to-bulk ratio near 2, falling close to the laboratory relationship for a 1 cm uniform mixing depth. Concentrations below 200 pCi/gm generally exhibit a ratio higher than 2.

The laboratory and field data are not totally comparable because uranium in the field is not expected to be uniformly mixed with depth. Figure 11 does suggest, however, that high concentrations of uranium are generally shallow. This result is consistent with the observations of section 3.3.

If the field instrument is to be used alone in a decontamination survey, an areal-to-bulk factor of 2 would provide a conservative over-estimate of U-238 concentrations. As shown in Figure 11, lower concentrations generally have ratios higher than 2. Dividing an areal measurement by the factor 2 will generally produce a high estimate of bulk U-238, especially in off-site locations where activity is diminished.

3.5 Regulatory Limits

Authority for regulating radioactive materials is discussed in a status report prepared by the N.Y.S. Department of Health (1979). The state Department of Environmental Conservation (DEC) regulates environmental releases

and cites limits for uranium concentrations in air at the point of release. Department of Health (DOH) regulations for releases to uncontrolled areas are the same as those for DEC. The State Department of Labor (DOL) establishes limits for installations and property which are subject to the jurisdiction of the Labor Law and to Industrial Code Rule 38.

A regulatory limit for uranium in soil is found in Table 5 of Code Rule 38. Soils in uncontrolled areas which contain greater than 0.05 percent uranium by weight are to be considered source material. This concentration is equivalent to 167 pCi/gm U-238.

4.0 CONCLUSIONS AND RECOMMENDATIONS

This study reports measurements of U-238 and U-235 in soil surrounding the NL Bearings plant to a distance of 600 m (0.37 mi). The area was divided into 120 sampling sectors on a radial grid centered at the building. In addition, 44 sectors were sampled on the plant site itself. The roof of the building was divided into approximately 1100 square grid elements which were surveyed for areal radioactivity.

Each sector has been characterized by separately compositing 3 shallow soil samples (0-0.5 inch depth) and 3 deep samples (0.5-2.0 inch). These were analysed by gamma spectroscopy at Teledyne Isotopes. In addition, a field instrument was used at all 3 locations within each sector to obtain areal U-238 activity.

Results have been presented in the form of maps and tables. Stippling patterns on maps readily identify the uranium contents of sectors. Deposition is greatest to the northwest and southeast of the plant in the directions of prevailing winds. Little uranium was found at distances greater than 400 m; only 3 sectors beyond this range exceeded 20 pCi/gram, the highest being 56 pCi/gram.

The measurements show a rapid decrease in uranium content with depth. Samples from 0.5 to 2.0 inches depth generally exhibit a small fraction of the concentration in the top 0.5 inch. Areal U-238 (expressed in pCi/cm^2) was found to be about 2 times the bulk U-238 (expressed in pCi/gram). This relationship varies with mixing depth, as shown by a laboratory experiment.

Regulatory limits for uranium in uncontrolled areas are prescribed by the State of New York Department of Labor in Code Rule 38. Soils containing greater than 0.05 percent uranium by weight are to be considered source

material and should be removed to an approved disposal site. This concentration is equivalent to 167 pCi/gram U-238, or nominally 200 pCi/gram. Rounding the activity in this way is justified by sampling uncertainty in any field program and by the scientific impropriety of translating a single-significant-digit weight ratio into a three-significant-digit activity. The figure 200 pCi/gm is recommended after discussion of this point at a meeting with representatives of DEC, DOH, and DOL.

The data of this study can be used to recommend a course of action for compliance with the regulatory limit. Sectors having high uranium concentrations should be surveyed in greater detail to delineate all areas which exceed the limit. Soil should be selectively removed from these areas until a re-survey finds them to be at acceptable levels.

Spatial variability must be considered in deciding which sectors to enter for further survey. A sector could exhibit an average concentration less than the regulatory limit (based on the 3 sample sites), but still contain areas which exceed the limit. In order to establish a guideline, 14 sectors were examined in which a roof dripline was sampled. Areal U-238 measurements at these sites averaged twice the readings at other locations in the same sector. This factor may be used to approximate the concentrating effect of buildings and topography.

If the soil composite from a sector measures 100 pCi/gram or greater, then application of the above factor indicates that some areas may exceed the nominal regulatory limit of 200 pCi/gram. It is recommended, therefore, that all sectors of 100 pCi/gram or greater U-238 be re-entered for a detailed survey. These sectors are easily identified by the stippling patterns on Figures 5 and 7. In addition, it is recommended that any sector exhibiting a

single areal U-238 reading greater than 400 pCi/cm^2 be re-surveyed as well. This criterion is based on the relationship of areal to bulk activity (section 3.4). The concentrating factor above is not included in this calculation because many areal measurements were taken at driplines.

Detailed surveys within a sector can be accomplished with a field instrument alone. Sufficient data exists to relate these measurements to bulk activity. Any area within a sector which reads 400 pCi/cm^2 or greater should be scraped of surface soil for disposal. The rapid decrease of activity with depth (section 3.3) indicates that removal of a thin layer will generally be sufficient. The area should be re-surveyed after the removal operation to verify its effectiveness.

Further study is recommended for the NL Bearings plant roof. Code Rule 38 cites separate limits for fixed and removable activity. The relative amounts of fixed and removable uranium should be determined at several locations using a vacuuming, brushing or washing operation. If a large portion is fixed, cores of the roofing material should be analysed to determine penetration depth in case a removal operation is required. Application of tar to fix all activity, and implementing security to designate the roof a controlled area should also be considered.

REFERENCES

ASME. 1973. Recommended Guide for the Prediction of the Dispersion of Airborne Effluents. Second Edition. American Society of Mechanical Engineers. New York.

ASTM. 1965. Recommended Practice for Probability Sampling of Materials. 1965 Book of ASTM Standards, Part 30. ASTM Designation E 105-58, p. 367-71.

Health and Safety Laboratory. 1972. Soil Sampling, pp B-05-01 to B-05-11 in: HASL Procedures Manual. John Harley, ed. Health and Safety Laboratory, U.S. Atomic Energy Commission, 376 Hudson Street, New York.

Martin, Delance O. 1976. Comment on the Change of Concentration Standard Deviations with Distance. J. Air Pollution Control 26 (2): p. 145-6.

McMullen, Robert W. 1975. The Change of Concentration Standard Deviations with Distance. J. Air Pollution Control 25 (10): p. 1057-8.

N.Y.S. Department of Health. 1979. Status Report Environmental and Public Health Evaluation of Discharges National Lead Industries. Bureau of Radiological Health, Division of Environmental Health.

State of New York. 1978. Ionizing Radiation Protection. Industrial Code Rule 38. Part 38 of the Official Compilation of Codes, Rules and Regulations of the State of New York (12 NYCRR 38). Department of Labor.

Turner, D. Bruce. 1970. Workbook of Atmospheric Dispersion Estimates. U.S. Department of Health, Education and Welfare, Cincinnati, Ohio. NTIS PB 191482.

APPENDIX I

PLANT-SITE SOIL DATA

Tolerances of individual measurements are 2 standard deviation counting errors. Tolerance of the areal average is 1 standard deviation, calculated without regard to counting error. If the areal average includes a detection limit, it is preceded by a "<" symbol.

Sector, depth		Special Composite Designation	Composited Bulk Measurement, pCi/gm U-238 (Th-234)	Composited Bulk Measurement, pCi/gm U-235	Areal U-238 (Th-234), pCi/cm² A	B	C	Avg
S-19	S	A only	1159 ± 10	19.3 ± 0.5	2663 ± 61			2663
	D	A only	160 ± 4	3.5 ± 0.2	1323 ± 49			1323
S-20	S	A only	991 ± 13	12.5 ± 0.4	2279 ± 60			2279
	D	A only	44 ± 5	0.9 ± 0.1	1010 ± 47			1010
S-21	S	A only	906 ± 8	15.0 ± 0.5	1783 ± 53			1783
	D	A only	49 ± 3	1.1 ± 0.1	694 ± 42			694
S-22	S	A only	528 ± 9	9.0 ± 0.4	1139 ± 41			1139
	D	A only	112 ± 3	1.9 ± 0.2	802 ± 37			802
S-25	S	AB only	479 ± 20	6.8 ± 0.7	487 ± 34	759 ± 38 *		623 ± 192
	D	AB only	52 ± 3	1.1 ± 0.2	186 ± 30	198 ± 31 *		192 ± 8
S-41	S	AB only	1136 ± 10	16.3 ± 0.4	4286 ± 80	7442 ± 99		5864 ± 2232
	D	A only	752 ± 11	11.2 ± 0.5	2060 ± 64			2060
S-42	S		787 ± 8	12.3 ± 0.5	2713 ± 64	1353 ± 53	1976 ± 62	2014 ± 681
	D		213 ± 5	4.3 ± 0.3	1437 ± 54	1470 ± 54	709 ± 51	1205 ± 430
S-43	S		778 ± 10	10.9 ± 0.6	3676 ± 73	1757 ± 52	682 ± 41	2038 ± 1517
	D		76 ± 4	1.3 ± 0.2	838 ± 50	426 ± 37	419 ± 37	561 ± 246
S-44	S		241 ± 5	4.6 ± 0.2	1607 ± 54	1157 ± 48	483 ± 45	1082 ± 566
	D		108 ± 4	1.9 ± 0.2	557 ± 43	353 ± 45	438 ± 46	449 ± 102
S-45	S		110 ± 3	2.0 ± 0.2	452 ± 41	895 ± 45	471 ± 41	606 ± 250
	D		127 ± 4	2.1 ± 0.2	575 ± 44	489 ± 39	175 ± 36	413 ± 211
S-46	S		134 ± 4	2.1 ± 0.2	918 ± 41	606 ± 37	119 ± 27	548 ± 402
	D		84 ± 4	1.5 ± 0.1	416 ± 34	395 ± 33	88 ± 27	300 ± 184
S-47	S		445 ± 6	6.4 ± 0.3	781 ± 41	735 ± 39	415 ± 32	644 ± 199
	D		122 ± 5	1.9 ± 0.2	440 ± 36	349 ± 34	145 ± 28	311 ± 151

* dripline

Sector, depth		Special Composite Designation	Composited Bulk Measurement, pCi/gm U-238 (Th-234)	U-235	Areal U-238 (Th-234), pCi/cm² A	B	C	Avg
S-48	S		283 ± 40	4.5 ± 0.4	99 ± 22	249 ± 29	368 ± 33	239 ± 125
	D		35 ± 2	0.8 ± 0.1	165 ± 28	151 ± 26	169 ± 30	162 ± 9
S-49	S		61 ± 4	0.9 ± 0.2	420 ± 33	95 ± 24	92 ± 24	202 ± 189
	D		48 ± 4	0.8 ± 0.2	256 ± 30	89 ± 23	85 ± 24	143 ± 98
S-50	S		345 ± 17	4.5 ± 0.7	494 ± 33	173 ± 26	196 ± 27	288 ± 180
	D		3 ± 2	0.1 ± 0.1	325 ± 31	128 ± 26	52 ± 24	168 ± 141
S-51	S		302 ± 18	4.2 ± 0.8	252 ± 28	186 ± 27	136 ± 26	191 ± 58
	D		40 ± 3	0.9 ± 0.2	128 ± 26	82 ± 25	71 ± 25	94 ± 30
S-52	S		297 ± 10	4.0 ± 0.7	235 ± 28	189 ± 27	153 ± 26	192 ± 41
	D		23 ± 3	0.4 ± 0.2	146 ± 26	87 ± 25	53 ± 24	95 ± 47
S-53	S	AB only	240 ± 8	3.3 ± 0.3	264 ± 28	268 ± 29		266 ± 3
	D	AB only	64 ± 5	1.1 ± 0.3	128 ± 18	186 ± 26		157 ± 41
S-65	S	AB only	144 ± 4	2.5 ± 0.2	436 ± 41	266 ± 34		351 ± 120
	D	AB only	75 ± 3	1.0 ± 0.2	370 ± 38	125 ± 33		247 ± 173
S-66	S		452 ± 7	6.6 ± 0.3	1014 ± 46	833 ± 41	559 ± 37	802 ± 229
	D		70 ± 4	1.1 ± 0.2	545 ± 39	120 ± 32	244 ± 34	303 ± 219
S-67	S		645 ± 5	9.2 ± 0.3	508 ± 38	1336 ± 47	1399 ± 47	1081 ± 497
	D		72 ± 4	1.3 ± 0.2	125 ± 31	417 ± 36	315 ± 34	286 ± 148
S-68	S		509 ± 8	6.9 ± 0.3	1108 ± 41	552 ± 37	1032 ± 42	897 ± 301
	D		62 ± 3	1.1 ± 0.1	273 ± 32	576 ± 37	367 ± 34	405 ± 155
S-69	S		373 ± 9	6.4 ± 0.4	860 ± 44	1235 ± 47	944 ± 44	1013 ± 197
	D		103 ± 5	1.6 ± 0.2	790 ± 42	565 ± 40	414 ± 38	590 ± 189
S-70	S		524 ± 11	6.8 ± 0.5	870 ± 38	648 ± 32	652 ± 35	723 ± 127
	D		104 ± 4	1.7 ± 0.2	252 ± 30	246 ± 29	386 ± 31	295 ± 79

Sector, depth		Special Composite Designation	Composited Bulk Measurement, pCi/gm U-238 (Th-234)	U-235	Areal U-238 (Th-234), pCi/cm² A	B	C	Avg
S-71	S		111 ± 5	1.6 ± 0.2	469 ± 36	493 ± 36	246 ± 31	402 ± 136
	D		52 ± 4	1.1 ± 0.2	230 ± 33	346 ± 34	167 ± 31	248 ± 198
S-72	S		11 ± 2	0.3 ± 0.1	152 ± 28	127 ± 27	206 ± 31	162 ± 40
	D		20 ± 3	0.3 ± 0.1	92 ± 27	151 ± 28	122 ± 30	122 ± 30
S-73	S		33 ± 3	0.5 ± 0.2	150 ± 25	90 ± 24	48 ± 23	96 ± 51
	D		9 ± 2	0.3 ± 0.1	46 ± 23	54 ± 24	61 ± 24	54 ± 8
S-74	S		142 ± 12	2.5 ± 0.5	138 ± 25	132 ± 25	130 ± 24	133 ± 4
	D		14 ± 3	0.4 ± 0.2	67 ± 23	67 ± 23	73 ± 23	69 ± 3
S-75	S		70 ± 5	0.9 ± 0.2	124 ± 25	119 ± 24	89 ± 24	111 ± 19
	D		4 ± 2	<0.1	59 ± 24	46 ± 23	42 ± 23	49 ± 9
S-76	S		90 ± 4	1.5 ± 0.3	118 ± 25	128 ± 25	178 ± 25	141 ± 32
	D		12 ± 2	0.5 ± 0.2	78 ± 24	69 ± 24	74 ± 23	74 ± 5
S-77	S		143 ± 5	2.5 ± 0.3	226 ± 27	167 ± 26	155 ± 26	183 ± 38
	D		26 ± 2	0.5 ± 0.2	91 ± 25	96 ± 24	66 ± 24	84 ± 16
S-78	S		229 ± 6	4.0 ± 0.4	299 ± 28	320 ± 29	204 ± 27	274 ± 62
	D		90 ± 4	1.5 ± 0.2	146 ± 26	143 ± 26	109 ± 25	133 ± 21
S-82	S	AB only	198 ± 2	2.9 ± 0.1	624 ± 36	290 ± 31		457 ± 236
	D	AB only	91 ± 2	1.7 ± 0.1	216 ± 30	304 ± 31		260 ± 62
S-83	S	AB only	536 ± 8	7.5 ± 0.3	284 ± 33	998 ± 41		641 ± 505
	D	AB only	37 ± 2	0.6 ± 0.1	229 ± 32	387 ± 33		308 ± 112
S-84	S	AB only	371 ± 7	5.9 ± 0.3	1060 ± 47	779 ± 40		920 ± 199
	D	AB only	146 ± 5	2.4 ± 0.2	405 ± 38	374 ± 34		390 ± 22
S-85	S	AB only	1209 ± 23	19.7 ± 1.0	523 ± 40	1068 ± 47		796 ± 385
	D	AB only	204 ± 9	3.4 ± 0.5	277 ± 35	394 ± 39		336 ± 83

Sector, depth	Special Composite Designation	Composited Bulk Measurement, pCi/gm U-238 (Th-234)	Composited Bulk Measurement, pCi/gm U-235	Areal U-238 (Th-234), pCi/cm² A	B	C	Avg
S-86 S	AB only	114 ± 2	2.3 ± 0.2	336 ± 35	711 ± 41		524 ± 27
D	AP only	87 ± 3	1.6 ± 0.2	276 ± 33	405 ± 36		341 ± 91
S-89 S		85 ± 4	1.2 ± 0.2	183 ± 34	250 ± 33	221 ± 34	218 ± 34
D		6 ± 2	0.2 ± 0.1	113 ± 32	93 ± 30	155 ± 33	120 ± 32
S-90 S		126 ± 2	1.9 ± 0.2	588 ± 39	331 ± 33	263 ± 41	394 ± 171
D		81 ± 4	1.5 ± 0.2	242 ± 34	154 ± 32	169 ± 42	188 ± 47
S-91 S		298 ± 5	4.7 ± 0.2	767 ± 42	604 ± 43	355 ± 36	582 ± 22
D		61 ± 2	1.0 ± 0.1	214 ± 35	308 ± 40	110 ± 32	211 ± 99
S-92 S		1020 ± 10	15.1 ±0.5	1154 ± 42	959 ± 40	1133 ± 42	1082 ± 107
D		91 ± 2	1.7 ± 0.1	250 ± 30	270 ± 31	298 ± 32	273 ± 24
S-93 S		556 ± 12	7.2 ± 0.5	838 ± 42	1151 ± 45	1157 ± 47	1049 ± 182
D		76 ± 4	1.5 ± 0.2	454 ± 36	531 ± 38	408 ± 37	464 ± 62
S-94 S		305 ± 12	3.9 ± 0.4	780 ± 36	164 ± 27	728 ± 35	557 ± 342
D		99 ± 6	1.4 ± 0.3	299 ± 30	151 ± 26	410 ± 31	287 ± 130
S-95 S		686 ± 25	8.1 ± 0.7	492 ± 36	404 ± 34	418 ± 35	438 ± 37
D		64 ± 6	0.9 ± 0.3	235 ± 33	241 ± 32	230 ± 31	235 ± 6
Gr[illegible]		414 [illegible]	6.2 [illegible]				

APPENDIX II

OFF-SITE SOIL DATA

Tolerances of individual measurements are 2 standard deviation counting errors. Tolerance of the areal average is 1 standard deviation, calculated without regard to counting error. If the areal average includes a detection limit, it is preceded by a "<" symbol.

Sector, depth		Special Composite Designation	Composited Bulk Measurement, pCi/gm U-238 (Th-234)	Composited Bulk Measurement, pCi/gm U-235	Areal U-238 (Th-234), pCi/cm² A	B	C	Avg
1	S	A only	82 ± 8	1.0 ± 0.3	119 ± 23			119
	D	A only	17 ± 3	0.3 ± 0.1	71 ± 23			71
2	S	All only	77 ± 4	1.0 ± 0.2	148 ± 24	87 ± 23		118 ± 43
	D	All only	9 ± 3	0.3 ± 0.2	61 ± 23	54 ± 23		58 ± 5
3	S	A only	85 ± 6	1.1 ± 0.3	101 ± 24			101
	D	A only	19 ± 3	0.5 ± 0.2	68 ± 23			68
4	S		41 ± 4	0.6 ± 0.2	112 ± 24	49 ± 21	54 ± 20	72 ± 35
	D		6 ± 2	0.2 ± 0.1	67 ± 23	40 ± 20	32 ± 20	46 ± 18
5	S	AB only	179 ± 6	2.7 ± 0.2	118 ± 25	80 ± 23		99 ± 27
	D	AB only	144 ± 5	2.2 ± 0.3	50 ± 24	<37		<44 ± 9
6	S		189 ± 6	2.5 ± 0.3	145 ± 23	307 ± 27	165 ± 26	157 ± 89
	D		70 ± 4	1.2 ± 0.2	52 ± 23	143 ± 25	114 ± 26	103 ± 46
7	S		99 ± 5	1.1 ± 0.2	663 ± 39*	140 ± 30	185 ± 22	329 ± 290
	D		52 ± 3	0.9 ± 0.2	179 ± 34*	111 ± 30	189 ± 22	160 ± 42
8	S	AB only	504 ± 9	6.6 ± 0.4	250 ± 26	494 ± 29		372 ± 172
	D	AB only	72 ± 4	1.2 ± 0.2	137 ± 25	339 ± 26		238 ± 143
9	S	pavement						
	D	pavement						
10	S		3689 ± 45	42 ± 18	916 ± 40	1337 ± 43Δ	866 ± 39	1040 ± 259
	D		351 ± 7	5.2 ± 0.3	578 ± 36	887 ± 40Δ	493 ± 35	653 ± 207
11	S		199 ± 6	2.7 ± 0.3	364 ± 30	323 ± 28	232 ± 27	306 ± 68
	D		64 ± 4	1.0 ± 0.2	145 ± 26	158 ± 26	134 ± 26	146 ± 12
12	S		1036 ± 22	11.3± 0.7	501 ± 31	293 ± 29	218 ± 26	337 ± 147
	D		151 ± 5	1.9± 0.2	225 ± 28	175 ± 26	108 ± 24	169 ± 59

* dripline

Δ low spot

Sector, depth		Special Composite Designation	Composited Bulk Measurement, pCi/gm U-238 (Th-234)	Composited Bulk Measurement, pCi/gm U-235	Areal U-238 (Th-234), pCi/cm² A	B	C	Avg
13	S		265 ± 7	3.8 ± 0.3	587 ± 35	370 ± 30	177 ± 25	378 ± 205
	D		116 ± 5	1.6 ± 0.2	381 ± 33	202 ± 27	150 ± 24	244 ± 121
14	S		56 ± 5	1.0 ± 0.2	270 ± 29	<34	76 ± 23	<127 ± 126
	D		21 ± 4	0.4 ± 0.2	170 ± 28	<33	37 ± 22	< 80 ± 78
15	S		46 ± 3	0.7 ± 0.2	304 ± 30	<39	69 ± 23	<137 ± 145
	D		34 ± 3	0.7 ± 0.2	154 ± 20	61 ± 24	51 ± 23	89 ± 57
16	S		45 ± 3	0.7 ± 0.2	97 ± 26	118 ± 29	66 ± 22	94 ± 36
	D		19 ± 3	0.3 ± 0.2	87 ± 26	101 ± 28	40 ± 21	113 ± 33
17	S	Bulk D only	1545 ± 13	23.5 ± 0.6	1870 ± 56	1758 ± 71	4400 ± 72	2722 ±1223
	D	ABC pavement	167 ± 4	3.4 ± 0.3				648
18	S		34 ± 2	0.7 ± 0.1	<45	<43	52 ± 28	<47 ± 5
	D		3 ± 2	0.2 ± 0.1	<43	<41	<45	<43
19	S		141 ± 4	2.0 ± 0.2	215 ± 32	225 ± 34	283 ± 31	241 ± 37
	D		5 ± 3	<0.1	138 ± 31	186 ± 35	111 ± 29	145 ± 38
20	S		208 ± 5	3.7 ± 0.3	697 ± 44	403 ± 38	341 ± 31	480 ± 90
	D		106 ± 3	2.1 ± 0.2	529 ± 44	321 ± 37	284 ± 30	378 ± 132
21	S	AABB	371 ± 6	5.4 ± 0.3	607 ± 35	472 ± 32	609 ± 37	531 ± 83
	S	C	1048 ± 12	14.2 ± 0.6	544 ± 34	422 ± 32		
	D	AABB	72 ± 4	1.4 ± 0.2	294 ± 32	222 ± 27	273 ± 34	284 ± 45
	D	C	115 ± 4	3.2 ± 0.2	347 ± 30	283 ± 31		
22	S		858 ± 11	9.7 ± 0.5	669 ± 35	842 ± 39	340 ± 29	617 ± 255
	D		168 ± 6	2.6 ± 0.2	453 ± 33	500 ± 35	86 ± 25	346 ± 226
23	S		770 ± 15	9.3 ± 0.5	586 ± 39*	708 ± 35	534 ± 32	609 ± 89
	D		37 ± 3	0.7 ± 0.1	357 ± 35*	258 ± 29	156 ± 27	257 ± 108

* dripline

‖ includes location D: S 2861 ± 50
D 648 ± 45

Sector, depth		Special Composite Designation	Composited Bulk Measurement, pCi/gm U-238 (Th-234)	U-235	Areal U-238 (Th-234), pCi/cm² A	B	C	Avg
24	S		148 ± 5	2.0 ± 0.2	236 ± 26	191 ± 32	257 ± 29	228 ± 34
	D		44 ± 2	0.7 ± 0.1	119 ± 24	100 ± 30	205 ± 27	141 ± 56
25	S	AB only	56 ± 4	0.7 ± 0.2	167 ± 24	118 ± 20		143 ± 35
	D	AB only	23 ± 1	0.4 ± 0.1	92 ± 23	80 ± 20		86 ± 8
26	S	no soil						
	D	no soil						
27	S	no soil						
	D	no soil						
28	S		10 ± 3	0.2 ± 0.1	35 ± 21*	44 ± 22	39 ± 19	39 ± 5
	D		6 ± 2	0.1 ± 0.1	<34 *	<36	<30	<33
29	S	AB only	59 ± 3	0.8 ± 0.1	178 ± 25*	66 ± 22		122 ± 79
	D	AB only	9 ± 1	0.3 ± 0.1	71 ± 23*	42 ± 22		57 ± 21
30	S	A only	17 ± 2	0.5 ± 0.1	<38			<38
	D	A only	3 ± 2	0.1 ± 0.1	<38			<38
31	S	no soil						
	D	no soil						
32	S	AB only	87 ± 3	1.1 ± 0.2	126 ± 26	60 ± 21		93 ± 47
	D	AB only	14 ± 3	0.3 ± 0.2	103 ± 23	55 ± 20		79 ± 34
33	S		290 ± 5	3.6 ± 0.3	512 ± 30	321 ± 27	204 ± 24	346 ± 155
	D		59 ± 3	0.9 ± 0.1	338 ± 28	139 ± 25	175 ± 24	217 ± 106
34	S		105 ± 5	1.5 ± 0.3	590 ± 33	223 ± 27	290 ± 28	368 ± 195
	D		90 ± 4	1.4 ± 0.2	252 ± 28	81 ± 24	168 ± 26	167 ± 86
35	S		72 ± 4	1.2 ± 0.2	192 ± 26	166 ± 26	144 ± 23	167 ± 24
	D		22 ± 1	0.3 ± 0.1	113 ± 24	91 ± 25	123 ± 22	109 ± 16

* dripline

Sector, depth		Special Composite Designation	Composited Bulk Measurement, pCi/gm U-238 (Th-234)	U-235	Areal U-238 (Th-234), pCi/cm² A	B	C	Avg
36	S		130 ± 4	1.5 ± 0.2	231 ± 25	206 ± 24	267 ± 25	235 ± 31
	D		18 ± 2	0.3 ± 0.1	50 ± 21	108 ± 21	142 ± 22	100 ± 47
37	S		214 ± 6	2.7 ± 0.3	173 ± 25	361 ± 29	192 ± 26	242 ± 103
	D		52 ± 3	0.8 ± 0.1	72 ± 24	346 ± 28	98 ± 24	172 ± 151
38	S		76 ± 4	1.2 ± 0.2	141 ± 25	159 ± 25	99 ± 25	133 ± 31
	D		18 ± 2	0.3 ± 0.1	81 ± 23	90 ± 22	80 ± 24	84 ± 6
39	S		26 ± 2	0.5 ± 0.1	87 ± 22	60 ± 22	85 ± 23	77 ± 15
	D		8 ± 2	0.2 ± 0.1	45 ± 22	<36	39 ± 22	<40 ± 5
40	S		22 ± 3	0.5 ± 0.2	75 ± 22	42 ± 21	38 ± 20	52 ± 20
	D		8 ± 2	0.2 ± 0.1	71 ± 22	<34	<32	<46 ± 22
41	S		19 ± 2	0.4 ± 0.1	84 ± 24	69 ± 22	57 ± 25	70 ± 14
	D		16 ± 3	0.3 ± 0.2	78 ± 24	59 ± 21	64 ± 24	67 ± 10
42	S		15 ± 1	0.3 ± 0.1	63 ± 24	44 ± 21	55 ± 21	54 ± 10
	D		1 ± 1	0.1 ± 0.1	<37	<34	<37 ± 21	<36 ± 2
43	S		123 ± 9	1.4 ± 0.4	136 ± 23	96 ± 23	86 ± 22	106 ± 26
	D		21 ± 2	0.4 ± 0.2	59 ± 22	37 ± 21	94 ± 21	63 ± 29
44	S		164 ± 5	2.5 ± 0.2	300 ± 30	217 ± 29	182 ± 28	233 ± 61
	D		30 ± 3	0.6 ± 0.1	184 ± 28	92 ± 27	133 ± 26	136 ± 46
45	S	no soil						
	D	no soil						
46	S		55 ± 2	0.7 ± 0.1	368 ± 28	211 ± 24	144 ± 24	241 ± 115
	D		24 ± 3	0.4 ± 0.1	182 ± 25	85 ± 23	111 ± 24	126 ± 50
47	S		37 ± 2	0.5 ± 0.1	316 ± 30	182 ± 25	50 ± 21	183 ± 133
	D		25 ± 2	0.4 ± 0.1	165 ± 28	169 ± 24	45 ± 21	126 ± 70

Sector, depth	Special Composite Designation	Composited Bulk Measurement, pCi/gm U-238 (Th-234)	U-235	Areal U-238 (Th-234), pCi/cm² A	B	C	Avg
48 S		308 ± 9	4.5 ± 0.3	1396 ± 43 *	481 ± 32	420 ± 29	766 ± 547
D		150 ± 4	2.1 ± 0.2	791 ± 37 *	246 ± 28	171 ± 25	403 ± 338
49 S		56 ± 4	0.9 ± 0.2	82 ± 22	107 ± 22	344 ± 33	178 ± 145
D		39 ± 3	0.5 ± 0.1	92 ± 21	84 ± 22	320 ± 32	165 ± 134
50 S		5 ± 2	0.2 ± 0.1	41 ± 19	55 ± 20	122 ± 24 *	73 ± 43
D		12 ± 2	0.3 ± 0.2	49 ± 19	50 ± 21	69 ± 23 *	56 ± 11
51 S		39 ± 3	0.6 ± 0.2	<32	62 ± 21 *	46 ± 21	<47 ± 15
D		6 ± 2	0.2 ± 0.1	34 ± 20	45 ± 20 *	<33	<37 ± 7
52 S		15 ± 2	0.3 ± 0.1	41 ± 19	49 ± 22 *	66 ± 19	52 ± 13
D		8 ± 1	0.2 ± 0.1	<31	53 ± 22	<31	<38 ± 13
53 S		16 ± 2	0.4 ± 0.1	<35	60 ± 21	<33	<43 ± 15
D		6 ± 2	0.1 ± 0.1	<35	<34	48 ± 20	<39 ± 8
54 S		17 ± 3	0.3 ± 0.2	<36	46 ± 20 *	48 ± 19	<43 ± 6
D		8 ± 1	0.2 ± 0.1	<36	<33 *	38 ± 19	<36 ± 3
55 S	AB only	21 ± 3	0.4 ± 0.2	55 ± 21	56 ± 20		<56 ± 1
D	AB only	9 ± 2	0.2 ± 0.1	48 ± 20	36 ± 20		<42 ± 8
56 S		46 ± 2	0.6 ± 0.1	127 ± 24	145 ± 24	121 ± 22	131 ± 12
D		27 ± 2	0.4 ± 0.1	107 ± 23	86 ± 23	70 ± 21	88 ± 19
57 S		128 ± 7	1.8 ± 0.3	120 ± 24	468 ± 31	161 ± 24	250 ± 190
D		30 ± 3	0.5 ± 0.2	68 ± 22	213 ± 27	52 ± 22	111 ± 89
58 S		58 ± 3	0.8 ± 0.2	331 ± 37	98 ± 24	147 ± 22	187 ± 101
D		37 ± 4	0.5 ± 0.2	267 ± 26	82 ± 24	89 ± 21	119 ± 102
59 S		54 ± 3	0.7 ± 0.2	134 ± 22	69 ± 20	129 ± 22	111 ± 36
D		24 ± 3	0.5 ± 0.2	84 ± 21	52 ± 20	115 ± 21	84 ± 32

* dripline

Sector, depth		Special Composite Designation	Composited Bulk Measurement, pCi/gm U-238 (Th-234)	U-235	Areal U-238 (Th-234), pCi/cm² A	B	C	Avg
60	S		45 ± 2	0.6 ± 0.1	60 ± 21	117 ± 22	99 ± 22	92 ± 29
	D		11 ± 2	0.2 ± 0.1	36 ± 20	48 ± 20	50 ± 20	45 ± 8
61	S		36 ± 3	0.5 ± 0.2	64 ± 23	103 ± 23	79 ± 22	82 ± 20
	D		16 ± 3	0.4 ± 0.1	59 ± 23	80 ± 22	78 ± 22	77 ± 15
62	S		26 ± 3	0.4 ± 0.1	53 ± 23	70 ± 22	56 ± 22	60 ± 9
	D		10 ± 1	0.2 ± 0.1	57 ± 23	54 ± 22	61 ± 22	57 ± 4
63	S		27 ± 2	0.3 ± 0.1	87 ± 22	69 ± 22	37 ± 21	64 ± 25
	D		6 ± 2	0.1 ± 0.1	44 ± 21	37 ± 22	62 ± 21	40 ± 4
64	S		30 ± 3	0.5 ± 0.1	96 ± 23 *	38 ± 22	36 ± 22	37 ± 1
	D		6 ± 1	0.1 ± 0.1	73 ± 23 *	<36	37 ± 22	<36 ± 1
65	S		5 ± 2	0.2 ± 0.1	43 ± 22	61 ± 21 *	79 ± 21	61 ± 18
	D		4 ± 2	0.1 ± 0.1	47 ± 21	<35 *	<34	<39 ± 7
66	S		22 ± 3	0.4 ± 0.2	71 ± 22	<35	<34	<47 ± 21
	D		7 ± 2	0.1 ± 0.1	48 ± 22	<35	<34	<39 ± 8
67	S		8 ± 2	0.3 ± 0.1	<33	<33	<33	<33
	D		3 ± 2	0.1 ± 0.1	<33	<33	<33	<33
68	S		29 ± 3	0.4 ± 0.2	61 ± 21	<34	<34	<43 ± 36
	D		12 ± 2	0.2 ± 0.1	43 ± 21	<33	<33	<36 ± 6
69	S		13 ± 2	0.3 ± 0.1	44 ± 29	64 ± 20	54 ± 22	54 ± 10
	D		4 ± 2	0.1 ± 0.1	<32	43 ± 20	<34	<36 ± 6
70	S	AB only	161 ± 6	2.2 ± 0.2	640 ± 32	111 ± 22		376 ± 374
	D	AB only	62 ± 3	0.9 ± 0.1	384 ± 29	64 ± 21		224 ± 226
71	S		212 ± 8	2.7 ± 0.3	281± 27 *	176 ± 26	317 ± 30	258 ± 73
	D		41 ± 2	0.7 ± 0.1	210± 26 *	126 ± 25	188 ± 28	175 ± 44

* dripline

Sector, depth		Special Composite Designation	Composited Bulk Measurement, pCi/gm U-238 (Th-234)	U-235	Areal U-238 (Th-234), pCi/cm² A	B	C	Avg
72	S		68 ± 4	1.0 ± 0.2	176 ± 23	169 ± 23 *	123 ± 21	156 ± 29
	D		24 ± 2	0.4 ± 0.1	80 ± 22	77 ± 23 *	87 ± 20	81 ± 57
73	S		38 ± 3	0.4 ± 0.2	<34	63 ± 22	60 ± 25	<52 ± 16
	D		8 ± 1	0.2 ± 0.1	50 ± 21	76 ± 22	88 ± 24	71 ± 19
74	S		8 ± 2	0.2 ± 0.1	<35	96 ± 25	38 ± 22	<56 ± 34
	D		7 ± 2	0.2 ± 0.1	<35	55 ± 24	<36	<42 ± 11
75	S		12 ± 3	0.5 ± 0.2	93 ± 22 *	38 ± 19	<35	<55 ± 3
	D		3 ± 1	0.2 ± 0.1	73 ± 22 *	<32	<35	<47 ± 23
76	S		6 ± 2	<0.1	<34	64 ± 24 *	33 ± 20	<44 ± 18
	D		2 ± 2	0.1 ± 0.1	<34	45 ± 23 *	48 ± 20	<42 ± 7
77	S		5 ± 5	<0.1	41 ± 23	<34	<36 *	<37 ± 4
	D		4 ± 4	<0.1	<37	<34	48 ± 22 *	<40 ± 7
78	S		9 ± 2	0.2 ± 0.1	43 ± 19	<35	<31	<36 ± 6
	D		3 ± 1	0.1 ± 0.1	<31	60 ± 22	37 ± 19	<43 ± 15
79	S		17 ± 2	0.2 ± 0.1	<32	<32	77 ± 20	<47 ± 16
	D		6 ± 2	0.1 ± 0.1	47 ± 19	<31	47 ± 20	<42 ± 9
80	S		42 ± 3	0.7 ± 0.2	516 ± 35 *	65 ± 22	68 ± 22	216 ± 250
	D		103 ± 4	1.5 ± 0.2	403 ± 34 *	<35	67 ± 22	<168 ± 203
81	S		164 ± 5	2.3 ± 0.2	224 ± 30 *	194 ± 23	96 ± 23	171 ± 67
	D		46 ± 2	0.6 ± 0.2	192 ± 27 *	77 ± 21	57 ± 21	109 ± 73
82	S		26 ± 3	0.4 ± 0.1	<34	35 ± 21	<32	<34 ± 2
	D		10 ± 1	0.2 ± 0.1	<34	<34	<31	<33
83	S		27 ± 2	0.6 ± 0.1	<34	<33	44 ± 20	<37 ± 6
	D		6 ± 1	0.2 ± 0.1	<33	<32	<32	<32

* dripline

Sector, depth		Special Composite Designation	Composited Bulk Measurement, pCi/gm U-238 (Th-234)	U-235	Areal U-238 (Th-234), pCi/cm² A	B	C	Avg
84	S		19 ± 3	0.4 ± 0.2	<32	<33	<32	<32
	D		7 ± 2	0.1 ± 0.1	<32	<32	<32	<32
85	S		46 ± 4	0.5 ± 0.2	94 ± 22	64 ± 23	79 ± 22	79 ± 15
	D		9 ± 2	0.2 ± 0.1	45 ± 22	52 ± 22	60 ± 21	52 ± 8
86	S		11 ± 1	0.2 ± 0.1	<36	<35	<36	<36
	D		4 ± 1	0.4 ± 0.1	<34	<34	<35	<34
87	S		7 ± 2	0.2 ± 0.1	<35	<35	<35	<35
	D		1 ± 1	0.1 ± 0.1	<34	<35	<35	<35
88	S		14 ± 2	0.3 ± 0.1	<34	<39	48 ± 23 *	<40 ± 7
	D		2 ± 1	0.1 ± 0.1	<34	<35	40 ± 23 *	<36 ± 3
89	S		5 ± 2	0.2 ± 0.1	51 ± 21	34 ± 20	45 ± 20	43 ± 9
	D		3 ± 1	<0.1	<34	<32	<33	<33
90	S		9 ± 2	0.1 ± 0.1	<32	<33	<32	<32
	D		4 ± 1	0.1 ± 0.1	<32	<33	32 ± 20	<32 ± 1
91	S		1 ± 1	<0.1	<34	<30	<31	<32
	D		1 ± 1	<0.1	<34	<31	<30	<32
92	S		3 ± 1	0.2 ± 0.1	<33	<35	<37	<35
	D		3 ± 1	0.1 ± 0.1	<33	<35	<37	<35
93	S		16 ± 3	0.6 ± 0.2	<33	113 ± 25 *	<34	<60 ± 46
	D		10 ± 1	0.1 ± 0.1	42 ± 20	77 ± 24 *	58 ± 20	59 ± 17
94	S		60 ± 4	0.9 ± 0.2	111 ± 22	154 ± 23	76 ± 24	114 ± 39
	D		8 ± 2	0.2 ± 0.1	53 ± 20	81 ± 22	100 ± 24	78 ± 24
95	S		78 ± 3	1.0 ± 0.2	103 ± 23	171 ± 24	200 ± 23 *	158 ± 50
	D		23 ± 3	0.4 ± 0.1	55 ± 22	82 ± 23	69 ± 21 *	69 ± 14

* dripline

Sector, depth	Special Composite Designation	Composited Bulk Measurement, pCi/gm U-238 (Th-234)	Composited Bulk Measurement, pCi/gm U-235	Areal U-238 (Th-234), pCi/cm² A	B	C	Avg
96 S		19 ± 2	0.3 ± 0.1	59 ± 21	73 ± 22	64 ± 21	65 ± 7
D		12 ± 2	0.2 ± 0.1	39 ± 20	37 ± 22	74 ± 21	50 ± 21
97 S		6 ± 2	0.1 ± 0.1	<35	<31	<37	<34
D		4 ± 2	0.1 ± 0.1	<35	<31	<37	<34
98 S				<31	<30	<33	<31
D		<2	0.1 ± 0.1	<31	<30	<34	<32
99 S		4 ± 2	<0.1	<35	<38	<33	<35
D		1 ± 1	0.1 ± 0.1	<35	<39	<34	<36
100 S		4 ± 2	<0.1	<40	<32	<33	<35
D		1 ± 1	0.1 ± 0.1	<43	<32	<34	<36
101 S		3 ± 2	<0.1	<32	<32	<36	<33
D		<2	0.1 ± 0.1	<32	<33	<36	<34
102 S		4 ± 2	<0.1	<34	<35	<37	<34
D		1 ± 1	0.1 ± 0.1	<33	<35	<36	<35
103 S		4 ± 2	<0.1	<35	<33	60 ± 23 *	<43 ± 15
D		8 ± 2	0.2 ± 0.1	<35	<33	50 ± 23 *	<39 ± 9
104 S		19 ± 2	0.4 ± 0.1	44 ± 22	39 ± 23	<37	<40 ± 4
D		12 ± 2	0.2 ± 0.1	64 ± 22	<37	38 ± 22	<46 ± 15
105 S		33 ± 3	0.6 ± 0.2	<36	75 ± 23	<38	<50 ± 22
D		6 ± 2	0.2 ± 0.1	<36	<36	<37	<36
106 S		5 ± 2	0.1 ± 0.1	<34	<34	<31	<33
D		5 ± 1	0.1 ± 0.1	<34	<36	<31	<34
107 S		16 ± 2	0.2 ± 0.1	<33	<33	<33	<33
D		2 ± 2	0.1 ± 0.1	<33	<32	<33	<33

* dripline

Sector, depth		Special Composite Designation	Composited Bulk Measurement, pCi/gm U-238 (Th-234)	Composited Bulk Measurement, pCi/gm U-235	Areal U-238 (Th-234), pCi/cm² A	B	C	Avg
108	S		8 ± 2	0.2 ± 0.1	<32	<35	<32	<33
	D		4 ± 1	0.1 ± 0.1	<31	<34	<33	<33
109	S		8 ± 3	0.2 ± 0.2	<39	<36	<37	<37
	D		2 ± 2	0.1 ± 0.1	<39	<36	<37	<37
110	S		3 ± 1	<0.1	<38	<39	<38	<38
	D		3 ± 1	0.2 ± 0.1	<39	<39	<39	<39
111	S		2 ± 1	0.1 ± 0.1	<31	<31	<30	<31
	D		<2	0.1 ± 0.1	34 ± 19	<32	<30	<32 ± 2
112	S		7 ± 2	0.1 ± 0.1	<32	<31	<31	<31
	D		<2	0.1 ± 0.1	<33	<31	<31	<32
113	S		5 ± 2	0.2 ± 0.1	<34	<38	<33	<35
	D		2 ± 2	0.1 ± 0.1	<30	<38	<33	<35
114	S		6 ± 5	<0.1	<30	<36	<33	<33
	D		1 ± 1	<0.1	<30	<32	<33	<32
115	S		4 ± 2	<0.1	<33	<33	<36	<34
	D		<2	<0.1	<33	<33	<35	<34
116	S		3 ± 1	<0.1	<33	<35	<33	<34
	D		1 ± 2	0.2 ± 0.1	<34	<34	<34	<34
117	S		5 ± 1	0.1 ± 0.1	<35	<37 *	<33	<35
	D		5 ± 2	0.2 ± 0.1	<35	<38 *	<33	<35
118	S		26 ± 4	0.5 ± 0.2	<33	42 ± 18	<36	<37 ± 15
	D		3 ± 1	0.1 ± 0.1	<33	<29	<36	<33 ± 4
119	S		56 ± 5	0.8 ± 0.3	<35	48 ± 19	41 ± 20	<41 ± 7
	D		7 ± 2	0.1 ± 0.1	<33	<30	<31	<31
120	S		12 ± 2	0.2 ± 0.1	45 ± 19	<32	<34	<37 ± 7
	D		4 ± 1	0.1 ± 0.1	<31	<33	<33	<32

* dripline

APPENDIX III

ROOF SURVEY DATA

Grid Location	Areal Activity pCi/cm^2
1-3	270
1-4	230
1-5	180
1-6	580
1-7	130
1-8	220
1-9	180
1-10	180
1-11	220
1-12	220
1-13	270
1-14	270
1-15	270
1-16	310
1-17	220
1-18	180
1-19	220
1-20	130
1-21	180
1-22	310
1-23	220
1-24	270

Grid Location	Areal Activity pCi/cm^2
1-25	130
1-26	180
1-27	220
1-28	220
2-3	<100
2-4	<100
2-5	<100
2-6	270
2-7	270
2-8	270
2-9	360
2-10	270
2-11	220
2-12	220
2-13	220
2-14	310
2-15	270
2-16	270
2-17	310
2-18	220
2-19	270
2-20	270

Grid Location	Areal Activity pCi/cm^2
2-21	220
2-22	220
2-23	270
2-24	270
2-25	270
2-26	220
2-27	220
2-28	220
3-3	<100
3-4	<100
3-5	<100
3-6	230
3-7	270
3-8	270
3-9	450
3-10	270
3-11	220
3-12	270
3-13	310
3-14	360
3-15	310
3-16	270

15 7/C

Grid Location	Areal Activity pCi/cm^2
3-17	220
3-18	220
3-19	360
3-20	310
3-21	370
3-22	450
3-23	400
3-24	400
3-25	310
3-26	400
3-27	310
3-28	450
4-3	<100
4-4	<100
4-5	<100
4-6	450
4-7	360
4-8	540
4-9	540
4-10	710
4-11	400
4-12	450
4-13	580

Grid Location	Areal Activity pCi/cm^2
4-14	490
4-15	450
4-16	400
4-17	540
4-18	450
4-19	360
4-20	490
4-21	540
4-22	1120
4-23	710
4-24	450
4-25	360
4-26	540
4-27	580
4-28	400
5-3	270
5-4	270
5-5	360
5-6	400
5-7	3480
5-8	4020
5-9	4020
5-10	3570

Grid Location	Areal Activity pCi/cm^2
5-11	1330
5-12	890
5-13	940
5-14	1020
5-15	800
5-16	450
5-17	360
5-18	400
5-19	400
5-20	490
5-21	220
5-22	270
5-23	220
5-24	220
5-25	220
5-26	270
5-27	310
5-28	270
6-3	310
6-4	270
6-5	360
6-6	1250
6-7	2590

Grid Location	Areal Activity pCi/cm^2
6-8	4460
6-9	4020
6-10	3130
6-11	1790
6-12	890
6-13	980
6-14	890
6-15	850
6-16	580
6-17	450
6-18	630
6-19	760
6-20	760
6-21	1120
6-22	710
6-23	800
6-24	580
6-25	850
6-26	1430
6-27	1650
6-28	1380
7-3	890

Grid Location	Areal Activity pCi/cm^2
7-4	1070
7-5	1250
7-6	1610
7-7	2140
7-8	2230
7-9	2680
7-10	1790
7-11	1340
7-12	890
7-13	1030
7-14	980
7-15	940
7-16	800
7-17	670
7-18	800
7-19	3570
7-20	4460
7-21	850
7-22	800
7-23	890
7-24	850
7-25	1030

Grid Location	Areal Activity pCi/cm^2
7-26	1560
7-27	2190
7-28	1380
8-3	1120
8-4	1030
8-5	1740
8-6	2190
8-7	2140
8-8	1160
8-9	1340
8-10	1790
8-11	1340
8-12	1340
8-13	1300
8-14	1300
8-15	1030
8-16	760
8-17	2190
8-18	4420
8-19	7990
8-20	6650
8-21	1160

1,6

109,375

Grid Location	Areal Activity pCi/cm^2
8-22	670
8-23	580
8-24	714
8-25	890
8-26	940
8-27	1070
8-28	940
8-32	360
8-33	360
8-34	310
8-35	400
8-36	360
9-3	1740
9-4	1740
9-5	3080
9-6	2630
9-7	2230
9-8	1790
9-10	1790
9-11	1340
9-12	1340
9-13	1340

Grid Location	Areal Activity pCi/cm^2
9-14	1160
9-15	940
9-16	710
9-17	2190
9-18	3530
9-19	5760
9-20	4420
9-21	1520
9-22	710
9-23	760
9-24	710
9-25	1300
9-26	1610
9-27	1560
9-28	1160
9-32	760
9-33	540
9-34	630
9-35	710
9-36	400
10-2	890
10-3	2190

Grid Location	Areal Activity pCi/cm^2
10-4	2190
10-5	2630
10-6	2190
10-7	2190
10-8	1518
10-9	1210
10-10	1250
10-11	1030
10-12	940
10-13	980
10-14	980
10-15	760
10-16	800
10-17	1210
10-18	2630
10-19	2630
10-20	3080
10-21	1070
10-22	850
10-23	850
10-24	800
10-25	800

*9-9 1340

Grid Location	Areal Activity pCi/cm^2
10-26	670
10-27	670
10-28	540
10-29	980
10-30	1070
10-31	940
10-32	850
10-33	540
10-34	630
10-35	760
10-36	800
11-2	400
11-3	2190
11-4	2190
11-5	1740
11-6	1380
11-7	1340
11-8	1300
11-9	1210
11-10	1070
11-11	980
11-12	940
11-13	980

Grid Location	Areal Activity pCi/cm^2
11-14	760
11-15	710
11-16	710
11-17	1160
11-18	1430
11-19	2190
11-20	1340
11-21	3530
11-22	1740
11-23	2190
11-24	2190
11-25	1740
11-26	1560
11-27	1380
11-28	710
11-29	1250
11-30	1120
11-31	980
11-32	850
11-33	630
11-34	490
11-35	540
11-36	490

Grid Location	Areal Activity pCi/cm^2
12-2	360
12-3	490
12-4	800
12-5	1070
12-6	1380
12-7	1470
12-8	1210
12-9	980
12-10	1160
12-11	1160
12-12	1300
12-13	1430
12-14	1210
12-15	940
12-16	710
12-17	800
12-18	1070
12-19	1030
12-20	1160
12-21	1030
12-22	1300
12-23	1610
12-24	3080

Grid Location	Areal Activity pCi/cm^2
12-25	2630
12-26	980
12-27	940
12-28	940
12-29	980
12-30	670
12-31	1030
12-32	400
12-33	540
12-34	400
12-35	450
12-36	450
13-2	490
13-3	1300
13-4	850
13-5	1650
13-6	1700
13-7	1340
13-8	1030
13-9	1430
13-10	3040
13-11	1300

Grid Location	Areal Activity pCi/cm^2
13-12	1250
13-13	2590
13-14	2140
13-15	1340
13-16	1030
13-17	1430
13-18	1250
13-19	1380
13-20	1210
13-21	2590
13-22	1470
13-23	1520
13-24	2630
13-25	3480
13-26	670
13-27	710
13-28	760
13-29	890
13-30	1070
13-31	1430
13-32	490
13-33	450

Grid Location	Areal Activity pCi/cm^2
13-34	360
13-35	510
13-36	400
14-2	940
14-3	2140
14-4	3480
14-5	4420
14-6	2590
14-7	1700
14-8	2190
14-9	2630
14-10	2140
14-11	2190
14-12	2190
14-13	4870
14-14	3970
14-15	2190
14-16	2590
14-17	5310
14-18	4420
14-19	5760
14-20	3040

Grid Location	Areal Activity pCi/cm^2
14-21	2140
15-2	2140
15-3	3040
15-4	3480
15-5	4380
15-6	3040
15-7	1700
15-8	1300
15-9	2140
15-10	1610
15-11	1030
15-12	2590
15-13	1070
15-14	1250
15-15	1700
15-16	2590
15-17	2140
15-18	2140
15-19	1030
15-20	940
15-21	1160

Grid Location	Areal Activity pCi/cm^2
16-2	630
16-3	2140
16-4	3480
16-5	2590
16-6	2590
16-7	1340
16-8	1250
16-9	1210
16-10	980
16-11	800
16-12	940
16-13	1430
16-14	1520
16-15	1160
16-16	3480
16-17	1340
16-18	1120
16-19	2590
16-20	980
16-21	800
16-22	400

Grid Location	Areal Activity pCi/cm^2
16-23	580
16-24	450
16-25	400
16-26	630
17-2	670
17-3	1610
17-4	2140
17-5	3040
17-6	2140
17-7	1340
17-8	1520
17-9	2140
17-10	1600
17-11	3480
17-12	2590
17-13	1070
17-14	1700
17-15	1700
17-16	2230
17-17	980
17-18	3040

Grid Location	Areal Activity pCi/cm^2
17-19	1250
17-20	710
17-21	3480
17-22	4380
17-23	3930
17-24	3480
17-25	4380
17-26	10600
18-2	490
18-3	1250
18-4	1610
18-5	4380
18-6	2140
18-9	2140
18-10	3480
18-11	1160
18-12	2590
18-13	2590
18-14	3480
18-15	3040
18-16	4380
18-17	3930

Grid Location	Areal Activity pCi/cm^2
18-18	3480
18-19	1700
18-20	2590
18-21	3930
18-22	3480
18-23	2590
18-24	3040
18-25	3040
18-26	6160
19-2	540
19-3	1120
19-4	1700
19-5	2140
19-6	2140
19-7	3930
19-8	3040
19-9	2590
19-10	3040
19-11	1700
19-12	1610
19-13	1520
19-14	4820

Grid Location	Areal Activity pCi/cm^2
19-15	3040
19-16	4820
19-17	1430
19-18	1700
19-19	1070
19-20	1380
19-21	1070
19-22	1470
19-23	540
19-24	1650
19-25	1380
19-26	800
20-2	800
20-3	1120
20-4	2140
20-5	2590
20-6	2140
20-7	3040
20-8	3040
20-9	3480
20-10	3480
20-11	1430

Grid Location	Areal Activity pCi/cm^2
20-12	2140
20-13	1700
20-14	3040
20-15	3480
20-16	3040
20-17	3480
20-18	2140
20-19	670
20-20	1700
20-21	890
20-22	1610
20-23	760
20-24	1030
20-25	1070
20-26	3480
20-27	1030
20-28	710
20-29	850
20-30	1070
20-31	310
20-32	360
21-2	940

Grid Location	Areal Activity pCi/cm^2
21-3	3040
21-4	2590
21-5	3480
21-6	2590
21-7	3040
21-8	5270
21-9	1700
21-10	2140
21-11	7050
21-12	7050
21-13	5710
21-14	6160
21-15	4820
21-16	5710
21-17	6160
21-18	7050
21-19	2140
21-20	6160
21-21	5710
21-22	3040
21-23	1120
21-24	3040

Grid Location	Areal Activity pCi/cm^2
21-25	540
21-26	1430
21-27	1120
21-28	800
21-29	1350
21-30	2140
21-31	360
21-32	400
22-2	1030
22-3	1300
22-4	490
22-5	1470
22-6	1300
22-7	1250
22-8	2140
22-9	4380
22-10	1520
22-11	1430
22-12	1160
22-13	3480
22-14	5710
22-15	1610

Grid Location	Areal Activity pCi/cm^2
22-16	4380
22-17	2140
22-18	5270
22-19	7500
22-20	5270
22-21	3480
22-22	3480
22-23	1700
22-24	3480
22-25	2140
22-26	2140
22-27	1120
22-28	1070
22-29	1160
23-1	980
23-2	1160
23-3	2140
23-4	2140
23-5	2140
23-6	2140
23-7	1700
23-8	2590
23-9	2590

Grid Location	Areal Activity pCi/cm^2
23-10	3040
23-11	2590
23-12	2590
23-13	2590
23-14	5270
23-15	1700
23-16	3040
23-17	3040
23-18	3930
23-19	3040
23-20	2590
23-21	4820
23-22	4380
23-23	2590
23-24	2140
23-25	1700
23-26	2140
23-27	1030
23-28	1070
23-29	1250
24-1	5270
24-2	710
24-3	2140

Grid Location	Areal Activity pCi/cm^2
24-4	2140
24-5	2590
24-6	2590
24-7	2140
24-8	1700
24-9	4380
24-10	5270
24-11	3040
24-12	4380
24-13	3930
24-14	3480
24-15	5270
24-16	5270
24-17	5270
24-18	4380
24-19	5270
24-20	4380
24-21	4820
24-22	3040
24-23	3480
24-24	2590
24-25	3040
24-26	2590

Grid Location	Areal Activity pCi/cm^2
24-27	1070
24-28	1160
24-29	980
25-1	2590
25-2	2230
25-3	1700
25-4	2590
25-5	1700
25-6	2590
25-7	1700
25-8	3040
25-9	1700
25-10	2590
25-11	2140
25-12	2140
25-13	2140
25-14	2590
25-15	2590
25-16	3040
25-17	4380
25-18	3480
25-19	3480
*26-6	2830

Grid Location	Areal Activity pCi/cm^2
25-20	2140
25-21	2590
25-22	1700
25-23	3480
25-24	3480
25-25	2590
25-26	2590
25-27	1030
25-28	850
25-29	890
26-1	1160
26-2	1120
26-3	2590
26-4	2800
26-5	2800
26-7	2950
26-8	6160
26-9	3040
26-10	3040
26-11	2590
26-12	5270
26-13	3480

Grid Location	Areal Activity pCi/cm^2
26-14	3480
26-15	4820
26-16	4380
26-17	4380
26-18	7500
26-19	4820
26-20	3930
26-21	3040
26-22	3040
26-23	3930
26-24	3480
26-25	1520
26-27	1120
26-28	1070
26-29	710
27-1	1700
27-2	3930
27-3	1520
27-4	2140
27-5	2140
27-6	1700
27-7	3480

Grid Location	Areal Activity pCi/cm^2
27-8	1700
27-9	3040
27-10	1700
27-11	2140
27-12	1700
27-13	2140
27-14	2140
27-15	2590
27-16	3480
27-17	3480
27-18	3480
27-19	2590
27-20	3040
27-21	2140
27-22	1700
27-23	4380
27-24	2590
27-25	890
27-26	5270
27-27	760
27-28	850
*29-9	5630

Grid Location	Areal Activity pCi/cm^2
27-29	710
28-1	1250
28-2	2140
28-3	3400
28-4	3400
28-5	3400
28-6	3840
28-7	5180
28-8	6520
28-9	5630
28-10	4730
28-11	6520
28-12	4290
28-13	7860
28-14	9200
28-15	7410
28-16	9640
28-17	6520
28-18	2950
28-19	2050
28-20	2500

Grid Location	Areal Activity pCi/cm^2
28-21	1610
28-22	2050
28-23	4290
28-24	1250
28-25	1120
28-26	2500
29-3	2500
29-4	3940
29-5	2950
29-6	5180
29-7	6070
29-8	8750
*29-10	8750
29-11	4730
29-12	15900
29-13	11900
29-14	12300
29-15	10500
29-16	8300
29-17	11500
29-18	38400

Grid Location	Areal Activity pCi/cm^2
29-19	2050
29-20	1610
29-21	1610
29-22	1250
29-23	3390
29-24	2050
29-25	1430
29-26	4290
30-3	2050
30-4	2500
30-5	2500
30-6	2950
30-7	11400
30-8	10100
30-9	7860
30-10	7410
30-11	5630
30-12	14100
30-13	13200
30-14	14100
30-15	13200

Grid Location	Areal Activity pCi/cm^2
30-16	9200
30-17	12300
30-18	8750
30-19	2050
30-20	2500
30-21	2500
30-22	1610
30-23	3390
30-24	1070
30-25	1250
30-26	2500
31-3	7050
31-4	5710
31-5	3530
31-6	2630
31-7	12400
31-8	10600
31-9	9780
31-10	5760
31-11	4870
31-12	5760

Grid Location	Areal Activity pCi/cm^2
31-13	9330
31-14	8880
31-15	12400
31-16	8390
31-17	10600
31-18	5760
31-19	3080
31-20	4870
31-21	1740
31-22	2190
31-23	1650
31-24	1650
31-25	2630
31-26	3530
32-3	3970
32-4	2630
32-5	3080
32-6	2190
32-7	2630
32-8	3970
32-9	1610

Grid Location	Areal Activity pCi/cm^2
32-10	3080
32-11	2190
32-12	1210
32-13	2630
32-14	8440
32-15	1520
32-16	2190
32-17	3530
32-18	3530
32-19	4420
32-20	5760
32-21	3970
32-22	3080
32-23	2630
32-24	800
32-25	1250
32-26	3080
33-3	3970
33-4	1740
33-5	3080
33-6	4870
33-7	3970
33-8	3970

Grid Location	Areal Activity pCi/cm^2
33-9	2630
33-10	5760
33-11	4870
33-12	2190
33-13	4870
33-14	3530
33-15	2630
33-16	3530
33-17	5310
33-18	3970
33-19	5760
33-20	4870
33-21	2630
33-22	2190
33-23	1700
33-24	1520
33-25	1120
33-26	2630
35-3	5710
35-5	1030
35-6	800
35-7	1520
35-8	1700

Grid Location	Areal Activity pCi/cm^2
35-9	1250
35-10	1700
35-11	1160
35-12	980
35-13	760
35-14	800
35-15	890
35-16	980
35-17	6610
35-18	6160
35-19	5270
35-20	4380
35-21	3040
35-22	3040
35-23	2140
35-24	2140
36-3	1520
36-4	940
36-5	800
36-6	890
36-7	3040
36-8	3480
36-9	2140

Grid Location	Areal Activity pCi/cm^2
36-10	1210
36-11	1030
36-12	980
36-13	800
36-14	940
36-15	1030
36-16	1070
36-17	2634
36-18	2190
36-19	2190
36-20	1300
36-21	1070
36-22	940
36-23	890
37-3	800
37-4	760
37-5	1610
37-6	3480
37-7	6160
37-8	5270
37-9	4420
37-10	4820

Grid Location	Areal Activity pCi/cm^2
37-11	3970
37-12	5310
37-13	3970
37-14	5310
37-15	4420
37-16	3080
37-17	3530
37-18	3530
37-19	2630
37-20	1300
37-21	800
37-22	710
38-3	760
38-4	580
38-5	710
38-6	1070
38-7	4020
38-8	3930
38-9	2590
38-10	2140
38-11	1160
38-12	630

Grid Location	Areal Activity pCi/cm^2
38-13	980
38-14	980
38-15	1070
38-16	1700
38-17	5310
38-18	4870
38-19	3970
38-20	1740
39-3	490
39-4	760
39-5	890
39-6	1610
39-7	4820
39-8	4380
39-9	3040
39-10	2140
39-11	1250
39-12	1610
39-13	1160
39-14	1120
39-15	1610
39-16	2590

Grid Location	Areal Activity pCi/cm^2
39-17	5310
39-18	4420
39-19	4420
40-3	760
40-4	800
40-5	1520
40-6	1560
40-7	3040
40-8	3480
40-9	2590
40-10	2140
40-11	1700
40-12	2190
40-13	3080
40-14	3530
40-15	3480
40-16	3930
40-17	5270
40-18	5270
41-3	630
41-4	670

Grid Location	Areal Activity pCi/cm^2
41-5	1340
41-6	2140
41-7	3040
41-8	3480
41-9	2590
41-10	2140
41-11	1700
41-12	1160
41-13	940
41-14	2630
41-15	1520
41-16	<100
42-3	400
42-4	450
42-5	890
42-6	1430
42-7	2190
42-8	2630
42-9	2630
42-10	1470
42-11	1160

Grid Location	Areal Activity pCi/cm^2
42-12	1070
42-13	850
42-14	540
42-15	710
43-3	490
43-4	450
43-5	760
43-6	1070
43-7	1250
43-8	2200
43-9	1340
43-10	1380
43-11	1070
43-12	540
43-13	800
44-3	450
44-4	540
44-5	850
44-6	890
44-7	980
44-8	670

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

HAZARD ASSESSMENT FOR RADIOACTIVE CONTAMINATION ON THE ROOF OF THE COMMERCIAL BUILDING AT 1104 CENTRAL AVENUE IN COLONIE, NEW YORK

Colonie, New York

May 1989

Bechtel National, Inc.

0989-0557.1

HAZARD ASSESSMENT FOR RADIOACTIVE CONTAMINATION ON THE ROOF OF THE COMMERCIAL BUILDING AT 1104 CENTRAL AVENUE IN COLONIE, NEW YORK

MAY 1989

Prepared for

UNITED STATES DEPARTMENT OF ENERGY

OAK RIDGE OPERATIONS OFFICE

Under Contract No. DE-AC05-81OR20722

By

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Oak Ridge, Tennessee

Bechtel Job No. 14501

EXECUTIVE SUMMARY

To assess the hazards associated with exposure to the contamination on the roof of the CISS vicinity property building at 1104 Central Avenue, Albany, New York, three exposure scenarios were quantitatively evaluated. The three scenarios that were evaluated are (1) the exposure to a roofer repairing the building's roof, (2) the exposure to an office worker working a 60-hour week inside the building, and (3) the exposure to a resident living on-site who raises all of his vegetables, grain, and fruit in a garden with contaminated soil. These three scenarios were selected because they cover the most realistic as well as the very unlikely but plausible exposure scenarios given the current use of the site.

Based on very conservative assumptions, the maximum whole-body dose calculated for a worker on the roof is 0.35 mrem/yr. Approximately 75 percent (0.26 mrem/yr) of the whole-body dose results from exposure to external gamma radiation, and the remaining 25 percent (0.09 mrem/yr) would result from the inhalation of contaminated dust particles. This total dose is less than 1 percent of the DOE radiation protection standard for the general public of 100 mrem/yr.

The maximum whole-body dose calculated for a person working 60 hours a week inside the building was 6 mrem/yr, or 6 percent of the DOE radiation protection standard for the general public. This total body dose would result exclusively from external gamma exposure.

For an on-site resident who raises all of his vegetables, fruit, and grain in garden soil mixed with contaminated roof material, the maximum whole-body dose would be 2.1 mrem/yr from the ingestion pathway, which is approximately 2 percent of the DOE radiation protection standard for the general public.

Based on the estimated dose calculated for these three scenarios, the roof of the building at 1104 Central Avenue meets the DOE guidelines, and the use of the building is acceptable without radiological restrictions.

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1.0 INTRODUCTION AND SUMMARY

1.1 OBJECTIVE AND SCOPE

This report describes the methodology used to perform an assessment of the hazards associated with a radioactively contaminated roof at a vicinity property near the Colonie Interim Storage Site (CISS) in Colonie, New York (Figure 1-1). Results of the hazard assessment are also described. Remedial action protocols established by the Department of Energy (DOE) permit use, without radiological restrictions, of a property if it can be shown that the basic dose limit of 100 mrem/yr is not exceeded at the property. This hazard assessment was performed to determine whether the dose resulting from exposure to radioactive materials on the roof of the building at 1104 Central Avenue in Colonie, New York, is within the basic annual dose limit established by DOE and, as such, whether the property is in compliance with the supplemental limit provisions of the guidelines.

1.2 BACKGROUND

Between 1958 and 1984, the National Lead (NL) Industries plant in Colonie, New York, performed various casting, machining, and milling operations on uranium. The plant processed primarily depleted uranium metal. The excess uranium metal was oxidized to reduce the potential for a uranium fire. The oxidation was performed in a small furnace called a chip burner. These operations resulted in the release of small quantities of uranium oxide dust to the atmosphere through exhaust ventilation. The uranium oxide dust was dispersed in the atmosphere and contaminated both residential and commercial properties in the area with low levels of uranium.

In 1980, the State of New York ordered the plant to reduce its level of production because an excessive amount of uranium oxide dust was being released into the air, and in the spring of 1984 operations were halted. DOE then took possession of the plant, as mandated by Congress, to begin the decontamination process as part of the

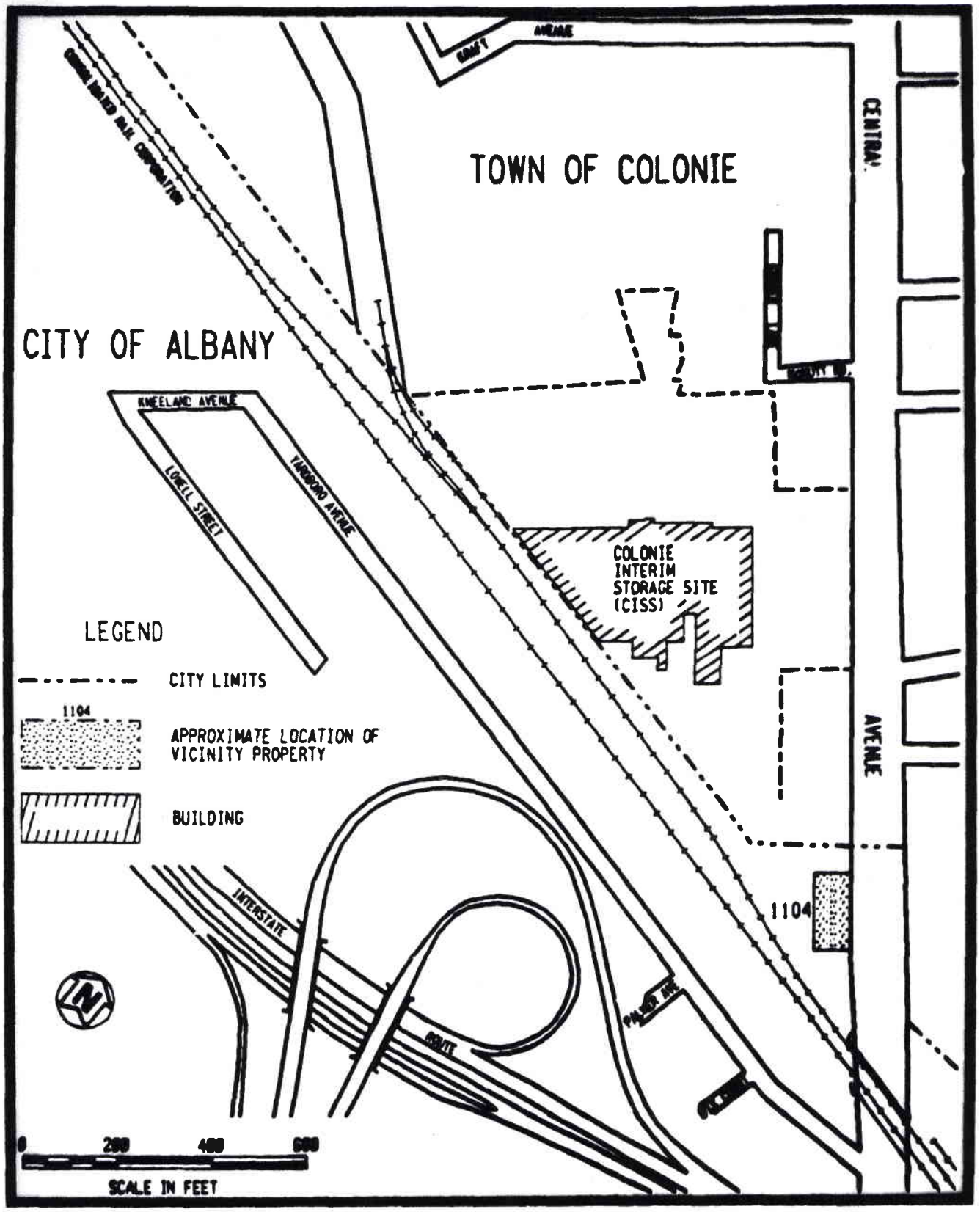

FIGURE 1-1 LOCATIONS OF THE CISS AND ITS VICINITY PROPERTY AT 1104 CENTRAL AVENUE, COLONIE, NEW YORK

Formerly Utilized Sites Remedial Action Program (FUSRAP). FUSRAP is a DOE effort to identify, decontaminate, or otherwise control sites where residual contamination (exceeding current guidelines) remains from the early days of the nation's atomic energy program. Although the contamination at the properties around the CISS did not result from the atomic energy program, it was included as part of FUSRAP by DOE after Congress gave responsibility for the site to DOE under the 1984 Energy and Water Appropriations Act. This act was reauthorized in 1985. FUSRAP is currently being managed by DOE's Oak Ridge Operations office. As project management contractor for FUSRAP, Bechtel National, Inc., (BNI) is responsible to DOE for the planning, management, and implementation of FUSRAP.

When operations at the former NL plant were terminated in the spring of 1984, the source of contamination on vicinity property roofs was eliminated. The subsequent effects of weather have stabilized the deposited contaminant, and radiation levels have, therefore, remained relatively constant. This condition could change, however, as the result of human activities (e.g., reroofing). Based on discussions with New York State officials, DOE agreed to remediate the soils on the vicinity properties to a uranium concentration of 35 pCi/g (Refs. 1 and 2). The DOE guidelines for surface contamination were adapted from Nuclear Regulatory Commission guidelines for the release of facilities without radiological restrictions (Ref. 3). These guidelines were also approved by the State of New York. Results of post-remedial action sampling at the designated properties indicate that the grounds around the building meet DOE guidelines and that the use of the grounds without radiological restrictions is acceptable.

2.0 DESCRIPTION AND STATUS OF VICINITY PROPERTY AT 1104 CENTRAL AVENUE

2.1 DESCRIPTION OF VICINITY PROPERTY

The building on the commercial property at 1104 Central Avenue in Colonie, New York, is a one-story, flat-roofed brick structure. The building is trapezoidal and measures approximately 21 m (68 ft) on the northeast side, 26 m (85 ft) on the southeast side, 25 m (83 ft) on the southwest side, and 41 m (135 ft) on the northwest side. A diagram of the property is shown in Figure 2-1. A radiological survey of the 695-m^2 (7,480-ft^2) tar roof was conducted by Oak Ridge National Laboratory (ORNL) in 1985 (Ref. 4).

2.2 CURRENT RADIOLOGICAL STATUS OF THE ROOF OVER VICINITY PROPERTY BUILDING

The description of the current radiological status of the roof of the commercial vicinity property evaluated in this hazard assessment is based on the results of surveys conducted by ORNL.

Because the termination of NL plant operations in 1984 eliminated the source of roof contamination, it is probable that weather conditions such as rain, wind, and snow have reduced roof contamination and stabilized it at a level below which further reduction is not expected to occur as the result of natural causes.

Alpha and beta-gamma activity levels were measured at selected locations on the roof of the building at 1104 Central Avenue. The fixed surface alpha activity ranged from 30 to 100 dpm/100 cm^2, with an average of 46 dpm/100 cm^2. The beta-gamma activity measured at 1 cm (0.39 in.) above the surface ranged from 0.04 to 2.2 mR/h, with an average of 0.34 mR/h, including a natural background radiation level of approximately 0.004 mR/h (Ref. 4).

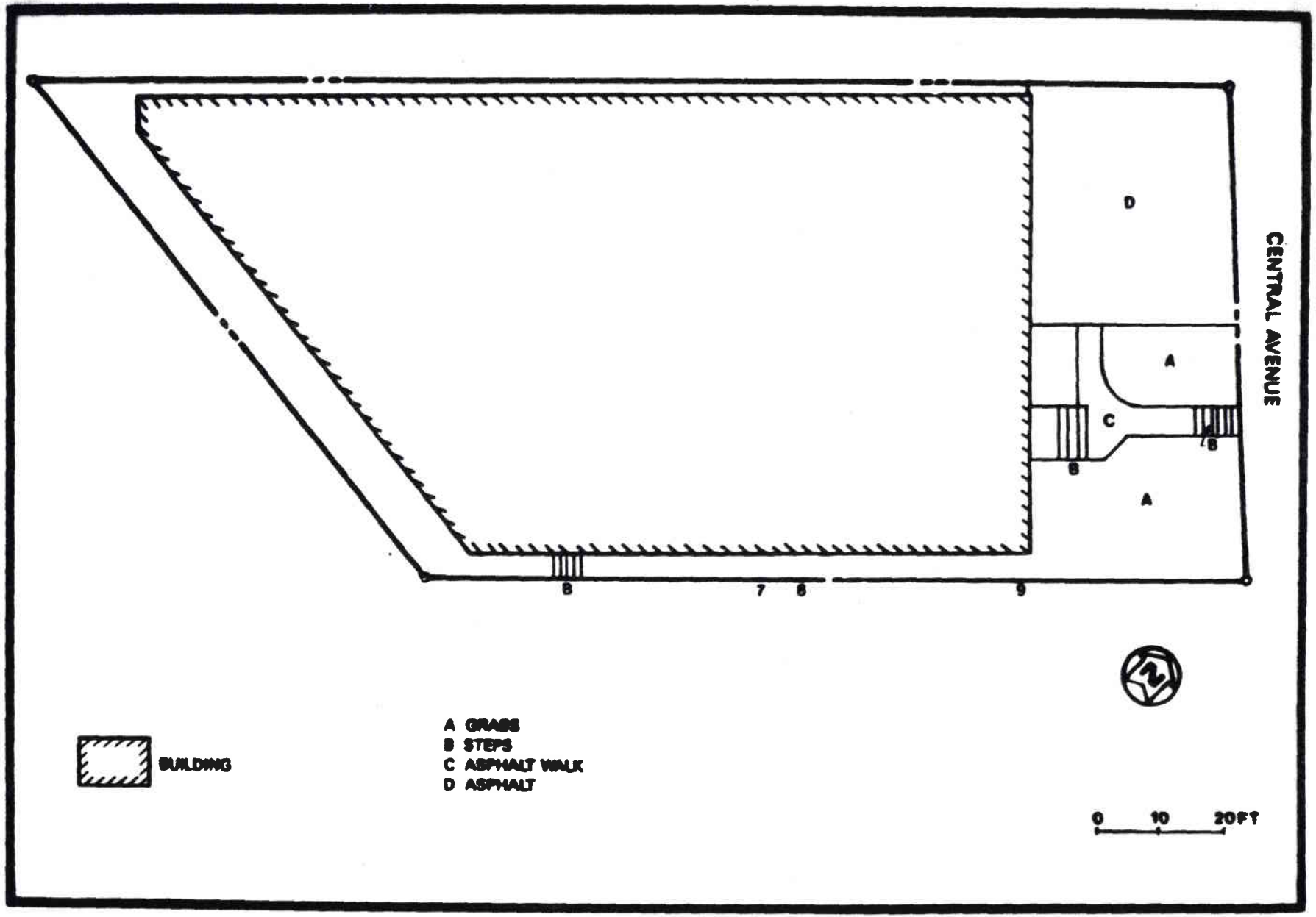

FIGURE 2-1 1104 CENTRAL AVENUE

The average fixed alpha activity of 46 dpm/100 cm^2 is within the DOE guideline of 5,000 dpm/100 cm^2 of fixed alpha activity for uranium on structure surfaces. The average beta-gamma activity of 0.34 mR/h exceeds the DOE guideline of 0.20 mR/h (Ref. 3). The maximum beta-gamma reading of 2.2 mR/h also exceeds the DOE guideline of 1.0 mR/h for maximum beta-gamma activity (Ref. 3).

3.0 RADIOLOGICAL ASSESSMENT

The potential doses to members of the general public that could result from exposure to the contaminated tar roof of the commercial structure at 1104 Central Avenue were calculated by evaluating the following possible exposure pathways: (1) external beta and gamma irradiation, (2) inhalation of resuspended radioactive dust particles, and (3) ingestion of contamination from removed roofing material, assuming that the roofing material has been mixed with soil that is used for gardening.

Three scenarios were selected to examine potential on-site exposures from the contaminated roof of the building at 1104 Central Avenue. The three scenarios evaluated are (1) the exposure to a roofer repairing the roof, (2) the exposure to an office worker working inside the structure at 1104 Central Avenue full time, and (3) the exposure to a resident that lives on-site and obtains all of his fruit and vegetables from a garden containing the contaminated roofing material. The first two scenarios are realistic scenarios and very conservative assumptions have been made. The third scenario is considered to be very unlikely and, again, conservative assumptions have been used. These three scenarios are described in detail below. The assumptions and parameters used in calculating the dose estimates not given below are described in Appendix A.

3.1 SCENARIO 1: ROOFER

3.1.1 Assumptions

It was assumed that a roofer engaged in repairing the contaminated roof at the 1104 Central Avenue location in Colonie, New York, would be exposed to two pathways of exposure: external gamma radiation and inhalation of airborne contaminated particles released during the roofing activities. Assumptions used in estimating the potential dose to the roofer are given below.

The methodology and parameters used in calculating internal dose are discussed in detail in the DOE supplemental A Manual for Implementing Residual Radioactive Material Guidelines (Ref. 5). Dose conversion factors used in the DOE supplement are based on data for an adult in the International Commission on Radiological Protection (ICRP) Publication 30 (Ref. 6).

The likelihood is minimal that radionuclides in materials fixed in tar on a roof surface would become resuspended in air. However, to calculate the maximum potential dose from this exposure pathway, the uranium concentration in the air can be estimated by multiplying the average concentration of uranium in the roofing material by a mass loading factor for the area. The Environmental Protection Agency (EPA) has indicated that data from the National Air Surveillance Network suggest annual mean mass concentrations of 0.05×10^{-4} to 0.5×10^{-4} g/m^3 for the country as a whole, and a mean mass concentration of approximately 0.05×10^{-4} g/m^3 for the Albany area (Ref. 7). To calculate the dose from this pathway, a conservative mean mass concentration of 1×10^{-4} g/m^3 is assumed for the period during which the worker is engaged in reroofing activities.

An inhalation rate of 8,400 m^3/yr (109,872 yd^3/yr) for an adult male is assumed (Ref. 5). Other parameters and details of the methodology used to calculate potential doses are included in Appendix A.

Actual radionuclide concentrations in the roofing material (expressed in pCi/g) were not measured. Measurement of beta-gamma activity was considered to be the most accurate way of determining uranium concentration in the roofing material, since most of the alpha activity of the uranium that migrated into the tar would likely be shielded from measurement. The concentrations reported in Table 3-1 were calculated by converting the measured total beta-gamma activity (mR/h) values in Table 3-2 to pCi/g. This

TABLE 3-1

SOURCE TERMS: RADIONUCLIDE CONCENTRATIONS IN ROOFING MATERIAL AT 1104 CENTRAL AVENUE, COLONIE, NEW YORK[a]

Radionuclide	Concentration (pCi/g)
Uranium-238	151
Uranium-235	2
Uranium-234	45

[a]Radionuclide concentrations are calculated based on measured gross beta-gamma activity (dpm/100 cm^2) for depleted uranium and on a density of 1.28 g/cm^3 for tar material.

TABLE 3-2

SOURCE TERMS: ALPHA ACTIVITY AND EXTERNAL BETA-GAMMA LEVELS MEASURED ON ROOF AT 1104 CENTRAL AVENUE, COLONIE, NEW YORK[a]

Number of Measurements	Average Alpha Activity (dpm/100 cm^2)	Average Beta-Gamma Level (mR/h taken at 1 cm)
6	46	--
16	--	0.34

[a]Surface measurements made at the site.

Source: Reference 4.

conversion procedure is explained and demonstrated in Appendix A. The calculated radionuclide concentration in the roofing material is based on isotopic analysis for depleted uranium.

The dose resulting from exposure to external gamma radiation was calculated based on the method detailed in the supplement to the DOE guidelines (Ref. 5). The external gamma radiation exposure is estimated based on actual beta-gamma survey measurements made at 1 cm (0.39 in.) above the surface of the roof (Table 3-2) (Ref. 4). Gamma radiation exposure rates at 1 cm (0.39 in.) from the roof surfaces were calculated based on field measurements of a depleted uranium source with a geometry that approximates an infinitely thick source (Ref. 8). The beta-gamma dose rate from this source averaged 240 mrad/h, and the dose rate from the gamma radiation was approximately 5 mrad/h.

Gamma radiation dose rates at 1 m (3.28 ft) were not measured and were conservatively assumed to be the same as those at 1 cm (0.39 in.). The measured beta-gamma dose rates are shown in Table 3-2; the gamma rates calculated for the roof surfaces are shown in Table 3-3. A factor of 0.95 mrem/mR was used for direct conversion of measured exposure in mR/yr to the effective dose equivalent in mrem/yr (Ref. 5).

TABLE 3-3

SOURCE TERMS: EXTERNAL EXPOSURE TO A ROOFER AND AN OFFICE WORKER AT 1104 CENTRAL AVENUE, COLONIE, NEW YORK

Beta-Gamma Roof[a] (mR/h)	Gamma Roof[b] (mR/h)	Gamma Work Level[c] (mR/h)
0.34	6.8×10^{-3}	1.7×10^{-3}

[a]Surface radiation levels measured on roof.

[b]Gamma exposure rates calculated based on ratio of beta to gamma in depleted uranium (2 percent of beta-gamma level at surface is due to gamma).

[c]Gamma exposure rates at working levels inside the building calculated assuming that the air and roofing material could be expected to attenuate 75 percent of the gamma rays.

3.1.2 Internal Exposure to a Roofer From Inhalation of Airborne Depleted Uranium

It was assumed that whi'e repairing the roof at 1104 Central Avenue in Colonie, New York, a roofer would be exposed to airborne depleted uranium during any cutting or removal operations. The exposure of the roofer is likely to be less than a week and would generally be limited to working hours. As a worst-case scenario, it was assumed that this type of operation would be conducted over a period of 40 hours without respiratory equipment. Thus, an occupancy factor (OF) of 4.6×10^{-3} (40 E 8,760) was assumed.

A committed effective dose equivalent of 9.3×10^{-2} mrem was estimated for internal exposure during roof repair work at 1104 Central Avenue. Thus, even if this unlikely scenario were to occur, the estimated internal exposure that would be received at this property from inhalation of resuspended contaminated dust would be very low.

3.1.3 Dose Resulting From External Exposure During Roof Repair

In evaluating the maximum potential external exposure to a roofer from contamination on the roof, it was conservatively assumed that a roofer would spend 40 hours repairing the roof at 1104 Central Avenue. Based on the highest external gamma exposure rate of 6.8×10^{-3} mR/h calculated for the 1104 Central Avenue structure (Table 3-3), an annual whole-body dose of 0.26 mrem would be received by the roofer. He could receive an additional exposure of 11 mrem/yr to the skin or to extremities if he were to maintain constant skin contact with the surface beta-gamma activity during reroofing operations. The values shown in Table 3-3 represent the exposures from external radiation at the structures surveyed. The calculated maximum potential dose of 0.26 mrem resulting from exposure to external gamma radiation is only 0.26 percent of the DOE

radiation protection standard of 100 mrem/yr (Ref. 3). At the current time the DOE has not developed a radiation protection standard for the general public for exposure to skin. However, the calculated maximum potential external beta exposure to the skin of 11 mrem/yr is only 0.02 percent of the 50,000 mrem/yr occupational exposure standard established by DOE (Ref. 9).

3.1.4 Summary of Dose to Roofer

The total estimated dose to a roofer during repair of the roof at 1104 Central Avenue in Colonie is approximately 0.35 mrem/yr, well below the DOE standard of 100 mrem/yr. Approximately 75 percent would result from the external gamma radiation dose; 25 percent would result from the internal dose through the inhalation pathway.

3.2 SCENARIO 2: WORKER INSIDE THE BUILDING

3.2.1 Assumptions

For the second scenario, it was assumed that a worker inside the building would be exposed only to external gamma radiation from the contaminated roof. Assumptions for estimating the potential dose to the worker inside the building are given below.

In determining the dose rate due to the roofing material, the same assumptions as were made in Scenario 1 were also used in evaluating Scenario 2. The gamma exposure rates are given in Table 3-3.

No beta-gamma radiation surveys were made inside the commercial structures. To estimate the potential dose resulting from external gamma radiation exposure to an office worker spending 3,000 h/yr (60 h/wk, 50 wk/yr) inside the building, the gamma radiation exposure rate was calculated based on conservative shielding estimates for the low-energy gamma radiation emitted by depleted uranium. The calculations in Section IV of Appendix A show that air and roofing material could be expected to attenuate roughly 75 percent of the gamma radiation.

3.2.2 External Exposure to an Office Worker From Roof Contamination

Assuming that the occupancy factor for a person working in the building is the exposure rate 1.7×10^{-3} mR/h at the work location, the resulting exposure would be an annual dose of 6 mrem (Table 3-3).

This dose is well below the DOE radiation protection standard of 100 mrem/yr and is approximately 9.5 percent of the natural beta-gamma background of 63 mrem/yr for the Albany, New York, area (Ref. 10).

3.3 SCENARIO 3: ON-SITE RESIDENT

For the on-site resident scenario, there are two possible cases. The first case is that the resident occupies the building with the contaminated roof that is presently on-site. If the first case is used, the exposure due to the contamination would be calculated in a manner similar to Scenario 2. However, the occupancy factor would be approximately double that given for Scenario 2. Since the building is a large industrial structure, the assumption that the building would become a permanent residence is very unlikely.

The other possible case is that the roof is removed from the structure and contaminated material is buried on-site, becoming mixed with clean soil. Scenario 3 assumes that the contaminated soil is used in a garden and that all of the resident's grain, fruit, and vegetables are produced in the garden. This scenario, while still unlikely, represents a very conservative estimate of the dose that could result from the ingestion pathway. This case will be developed for Scenario 3.

3.3.1 Assumptions

For Scenario 3, it was assumed that the on-site resident would be exposed only to internal radiation from the ingestion of grains, fruits, and vegetables grown in contaminated soil. The assumptions for estimating the potential dose to an on-site resident are given below.

The methodology and parameters used in calculating internal dose are discussed in detail in the DOE supplemental A Manual for Implementing Residual Radioactive Material Guidelines (Ref. 5). Dose conversion factors used in the DOE supplement are based on data for an adult in the International Commission on Radiological Protection (ICRP) Publication 30 (Ref. 6).

Actual radionuclide concentrations in the roofing material (expressed in pCi/g) were not measured. Measurement of beta-gamma activity was considered to be the most accurate way of determining uranium concentration in the roofing material, since most of the alpha activity of the uranium that migrated into the tar would likely be shielded from measurement. The concentrations reported in Table 3-1 were calculated by converting the measured total beta-gamma activity (mR/h) values in Table 3-2 to pCi/g. This conversion procedure is explained and demonstrated in Appendix A. The calculated radionuclide concentration in the roofing material is based on isotopic analysis for depleted uranium.

The dilution factor of 10 was obtained by assuming the entire roof surface, approximately 695 m^2 (2,480 ft^2), is contaminated and that the thickness of the contaminated tar is 1 cm (0.39 in.). Thus, if the total volume of contaminated material was uniformly mixed with the soil from a 25 x 20 m garden to a depth of 15 cm (6 in.) [total volume of soil = 75 m^3 (98.1 yd^3)], a dilution of the contaminant concentration by approximately a factor of 10 would occur.

Most ingestion pathways associated with the contaminated roof are unrealistic because the contamination is fixed in place in the roofing material and the uranium oxide is fairly insoluble. This eliminates all foreseeable ingestion pathways as long as the material remains fixed in place on the roof. Removal of the roofing material still would not provide any significant pathways for exposure via ingestion. Much of the uranium would remain fixed in the roofing material and would, therefore, not be available for migration and uptake. Furthermore, the uranium oxide from the incineration of uranium metal is extremely insoluble, further reducing potential uptake.

3.3.2 Internal Exposure From Ingestion

If the equivalent of the average radionuclide concentration in roofing material, calculated on the basis of direct radiation measurements, is diluted with topsoil, the potential internal exposure from ingestion of vegetables, fruit, and grain grown in the soil would be only 2.1 mrem/yr effective dose equivalent. This calculation is conservatively based on the assumption that all the vegetables, fruit, and grain consumed (estimated at 160 kg/yr) are produced from the contaminated soil (Ref. 5).

This dose is approximately 2 percent of the DOE radiation protection standards.

4.0 SUMMARY AND CONCLUSIONS

Of the assessed scenarios, the highest estimated potential dose from exposure to the contaminated roof of the commercial structure at 1104 Central Avenue would be received by a worker inside the building. The only pathway of exposure to this worker would be the gamma radiation emanating from the roof surface. This maximum calculated potential total dose of 6 mrem/yr is approximately 6 percent of the DOE radiation protection standard of 100 mrem/yr (Ref. 3). For comparison purposes, a person living in a brick house (based on occupancy 75 percent of the time) would receive a dose of approximately 45 mrem/yr (Ref. 10).

The maximum calculated potential dose to a roofer engaged in repairing the roof at the 1104 Central Avenue building is 0.4 mrem/yr, resulting primarily (75 percent) from exposure to external gamma radiation, as shown in Scenario 1. Exposure via the inhalation pathway would contribute approximately 25 percent of the dose. The total dose is only 0.4 percent of the DOE limit of 100 mrem/yr. The greatest potential exposure of 11 mrem/yr to the skin, which would be received by the roofer only in the event of 40 hours of continuous skin contact with surface beta-gamma radiation, is only approximately 0.02 percent of the 50,000-mrem/yr DOE radiation protection standard for occupational exposure for the skin (Ref. 9).

As described in Scenario 3, the likelihood of internal exposure resulting from ingestion of contaminated roofing material is minimal. However, even if this scenario should occur, an internal exposure of only 2.1 mrem/yr (approximately 2 percent of the DOE radiation protection standard) would result, based on the assumptions in subsection 3.4.2.

Each of these scenarios for all potential exposure pathways results in a dose that is well below the DOE radiation protection standard limiting the annual dose to an individual of the general public to 100 mrem.

REFERENCES

1. Letter, W. J. Condon, Bureau of Environmental Radiation Protection, New York Department of Health, to L. Campbell, Oak Ridge Operations Office, Department of Energy, CCN 17492, February 22, 1984.

2 Letter, E. G. Delaney, Office of Nuclear Energy, Department of Energy, to R. Guimond, Criteria and Standards Division, Environmental Protection Agency, CCN 18873, April 30, 1984.

3. U.S. Department of Energy. U.S. Department of Energy Guidelines for Residual Radioactivity at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites, Revision 2, Washington, DC, March 1987.

4. Marley, J. L., Berven, B. A., and Cottrell, W. D. Results of the Radiological Survey at 1104 Central Avenue, Colonie, New York (AL042), ORNL/RASA-84/294, Oak Ridge National Laboratory, July 1985.

5. Gilbert, T. L., et al. A Manual for Implementing Residual Radioactive Material Guidelines, Washington, DC, January 1988 (In Press). A Supplement to U.S. Department of Energy Guidelines for Residual Radioactivity at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites.

6. International Commission on Radiological Protection. Limits for Intakes of Radionuclides by Workers, A Report of Committee 2 of the International Commission on Radiological Protection, ICRP Publication 30, 1978.

7. Environmental Protection Agency. Proposed Guidance on Dose Limits for Persons Exposed to Transuranic Elements in the General Environment, EPA 520/4-77-016, September 1977.

8. Memorandum, R. C. Robertson, Bechtel National, Inc., to E. M. McNamee, Bechtel National, Inc., CCN 060272, March 29, 1989.

9. U.S. Department of Energy. Order 5480.1B, "Environmental, Safety, and Health Program for Department of Energy (DOE) Operations, Attachment 1, Order 5480.11, Requirements for Radiation Protection," Washington, DC, September 23, 1986.

10. Bechtel National, Inc. Colonie Interim Storage Site Annual Site Environmental Report, Colonie, New York, Calendar Year 1987, Appendix D, DOE/OR/20722-146, April 1988.

APPENDIX A

DOSE CALCULATION: PARAMETERS AND METHODOLOGY

APPENDIX A

DOSE CALCULATION: PARAMETERS AND METHODOLOGY

I. INTERNAL DOSE

A. Parameters used in calculating internal dose (committed effective dose equivalent) via inhalation and ingestion pathways

Parameter	Unit or Definition
Inhalation rate (Ref. A-1)	8,400 m^3/yr
Mass loading factor	1×10^{-4} g/m^3
Occupancy factor	(Fraction of year spent in area)
Ingestion rate (vegetables, fruit, and grain) (Ref. A-1)	1.6×10^5 g/yr
Density of tar roof material (Ref. A-2)	1.28 g/cm^3
Concentration Factor for Uranium in Plants (B_{iv})* (Ref. A-1)	2.5×10^{-3}

*B_{iv} is the ratio of the radionuclide concentration in edible portions of the plant to the concentration in the dry soil (both in the same units) at the time of harvest.

	Dose Conversion Factors*			
Radionuclide	Ingestion (mrem/pCi)	f_1	Inhalation (mrem/pCi)	Lung Class
Uranium-238	2.55×10^{-4}	5×10^{-2}	1.18×10^{-1}	Y
Uranium-235	2.66×10^{-4}	5×10^{-2}	1.23×10^{-1}	Y
Uranium-234	2.83×10^{-4}	5×10^{-2}	1.32×10^{-1}	Y

*Dose conversion factors are for the adult. The fraction of a stable element entering the gastrointestinal tract that reaches bodily fluids is represented by f_1. Lung class for clearance of inhaled radioactive materials from the lung: Y corresponds to a retention half-time of greater than 100 days.

B. Methodology for calculating inhalation dose (Ref. A-1)

Dose (mrem/yr) = [concentration of radionuclide in tar (pCi/g)] [mass loading factor (g/m^3)] [occupancy factor] [inhalation rate (m^3/yr)] [dose conversion factor (mrem/pCi)]

C. Methodology for calculating ingestion dose (Ref. A-1)

Dose (mrem/yr) = [concentration of radionuclide in soil (pCi/g)] [concentration factor for plants (B_{iv})] [vegetable, fruit, and grain intake (g/yr)] [dose conversion factor (mrem/pCi)]

II. EXTERNAL GAMMA DOSE

A. Parameters used in calculating external gamma dose (effective dose equivalent) (Ref. A-1)

Parameter	Unit or Definition
Dose conversion factor (converts exposure in mR to effective dose equivalent in mrem)	0.95 mrem/mR
Depth factor	1
Area factor	1
Occupancy factor	(average fraction of year spent in area)

B. Methodology for calculating external gamma dose from estimated gamma exposure rate (Ref. A-1)

Dose (mrem/yr) = [estimated gamma exposure at 1 m (mR/h)] [0.95 (dose conversion factor)] [occupancy factor (h/yr)]

III. CONVERSION OF MEASURED BETA-GAMMA ACTIVITY (mrad/h) TO ESTIMATED URANIUM CONCENTRATION (pCi/g):

A. Since the beta-gamma activity is due largely to the beta radiation from Pa-234m, a dose conversion factor of 3.17×10^{-3} Sv/yr/Bq/cm^2 is used in the conversion (Ref. A-4).

Example:

$$\left[\frac{0.34\ \text{mrad}}{\text{h}}\right] \left[\frac{1\ \text{Bq/cm}^2}{3.17\times10^{-3}\ \text{Sv/yr}}\right] \left[\frac{\text{Sv}}{\text{Gy}}\right] \left[\frac{1\ \text{Gy}}{10^5\ \text{mrad}}\right] \left[\frac{8760\ \text{h}}{\text{yr}}\right] \left[\frac{60\ \text{dpm}}{\text{Bq}}\right]$$

$$= 564\ \text{dpm/cm}^2$$

B. Total calculated concentration of depleted uranium in roofing material (Ref. A-2)

$$\text{Concentration (pCi/g)} = \left[564\ \text{dpm/cm}^2\right] \left[\frac{1}{2.22\ \text{dpm/pCi}}\right]$$

$$\left[\frac{1}{1\ \text{cm (depth)}}\right] \left[\frac{1}{1.28\ \text{g/cm}^3\ \text{(density of roofing material)}}\right]$$

$$= 198\ \text{pCi/g}$$

C. Depleted Uranium

Radionuclide	% of Atom	Specific Activity (Ci/g)	Total Activity (Ci/g)	% of Activity in 1 Ci of Depleted U
Uranium-238	99.79	3.3×10^{-7}	3.3×10^{-7}	76.27
Uranium-235	0.208	2.1×10^{-6}	4.5×10^{-9}	1.02
Uranium-234	0.0016	6.2×10^{-3}	9.9×10^{-8}	22.71
			4.4×10^{-7}	

IV. SHIELDING CALCULATIONS FOR DOSE TO OCCUPANT FROM EXPOSURE TO CONTAMINATION ON ROOF

Assume following shielding components:

Component	Thickness(t)(in.)	$\mu(cm^2/g)$*	$\rho(g/cm^3)$(Ref. A-2)
roofing (tar)	0.25	0.161 (carbon)	1.28
decking (wood)	0.5	0.161 (carbon)	0.6
attic air space	10.0	0.167 (air)	0.001293
ceiling (sheetrock)	0.5	0.365 (calcium)	2.31
air space in room	60.0	0.167 (air)	0.001293

$$I = I_o e^{-\sum \mu \rho t}$$

$$I = I_o(0.26)$$

*Assumes 80 keV average gamma energy since the majority of gamma radiation is due to thorium-234 decay (63 and 93 keV gamma rays)

REFERENCES FOR APPENDIX A

A-1. Gilbert, T. L., et al. A Manual for Implementing Residual Radioactive Material Guidelines, Washington, DC, January 1988 (In press). A Supplement to U.S. Department of Energy Guidelines for Residual Radioactivity at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites.

A-2. The Chemical Rubber Co. Handbook of Chemistry and Physics, 54th Edition, Robert C. Weast, editor, Cleveland, Ohio: CRC Press, 1973-1974.

A-3. International Commission on Radiological Protection. Limits for Intakes of Radionuclides by Workers, A Report of Committee 2 of the International Commission on Radiological Protection, ICRP Publ. 30, 1978.

A-4. Kocher, D. C., Oak Ridge National Laboratory, "Dose-Rate Conversion Factors for External Exposure to Photons and Electrons," NUREG/CR-1918, August 1981.

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

HAZARD ASSESSMENT FOR RADIOACTIVE CONTAMINATION ON THE ROOF OF THE COMMERCIAL BUILDING AT 50 YARDBORO AVENUE IN COLONIE, NEW YORK

Colonie, New York

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MAY 1989

Prepared for

UNITED STATES DEPARTMENT OF ENERGY

OAK RIDGE OPERATIONS OFFICE

Under Contract No. DE-AC05-81OR20722

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EXECUTIVE SUMMARY

To assess the hazards associated with exposure to the contamination on the roof of the CISS vicinity property building at 50 Yardboro Avenue, Colonie, New York, three exposure scenarios were quantitatively evaluated. The three scenarios that were evaluated are (1) the exposure to a roofer repairing the building's roof, (2) the exposure to an office worker working a 60-hour work week inside the building, and (3) the exposure to a resident living on-site who raises all of his vegetables, grain, and fruit in a garden with contaminated soil. These three scenarios were selected because they cover the most realistic as well as the very unlikely but plausible exposure scenarios given the current use of the site.

Based on very conservative assumptions, the maximum whole-body dose calculated for a worker on the roof is 0.2 mrem/yr. Approximately 75 percent (0.15 mrem/yr) of the whole-body dose results from exposure to external gamma radiation, and the remaining 25 percent (0.05 mrem/yr) would result from the inhalation of contaminated dust particles. This total dose is less than 1 percent of the DOE radiation protection standard for the general public of 100 mrem/yr.

The maximum whole-body dose calculated for a person working 60 hours a week inside the building was 4 mrem/yr, or 4 percent of the DOE radiation protection standard for the general public. This total body dose would result exclusively from external gamma exposure.

For an on-site resident who raises all of his vegetables, fruit, and grain in garden soil mixed with contaminated roof material, the maximum whole-body dose would be 1.7 mrem/yr from the ingestion pathway, which is approximately 2 percent of the DOE radiation protection standard for the general public.

Based on the estimated dose calculated for these three scenarios, the roof of the building at 50 Yardboro Avenue meets the DOE guidelines, and the use of the building is acceptable without radiological restrictions.

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1.0 INTRODUCTION

1.1 OBJECTIVE AND SCOPE

This report describes the methodology used to perform an assessment of the hazard associated with radioactively contaminated roofs at vicinity properties near the Colonie Interim Storage Site (CISS) in Colonie, New York (Figure 1-1). Results of the hazard assessment are also described. Remedial action protocols established by the Department of Energy (DOE) permit use, without radiological restrictions, of the property if it can be shown that the basic dose limit of 100 mrem/yr is not exceeded at the property. This hazard assessment was performed to determine whether the dose resulting from exposure to radioactive materials on the roof of the building at 50 Yardboro Avenue in Colonie, New York, is within the basic annual dose limit established by DOE, and as such, whether the property is in compliance with the supplemental limit provisions of the guidelines.

1.2 BACKGROUND

Between 1958 and 1984, the National Lead (NL) Industries plant in Colonie, New York, performed various casting, machining, and milling operations on uranium. The plant processed primarily depleted uranium metal. The excess uranium metal was oxidized to reduce the potential for a uranium fire. The oxidation was performed in a small furnace called a chip burner. These operations resulted in the release of small quantities of uranium oxide dust through exhaust ventilation to the atmosphere. The uranium oxide dust was dispersed in the atmosphere and contaminated both residential and commercial properties in the area with low levels of uranium.

In 1980, the State of New York ordered the plant to reduce its level of production because an excessive amount of uranium oxide dust was being released into the air, and in the spring of 1984 operations were halted. DOE then took possession of the plant to begin the

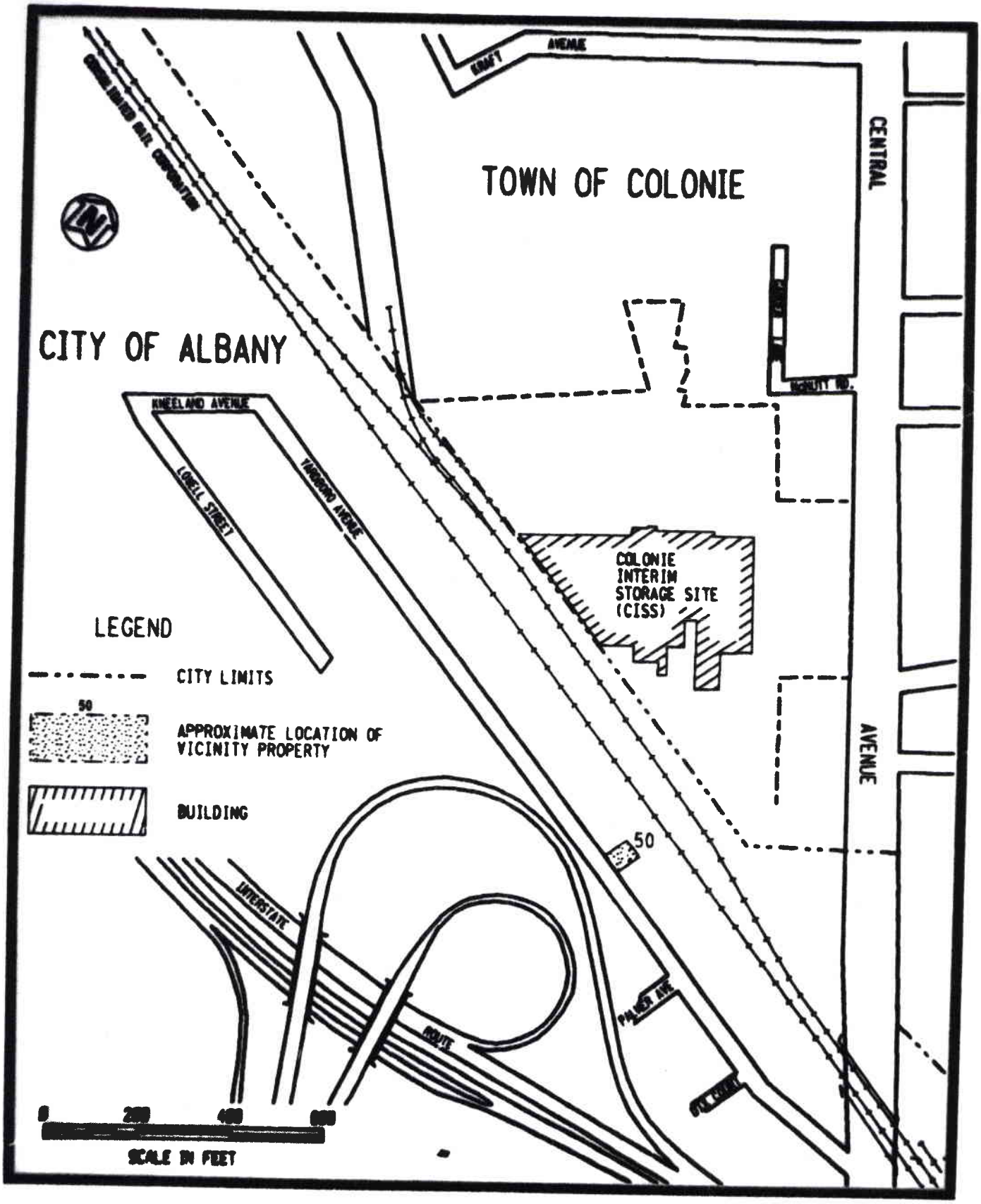

FIGURE 1-1 LOCATIONS OF THE CISS AND ITS VICINITY PROPERTY AT 50 YARDBORO AVENUE, ALBANY, NEW YORK

decontamination process as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP). FUSRAP is a DOE effort to identify, decontaminate, or otherwise control sites where residual contamination (exceeding current guidelines) remains from the early days of the nation's atomic energy program. Although the contamination at the properties around the CISS did not result from the atomic energy program, it was included as part of FUSRAP by DOE after Congress gave responsibility for the site to DOE under the 1984 Energy and Water Appropriations Act. FUSRAP is currently being managed by DOE's Oak Ridge Operations office. As project management contractor for FUSRAP, Bechtel National, Inc. (BNI) is responsible to DOE for the planning, management, and implementation of FUSRAP.

When operations at the former NL plant were terminated in the spring of 1984, the source of contamination on vicinity property roofs was eliminated. The subsequent effects of weather have stabilized the deposited contaminant, and radiation levels have therefore remained relatively constant. This condition could change, however, as the result of human activities (e.g., reroofing). Based on discussions with New York State officials, DOE agreed to remediate the soils on the vicinity properties to a uranium concentration of 35 pCi/g (Ref. 1). The DOE guidelines for surface contamination were adapted from Nuclear Regulatory Commission guidelines for the release of facilities without radiological restrictions (Ref. 2). These guidelines were also approved by the State of New York. Results of post-remedial action sampling at the designated properties indicate that the grounds around the building meet DOE guidelines and that the use of the grounds without radiological restrictions is acceptable.

2.0 DESCRIPTION AND STATUS OF VICINITY PROPERTY AT 50 YARDBORO AVENUE

2.1 DESCRIPTION OF VICINITY PROPERTY AT 50 YARDBORO AVENUE

The building on the commercial property at 50 Yardboro Avenue in Colonie, New York, is a one-story, irregularly shaped concrete structure. The building has a flat, two-level tar roof with an area of approximately 1,640 ft^2. A diagram of the property is shown in Figure 2-1. A radiological survey of the tar roof was conducted by Oak Ridge National Laboratory (ORNL) in 1985 (Ref. 3).

2.2 CURRENT RADIOLOGICAL STATUS OF ROOF OVER VICINITY PROPERTY BUILDING AT 50 YARDBORO AVENUE

The description of the current radiological status of the roof of the commercial vicinity property evaluated in this hazard assessment is based on the results of surveys conducted by ORNL.

Because the termination of NL plant operations in the spring of 1984 eliminated the source of roof contamination, it is probable that weather conditions such as rain, wind, and snow have reduced roof contamination and stabilized it at a level below which further reduction is not expected to occur as the result of natural causes.

Alpha and beta-gamma activity levels were measured at selected locations on the roof of the building at 50 Yardboro Avenue. The fixed surface alpha activity ranged from 77 to 330 dpm/100 cm^2, with an average of 170 dpm/100 cm^2. The beta-gamma activity measured at 1 cm above the surface ranged from 0.11 to 0.5 mR/h, with an average of 0.27 mR/h, including a natural background radiation level of approximately 0.004 mR/h (Ref. 3).

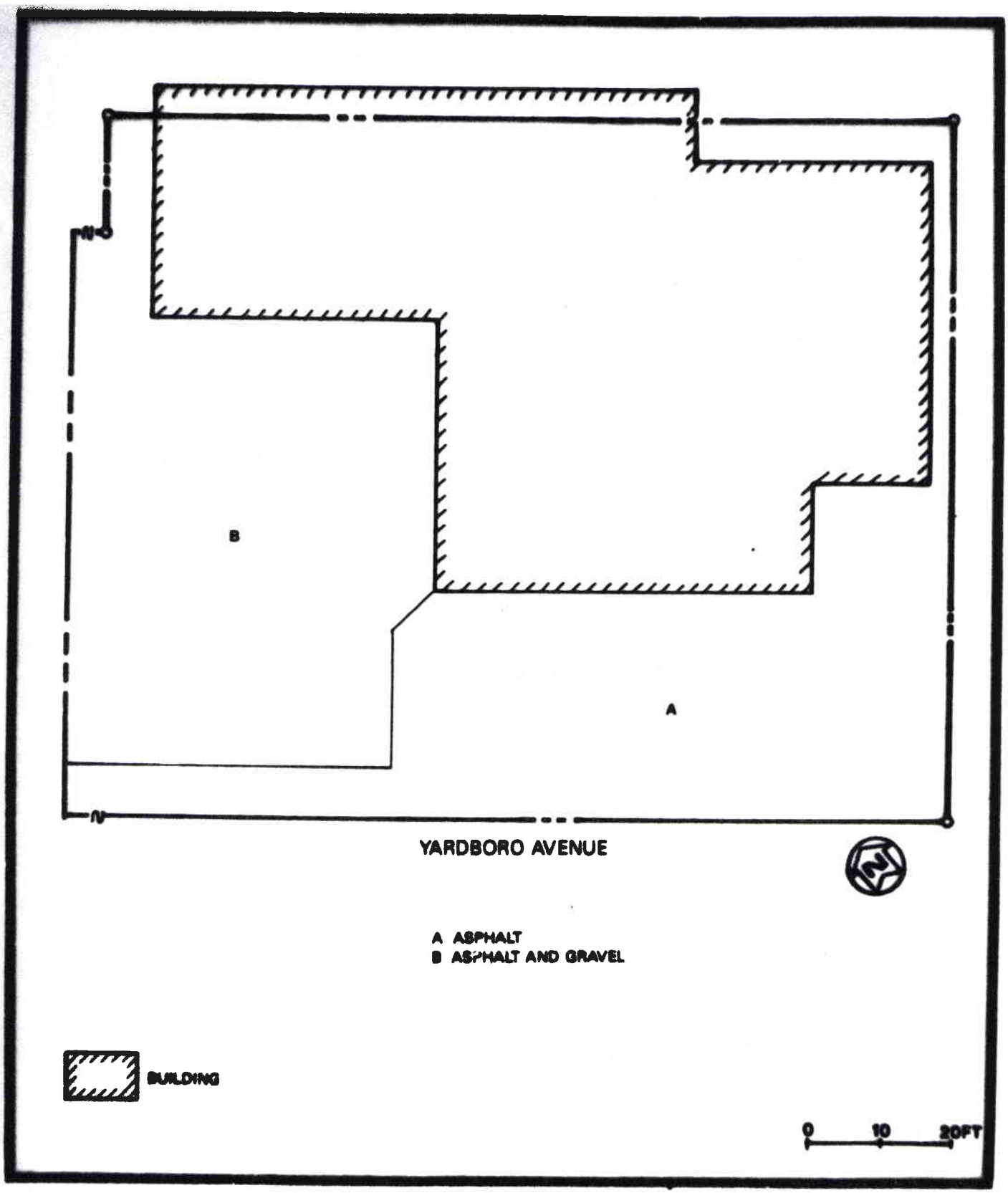

FIGURE 2-1 50 YARDBORO AVENUE

The average fixed alpha activity of 170 dpm/100 cm^2 is within the DOE guideline of 5,000 dpm/100 cm^2 for uranium on structure surfaces. The average beta-gamma activity of 0.27 mR/h, which includes a natural background radiation level of 0.004 mR/h, exceeds the DOE guideline of 0.20 mR/h (Ref. 2). However, the maximum beta-gamma reading of 0.5 mR/h is within the DOE guideline of 1.0 mR/h for maximum beta-gamma activity (Ref. 2).

3.0 RADIOLOGICAL ASSESSMENT

The potential doses to members of the general public that could result from exposure to the contaminated tar roof of the commercial structure at 50 Yardboro Avenue were calculated by evaluating the following possible exposure pathways: (1) external beta and gamma irradiation, (2) inhalation of resuspended radioactive dust particles, and (3) ingestion of contamination from removed roofing material, assuming that the roofing material has been mixed with soil that is used for gardening.

Three very conservative scenarios were selected to examine potential on-site exposures from the contaminated roof of the building at 50 Yardboro Avenue. The three scenarios evaluated are (1) the exposure to a roofer repairing the roof, (2) the exposure to an office worker working inside the structure at 50 Yardboro Avenue full time, and (3) the exposure to a resident that lives on-site and obtains all of his fruit and vegetables from a garden containing the contaminated roofing material. The first two scenarios are realistic scenarios and very conservative assumptions have been made. The third scenario is considered to be very unlikely and, again, conservative assumptions have been used. These three scenarios are described in detail below. The assumptions and parameters used in calculating the dose estimates not given below are described in Appendix A.

3.1 SCENARIO 1: ROOFER

3.1.1 Assumptions

It was assumed that a roofer engaged in repairing the contaminated roof at the 50 Yardboro Avenue location in Colonie, New York, would be exposed to two pathways of exposure: external gamma radiation and inhalation of airborne contaminated particles released during the roofing activities. Assumptions used in estimating the potential dose to the roofer are given below.

The dose resulting from exposure to external gamma radiation was calculated based on the method detailed in the supplement to the DOE guidelines (Ref. 4). Dose conversion factors used in the DOE supplement are based on data for an adult in the International Commission on Radiological Protection (ICRP) Publication 30 (Ref. 5).

The likelihood is minimal that radionuclides in materials fixed in tar on a roof surface would become resuspended in air. However, to calculate the maximum potential dose from this exposure pathway, the uranium concentration in the air can be estimated by multiplying the average concentration of uranium in the roofing material by a mass loading factor for the area. The Environmental Protection Agency (EPA) has indicated that data from the National Air Surveillance Network suggest annual mean mass concentrations of 0.05×10^{-4} to 0.5×10^{-4} g/m^3 for the country as a whole, and a mean mass concentration of approximately 0.05×10^{-4} g/m^3 for the Colonie area (Ref. 6). To calculate the dose from this pathway, a conservative mean mass concentration of 1×10^{-4} g/m^3 is assumed for the period during which the worker is engaged in reroofing activities.

An inhalation rate of 8,400 m^3/yr (109,872 yd^3/yr) for an adult male is assumed (Ref. 4). Other parameters and details of the methodology used to calculate potential doses are included in Appendix A.

Actual radionuclide concentrations in the roofing material (expressed in pCi/g) were not measured. Measurement of beta-gamma activity was considered to be the most accurate way of determining uranium concentration in the roofing material, since most of the alpha activity of the uranium that migrated into the tar would likely be shielded from measurement. The concentrations reported in Table 3-1 were calculated by converting the measured total beta-gamma activity (mR/h) values in Table 3-2 to pCi/g. This

TABLE 3-1

SOURCE TERMS: RADIONUCLIDE CONCENTRATIONS IN ROOFING MATERIAL AT 50 YARDBORO AVENUE, COLONIE, NEW YORK[a]

Radionuclide	Concentration (pCi/g)
Uranium-238	120
Uranium-235	2
Uranium-234	36

[a]Radionuclide concentrations are calculated based on measured gross beta-gamma activity (dpm/100 cm^2) for depleted uranium and on a density of 1.28 g/cm^3 for tar material.

conversion procedure is explained and demonstrated in Appendix A. The calculated radionuclide concentration in the roofing material is based on isotopic analysis for depleted uranium.

The dose resulting from exposure to external gamma radiation was calculated based on the method detailed in the supplement to the DOE guidelines (Ref. 4). The external gamma radiation exposure is estimated based on actual beta-gamma survey measurements made at 1 cm (0.39 in.) above the surface of the roof (Table 3-2) (Ref. 3). Gamma radiation exposure rates at 1 cm (0.39 in.) from the roof surfaces were calculated based on field measurements of a depleted uranium source with a geometry that approximates an infinitely thick source (Ref. 7). The beta-gamma dose rate from this source averaged 240 mrad/h, and the dose rate from the gamma radiation was approximately 5 mrad/h.

Gamma radiation dose rates at 1 m (3.28 ft) were not measured and were conservatively assumed to be the same as those at 1 cm (0.39 in.). The measured beta-gamma dose rates are shown in Table 3-2; the gamma rates calculated for the roof surfaces are shown in Table 3-3. A factor of 0.95 mrem/mR was used for direct conversion of measured exposure in mR/yr to the effective dose equivalent in mrem/yr (Ref. 4).

3.1.2 Internal Exposure to a Roofer From Inhalation of Airborne Depleted Uranium

It was assumed that while repairing the roof at 50 Yardboro Avenue in Colonie, New York, a roofer would be exposed to airborne depleted uranium during any cutting or removal operations. The exposure of the roofer is likely to be less than a week and would generally be limited to working hours. As a worst-case scenario, it was assumed that this type of operation would be conducted over a period of 24 hours without respiratory equipment. Thus, an occupancy factor (OF) of 2.7×10^{-3} (24 ÷ 8,760) was assumed.

TABLE 3-2

SOURCE TERMS: ALPHA ACTIVITY AND EXTERNAL BETA-GAMMA LEVELS MEASURED ON ROOF AT 50 YARDBORO AVENUE, COLONIE, NEW YORK[a, b]

Number of Measure-ments	Average Alpha Activity (dpm/100 cm^2)	Average Beta-Gamma Level (mR/h)
14	170	
13		0.27

[a]Surface measurements made at the site.

Source: Reference 3

TABLE 3-3

SOURCE TERMS: EXTERNAL EXPOSURE TO A ROOFER AND AN OFFICE WORKER AT 50 YARDBORO AVENUE, COLONIE, NEW YORK

Beta-Gamma (Roof)[a] (mR/h)	Gamma (Roof)[b] (mR/h)	Gamma (Work Level)[c] (mR/h)
0.27	5.4×10^{-3}	1.4×10^{-3}

[a]Surface radiation levels measured on roof.

[b]Gamma exposure rates calculated based on ratio of beta to gamma in depleted uranium (2 percent of beta-gamma level at surface is due to gamma).

[c]Gamma exposure rates at working levels inside the building calculated assuming that the air and roofing material could be expected to attenuate 75 percent of the gamma rays.

A committed effective dose equivalent of 4.4×10^{-2} mrem was estimated for internal exposure during roof repair work at 50 Yardboro Avenue. Thus, even if this unlikely scenario were to occur, the estimated internal exposure that would be received at this property from inhalation of resuspended contaminated dust would be very low.

3.1.3 Dose Resulting From External Exposure During Roof Repair

In evaluating the maximum potential external exposure to a roofer from contamination on the roof, it was conservatively assumed that a roofer would spend 24 hours repairing the roof at 50 Yardboro Avenue. Based on the highest external gamma exposure rate of 5.4×10^{-3} mR/h calculated for the 50 Yardboro Avenue structure (Table 3-3), an annual whole-body dose of 0.12 mrem would be received by the roofer. He could receive an additional exposure of 10 mrem/yr to the skin or to extremities if he were to maintain constant skin contact with the surface beta-gamma activity during reroofing operations. The values shown in Table 3-3 represent the exposures from external radiation at the structures surveyed. The calculated maximum potential dose of 0.12 mrem resulting from exposure to external gamma radiation is only 0.12 percent of the DOE radiation protection standard of 100 mrem/yr (Ref. 2). At the current time the DOE has not finalized a radiation protection standard for the general public for exposure to skin. However, the calculated maximum potential external beta exposure to the skin of 10 mrem/yr is only 0.02 percent of the 50,000 mrem/yr occupational exposure standard established by DOE (Ref. 8).

3.1.4 Summary of Dose to Roofer

The total estimated dose to a roofer during repair of the roof at 50 Yardboro Avenue in Colonie is approximately 0.2 mrem/yr, well below the DOE standard of 100 mrem/yr. Approximately 75 percent would result from the external gamma radiation dose; 25 percent would result from the internal dose through the inhalation pathway.

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

POST REMEDIAL ACTION REPORT FOR THE COLONIE INTERIM STORAGE SITE VICINITY PROPERTIES - 1984

Colonie, New York

March 1986

Bechtel National, Inc.
Advanced Technology Division

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POST-REMEDIAL ACTION REPORT
FOR THE
COLONIE INTERIM STORAGE SITE
VICINITY PROPERTIES - 1984

MARCH 1986

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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ABBREVIATIONS

cpm*	counts per minute
ft	feet
ft^2	square feet
g	gram
h	hour
in.	inch
$in.^2$	square inch
uCi	microcurie
uCi/ml	microcurie per milliliter
ml	milliliter
mrad	millirad
mrad/h	millirad per hour
mrem	millirem
mrem/yr	millirem per year
pCi	picocurie
yr	year

*Words appearing in bold face print are explained in the glossary.

1.0 INTRODUCTION

The purpose of this report is to document Bechtel National, Inc.'s (BNI) post-remedial action sampling of certain properties in the vicinity of the former National Lead (NL) Industries plant in Colonie, New York. This report briefly describes the origin of the radioactive **contamination** on the properties, the methods used to determine the extent of it, and the types of **remedial action** performed. It also provides the guidelines used in performing the remedial action and data on the current radiological status of the properties.

Background

The NL plant began working with **depleted uranium** in 1958, performing operations dealing with the casting, machining, and milling of this uranium into various items. In subsequent years, the plant primarily made depleted uranium counterweights for airplanes and projectiles for the armed services. In 1980, the State of New York ordered the plant to reduce its level of production because uranium dust was being released into the air, and in the spring of 1984 operations were halted. In February 1984, the Department of Energy (DOE) took possession of the plant to begin the cleanup process as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP) after Congress assigned the site to DOE. FUSRAP is a DOE effort to identify, decontaminate, or otherwise control sites where low-level radioactive contamination (exceeding current guidelines) remains from the early days of the nation's atomic energy program. Although the contamination at the Colonie properties did not result from the atomic energy program, it was included as part of FUSRAP by the DOE after Congress gave responsibility for the site to DOE. FUSRAP is currently being managed by DOE's Oak Ridge Operations Office. BNI is the Project Management Contractor and acts as DOE's representative in the planning, management, and implementation of FUSRAP.

Radiological Surveys

Teledyne Isotopes (Ref. 1) surveyed the neighborhood surrounding the NL plant for radioactivity in 1980 and determined that uranium released into the air had deposited on residential properties and structures. Teledyne's finding also showed that the majority of the contamination was in the direction of the area's prevailing winds.

In October 1983, the Oak Ridge National Laboratory (ORNL) performed more detailed radiological surveys of the individual properties surrounding the NL plant (Refs. 2 through 10), which included private residences. These surveys were designed to locate all properties on which uranium contamination exceeded DOE guidelines.

2.0 REMEDIAL ACTION GUIDELINES

The cleanup guideline for the Colonie properties was derived based on site-specific information concerning the distribution of the uranium in the soil. Based on discussions with New York state and EPA officials, the DOE agreed to clean the properties to a uranium concentration of 35 pCi/g.

For surfaces other than soil, the DOE guideline is that the **radiation dose** rate must be less than 0.2 mrad/h averaged over 10 ft^2 (1 m^2) or a maximum of 1.0 mrad/h in any 15-in.^{2} (100-cm^2) area. These guidelines were adopted from Nuclear Regulatory Commission guidelines for the release of facilities (such as the former NL plant) for **unrestricted use.** These guidelines are given in Table 1.

All soil contains some trace amounts of **radionuclides** because uranium is a naturally occurring element. Typically, soil contains about 1 pCi/g of uranium, radium, and thorium. These amounts are called **"background"** levels, and do not originate from manufacturing operations using radioactive materials. The annual dose to a New York resident due to background radiation is typically 100 mrem.

3.0 REMEDIAL ACTION

After a property was determined to be contaminated based on the ORNL survey, BNI began engineering design work based on the survey data. These activities included hiring local subcontractors to perform the cleanup work (Ref. 11). Also, BNI and its radiological support subcontractor, Eberline Analytical Corporation (EAC), again surveyed the property for radiation. This survey more accurately defined the boundaries of contamination.

BNI/EAC Survey Methods

To conduct this survey, each property was subdivided into grids that were typically 6 ft by 6 ft. At each grid intersection, a radiation measurement was made using a "FIDLER" type detector. The FIDLER is a special type of radiation detector that is made for detecting the very low energy gamma radiation emitted by depleted uranium. The FIDLER was **calibrated** by measuring the radioactivity in the soil on the former NL plant site using the FIDLER, then removing the soil and having its uranium content determined under laboratory conditions by EAC. From this calibration, it was determined that a FIDLER reading of 11,000 cpm represented a uranium concentration in the soil of 35 pCi/g. The calibration line is shown in Figure 1 (Page 7). The FIDLER measurements were checked periodically by taking a soil sample and analyzing it at the EAC laboratory to ensure that the calibration remained consistent. By plotting all the readings taken on the property in excess of 11,000 cpm, the areas of contamination were mapped (Ref. 12).

To determine if surfaces other than soil were contaminated (e.g., asphalt, concrete, or wood), a **pancake-type** beta-gamma detector was used. This detector was calibrated so that the readings in cpm could be converted into mrad/h and compared to the appropriate guideline. In general, radioactive contamination of these surfaces was found only on properties immediately adjacent to the former NL plant. It was usually found in rough surfaces (e.g., wood or

asphalt) where it would become trapped and would not wash off. In all cases, the uranium contamination was only found on the outer surface of these materials.

Cleanup/Decontamination Activities

Drawings showing the extent of the contamination in the soil on each property were then given to the excavation subcontractor. The subcontractor removed the soil as indicated in the drawings, placed it in covered boxes, and transported it to the former NL plant. It is being stored there until a permanent disposal site is selected for this material. The shaded areas in Figures 2 through 11 indicate the limits of contamination and excavation for each property.

For most excavations, the depth was less than 3 in. The uranium released while the plant was operating was insoluble (i.e., would not dissolve in water) and deposited in the top few inches of the soil. In a few cases, excavation was slightly deeper because the uranium had washed deeper into the soil around roots of trees and shrubs. During excavation, the subcontractor was required to keep all areas free from dust and to avoid spilling the contaminated soil onto any clean areas. Personnel trained in radiation protection observed all operations to ensure that safety procedures were followed. Air monitoring during remedial action showed that airborne uranium concentrations were below DOE radiation protection guidelines for members of the general public. Fifty-eight measurements were taken ranging from 0.0007×10^{-12} to 0.8×10^{-12} uCi/ml. For comparison, the DOE standard is 5×10^{-12} uCi/ml.

Removal of some material other than soil was also required to comply with the DOE surface contamination guideline. This included removal of tar paper from one flat roof, scabbling of asphalt on two properties, removal of a stone driveway, and replacement of a wooden door to a coal chute. The notes on Figures 2 through 11 indicate any remedial action taken on these types of materials.

4.0 POST-REMEDIAL ACTION SAMPLING

After the soil containing the uranium was removed, another radiological survey was conducted to ensure that the property was indeed clean (no uranium concentrations in excess of 35 pCi/g). This survey used two techniques. First, another FIDLER scan of the excavated areas was made. If the FIDLER showed some remaining contamination, more soil was removed until the FIDLER indicated levels below 35 pCi/g. Soil samples were taken after the FIDLER scan, were analyzed by the EAC laboratory, and showed contamination levels below 35 pCi/g. The numbered locations in Figures 2 through 11 indicate where soil samples were collected after the cleanup had been performed. These location numbers correspond to those in Tables 2 through 11 and give the concentrations of the radionuclides remaining at those locations.

For those cases where surfaces other than soil required remedial action, the pancake beta-gamma detector was used to perform another survey after removal of the contaminated surface. If no additional contamination in excess of DOE guidelines was found, the surface was restored (when necessary). Notes on the figures indicate these types of remedial action.

In addition to the sampling performed by BNI for DOE, New York state officials performed an independent survey of some properties as they were cleaned.

5.0 POST-REMEDIAL ACTION STATUS

As shown in Tables 2 through 11, the samples taken after removing the radioactive materials show that there is no area where radioactive contamination exists that exceeds the remedial action guideline of 35 pCi/g for uranium agreed upon by the State of New York and DOE. An independent review of the remedial action performed by BNI on the parcels discussed in this report has been conducted by the Oak Ridge Associated Universities Radiological Site

Assessment Program. The purpose of the assessment was to verify the data supporting the adequacy of the remedial action and to confirm the site's compliance with remedial action guideline agreed upon by the State of New York and DOE.

Based on all data collected, these parcels conform to all applicable radiological guidelines established for release of these properties for unrestricted use (Ref. 13).

In addition to the surveys that have been performed on behalf of DOE, measures have been taken by the New York state officials to monitor remedial action activities. These measures include observing on-site operations and procedures, and analyzing archived soil samples.

TABLE I

REMEDIAL ACTION GUIDELINES FOR STRUCTURE SURFACES

Indoor/Outdoor Structure Surface Contamination

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

[a]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.

[b]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.

[c]Measurements of average contamination 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.

[d]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.

[e]The maximum contamination level applies to an area of not more than 100 cm^2.

[f]The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, measuring the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of surface area less than 100 cm^2 is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. The numbers in this column are maximum amounts.

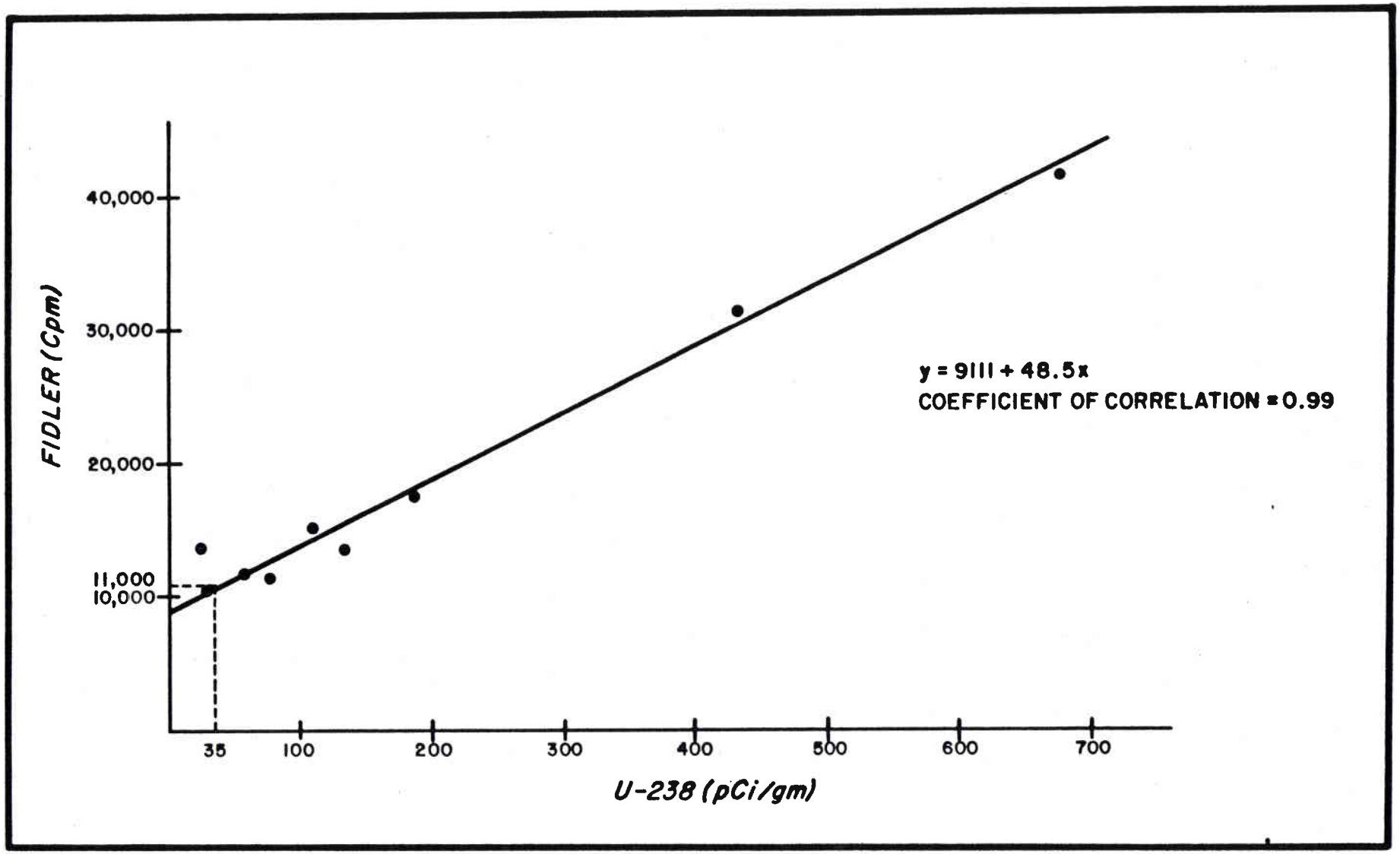

FIGURE 1 FIDLER CALIBRATION

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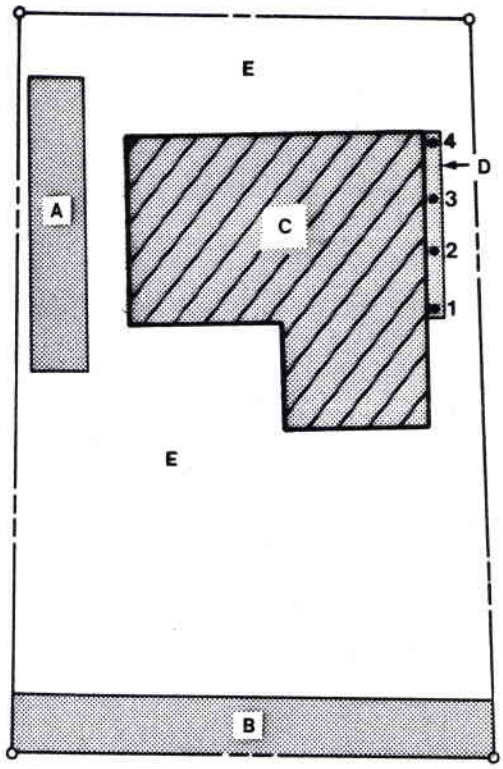

A ASPHALT SCABBLED
B ROCKS/DIRT ON TOP OF ASPHALT EXCAVATED - ASPHALT SCABBLED
C TAR PAPER ROOF REMOVED
D SMALL GRASS STRIP REMOVED (3-IN. DEPTH) AND REPLACED
E ASPHALT

AREAS REQUIRING REMEDIAL ACTION

BUILDING

• NUMBERS INDICATE SOIL SAMPLING LOCATIONS

1" = 20'

FIGURE 2 REMEDIAL ACTION AT 1114 CENTRAL AVENUE

TABLE 2

POST-REMEDIAL ACTION SAMPLING RESULTS

1114 CENTRAL AVENUE

Sample No.	Concentrations (pCi/g) Uranium-238
1	2.0 ± 0.2
2	3.0 ± 0.3
3	3.0 ± 0.3
4	5.0 ± 0.4

SURFACE CONTAMINATION SURVEY

Survey Location	Number of Measurements*	Average mrad/h	Range mrad/h
Roof(Area C)	330	0.1	0.1 - 0.1
Scabbled asphalt on side of dwelling (Area A)	156	0.1	0.1 - 0.3
Scabbled asphalt (Area B)	120	0.1	0.1 - 0.2

*Measurements were taken at each intersection of a 1-m grid.

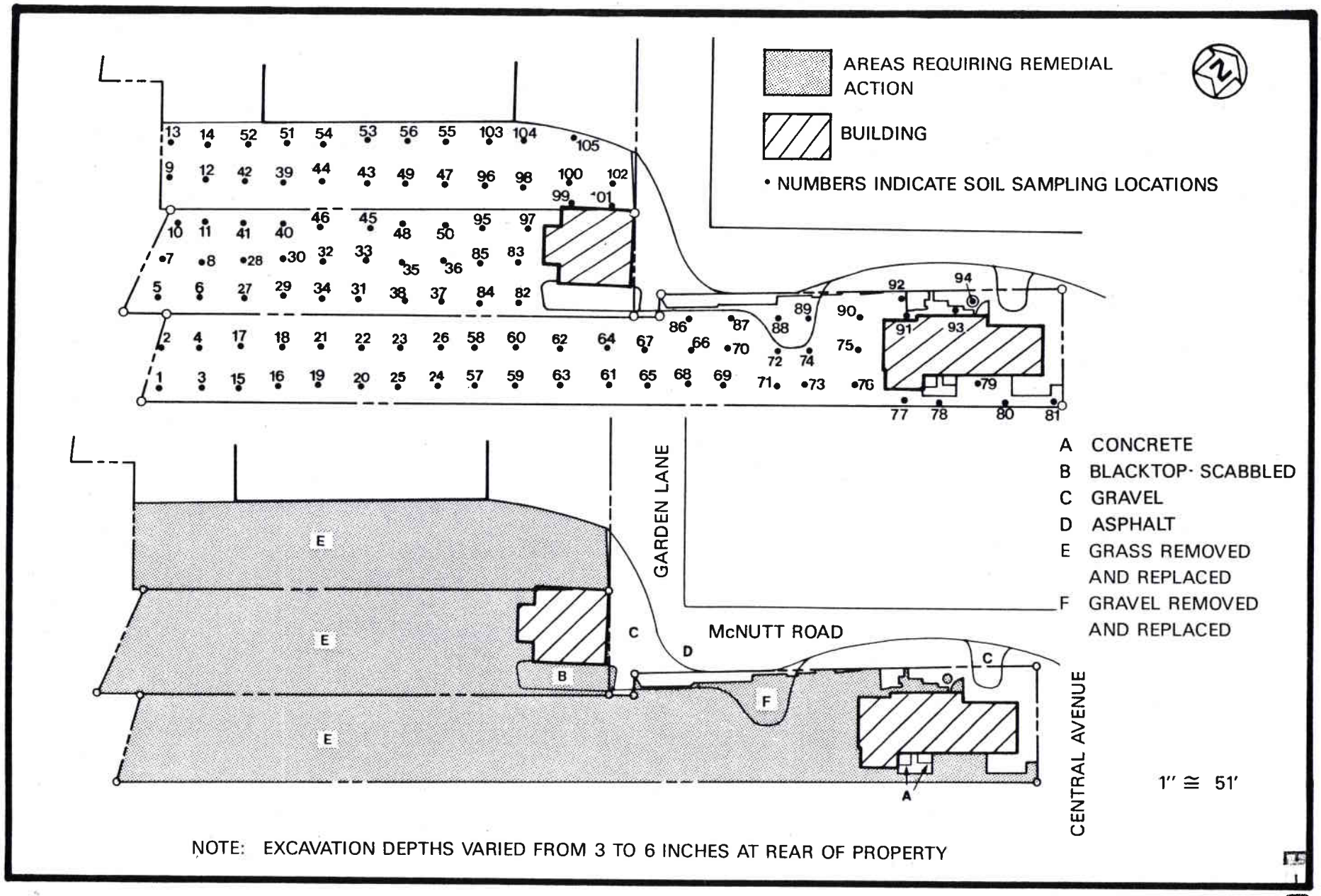

FIGURE 3 REMEDIAL ACTION AT 1144/1144A CENTRAL AVENUE

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TABLE 3

POST-REMEDIAL ACTION SAMPLING RESULTS

1144/1144A CENTRAL AVENUE

Sample No.	Concentrations (pCi/g) Uranium-238
1	<2.0
2	<2.0
3	2.2 ± 1.0
4	<2.0
5	<5.0
6	<1.4
7	<5.0
8	<1.4
9	2.0 ± 0.8
10	<2.0
11	1.0 ± 0.2
12	3.0 ± 0.3
13	1.2 ± 0.6
14	13.3 ± 1.0
15	<5.0
16	<1.4
17	1.5 ± 0.7
18	<1.5
19	2.5 ± 0.7
20	<2.0
21	<5.0
22	<1.4
23	2.4 ± 0.6
24	<1.4
25	3.0 ± 0.8
26	6.1 ± 0.7
27	<5.0
28	<5.0
29	<1.6
30	<1.2
31	<2.0
32	<1.34
33	2.3 ± 0.7
34	<5.0
35	<5.0
36	4.0 ± 1.0
37	8.0 ± 1.4
38	<1.6
39	1.7 ± 1.2
40	<1.7
41	1.0 ± 0.7
42	<1.4
43	6.0 ± 1.4
44	5.3 ± 0.7

TABLE 3

Sample No.	Concentrations (pCi/g) Uranium-238
45	16.3 ± 1.4
46	13.0 ± 1.0
47	11.1 ± 0.6
48	12.2 ± 0.4
49	8.4 ± 1.0
50	3.0 ± 1.0
51	<2.0
52	0.4 ± 1.0
53	2.0 ± 0.7
54	<1.2
55	<2.0
56	<1.4
57	<2.0
58	2.0 ± 0.4
59	<5.0
60	<5.0
61	1.1 ± 0.6
62	<5.0
63	3.0 ± 0.4
64	3.0 ± 1.0
65	2.3 ± 0.3
66	3.1 ± 0.3
67	<2.0
68	2.4 ± 0.6
69	5.0 ± 0.8
70	8.3 ± 1.2
71	1.6 ± 1.3
72	<5.0
73	3.0 ± 1.0
74	<5.0
75	<5.0
76	3.0 ± 0.8
77	1.5 ± 0.3
78	2.2 ± 0.3
79	<2.0
80	7.2 ± 0.8
81	2.2 ± 1.0
82	<2.0
83	2.0 ± 0.8
84	<2.0
85	2.0 ± 0.7
86	3.2 ± 0.0
87	1.5 ± 1.0
88	<5.0
89	<2.0
90	<1.4

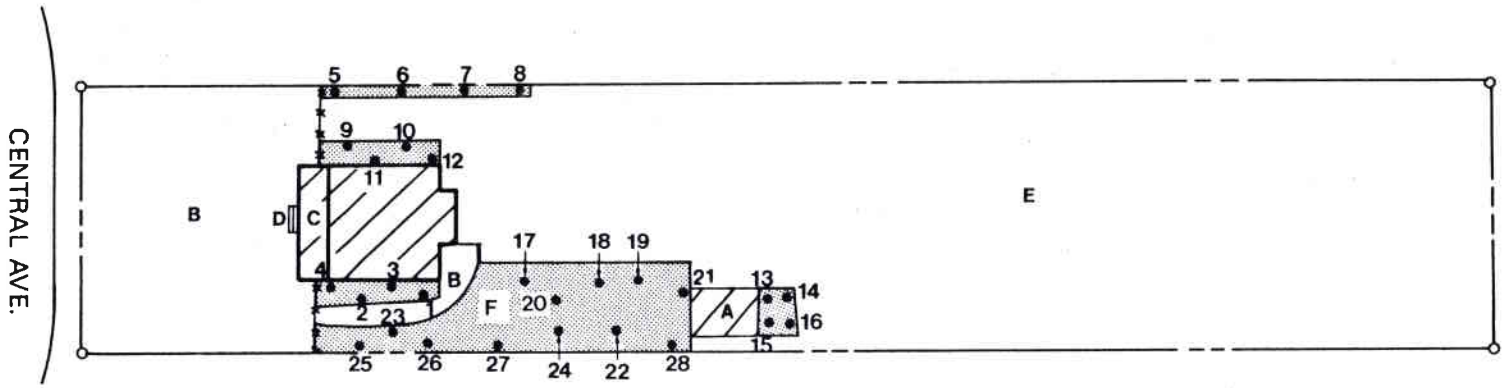
TABLE 3

Sample No.	Concentrations (pCi/g) Uranium-238
91	2.4 ± 0.7
92	2.0 ± 0.7
93	<5.0
94	<5.0
95	1.4 ± 0.6
96	<5.0
97	2.3 ± 0.3
98	15.0 ± 0.4
99	<5.0
100	9.0 ± 1.3
101	9.0 ± 1.0
102	4.1 ± 0.7
103	3.2 ± 0.3
104	5.4 ± 0.3
105	5.1 ± 0.4

SURFACE CONTAMINATION SURVEY

Survey Location	Number of Measurements*	Average mrad/h	Range mrad/h
Scabbled asphalt (Area B)	50	0.2	0.1 - 0.4

*Measurements taken at each intersection of a 1-m grid.



A GARAGE
B GRAVEL
C PORCH
D STEPS
E GRASS
F GRASS REMOVED (3-IN. DEPTH) AND REPLACED

AREAS REQUIRING REMEDIAL ACTION

BUILDING

• NUMBERS INDICATE SOIL SAMPLING LOCATIONS

1" ≅ 45'

FIGURE 4 REMEDIAL ACTION AT 1159 CENTRAL AVENUE

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TABLE 4

POST-REMEDIAL ACTION SAMPLING RESULTS

1159 CENTRAL AVENUE

Sample No.	Concentrations (pCi/g) Uranium-238
1	<5.0
2	<5.0
3	<2.5
4	<1.4
5	<2.0
6	6.3 ± 0.6
7	4.5 ± 0.9
8	3.0 ± 0.6
9	2.3 ± 0.7
10	<1.6
11	<2.0
12	2.3 ± 0.5
13	<1.6
14	14.7 ± 1.1
15	<2.0
16	5.1 ± 0.9
17	2.3 ± 0.8
18	2.0 ± 0.6
19	<5.0
20	<5.0
21	<5.0
22	<2.0
23	3.0 ± 0.7
24	<2.0
25	<5.0
26	<2.0
27	1.5 ± 1.0
28	<2.0

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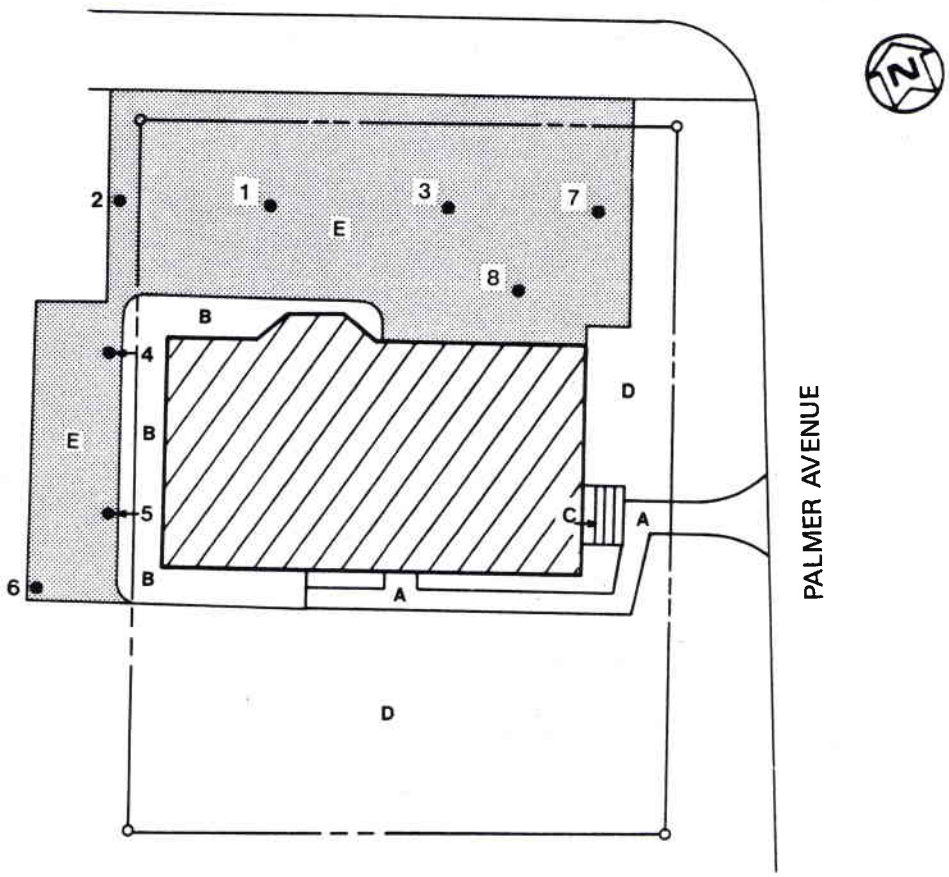

A CONCRETE WALK
B ASPHALT WALK
C STEPS
D GRASS
E GRASS REMOVED (3-IN. DEPTH) AND REPLACED

AREAS REQUIRING REMEDIAL ACTION

BUILDING

• NUMBERS INDICATE SOIL SAMPLING LOCATIONS

1" = 20'

FIGURE 5 REMEDIAL ACTION AT 33 PALMER AVENUE

TABLE 5

POST-REMEDIAL ACTION SAMPLING RESULTS

33 PALMER AVENUE

Sample No.	Concentrations (pCi/g) Uranium-238
1	4.0 ± 0.7
2	8.2 ± 0.8
3	5.3 ± 0.9
4	5.2 ± 0.7
5	5.0 ± 0.9
6	<2.0
7	3.1 ± 0.8
8	2.2 ± 0.7

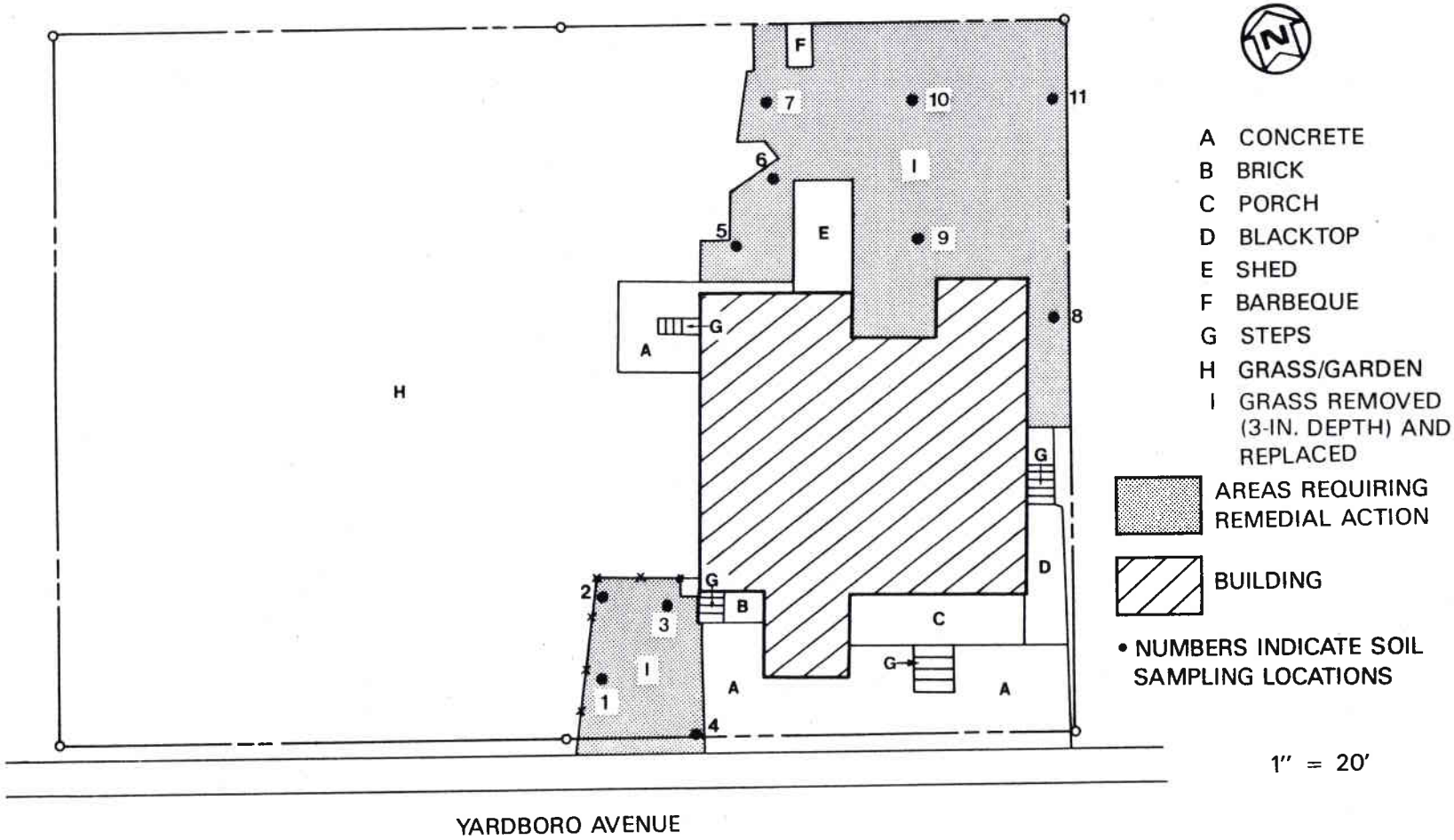

FIGURE 6 REMEDIAL ACTION AT 27/29 YARDBORO AVENUE

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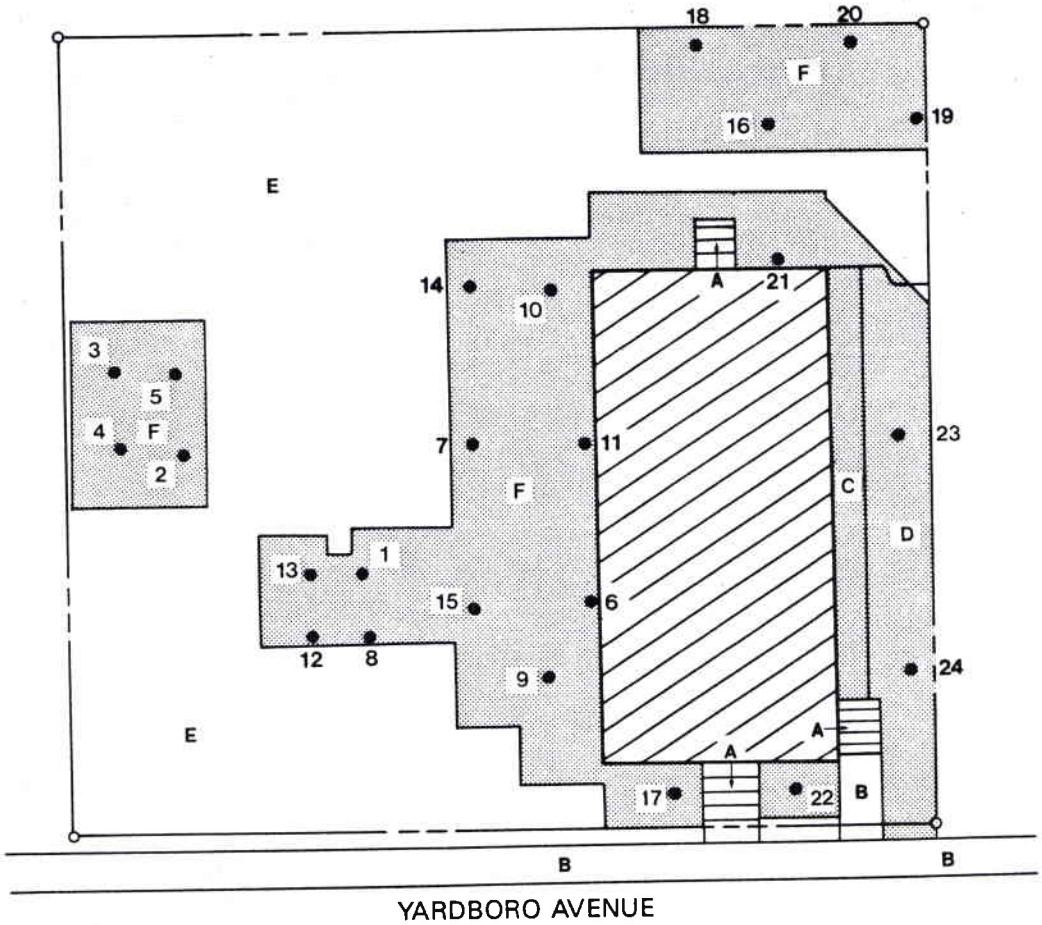
TABLE 6

POST-REMEDIAL ACTION SAMPLING RESULTS

27/29 YARDBORO AVENUE

Sample No.	Concentrations (pCi/g) Uranium-238
1	2.0 ± 0.6
2	5.0 ± 1.0
3	4.0 ± 0.3
4	2.5 ± 0.3
5	14.0 ± 1.0
6	4.0 ± 0.9
7	10.0 ± 1.2
8	1.4 ± 0.7
9	6.0 ± 0.5
10	13.2 ± 1.2
11	1.0 ± 1.0



A STEPS
B CONCRETE WALK
C CONCRETE WALK CLEANED
D GRAVEL EXCAVATED AND REPLACED
E GRASS
F GRASS REMOVED (3-IN. DEPTH) AND REPLACED

AREAS REQUIRING REMEDIAL ACTION

BUILDING

• NUMBERS INDICATE SOIL SAMPLING LOCATIONS

1" = 20'

FIGURE 7 REMEDIAL ACTION AT 52 YARDBORO AVENUE

TABLE 7

POST-REMEDIAL ACTION SAMPLING RESULTS

52 YARDBORO AVENUE

Sample No.	Concentrations (pCi/g) Uranium-238
1	3.0 ± 0.3
2	3.6 ± 0.3
3	6.2 ± 0.4
4	1.7 ± 0.2
5	5.3 ± 1.0
6	1.5 ± 0.3
7	3.5 ± 0.6
8	2.6 ± 0.6
9	3.6 ± 0.3
10	4.9 ± 0.3
11	8.7 ± 1.0
12	3.3 ± 0.6
13	3.1 ± 0.7
14	4.2 ± 0.7
15	7.1 ± 0.9
16	<5.0
17	2.3 ± 1.0
18	4.0 ± 0.7
19	<5.0
20	<1.7
21	1.1 ± 0.6
22	5.2 ± 0.7
23	3.4 ± 0.8
24	5.0 ± 0.6

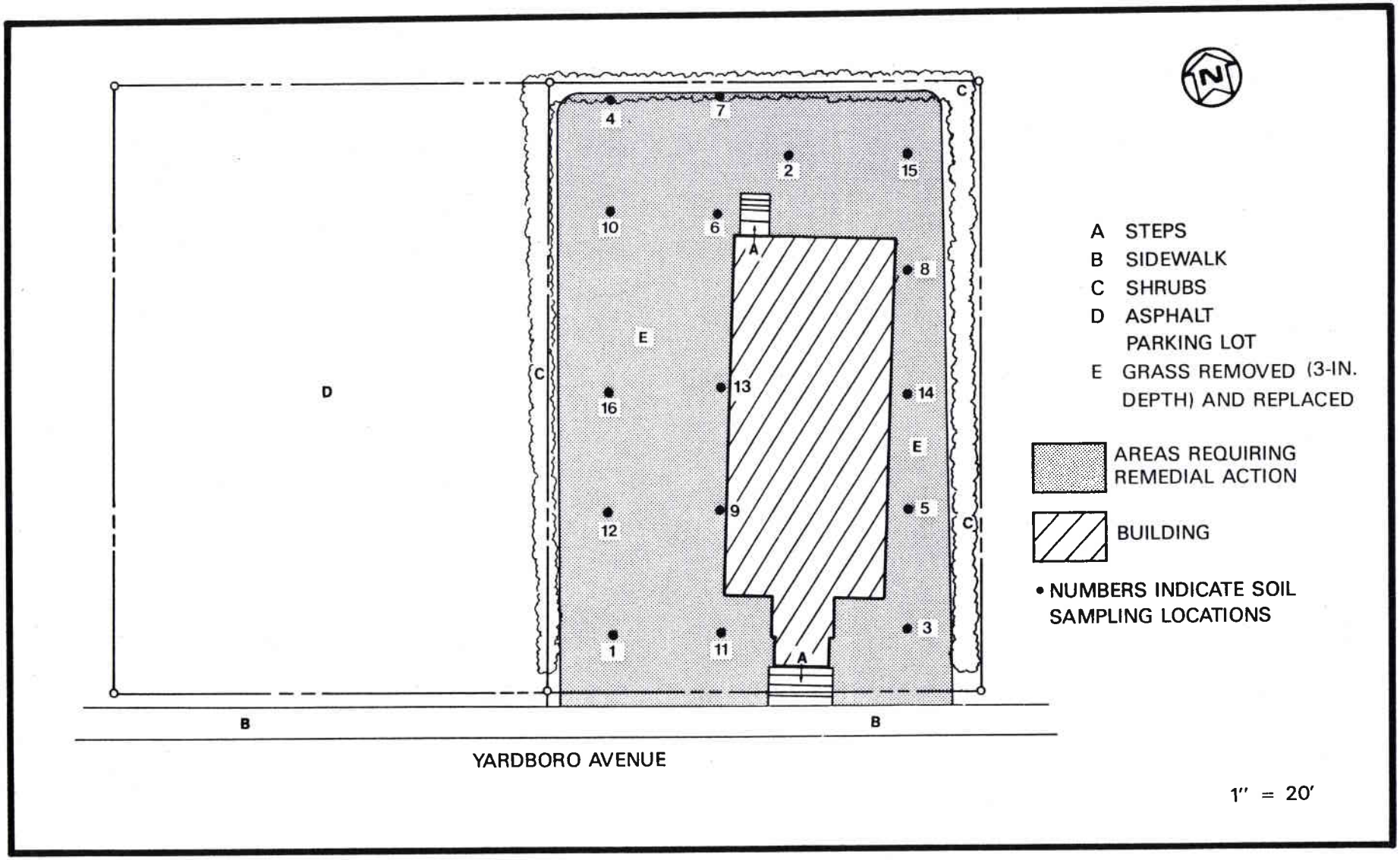


FIGURE 8 REMEDIAL ACTION AT 68 YARDBORO AVENUE

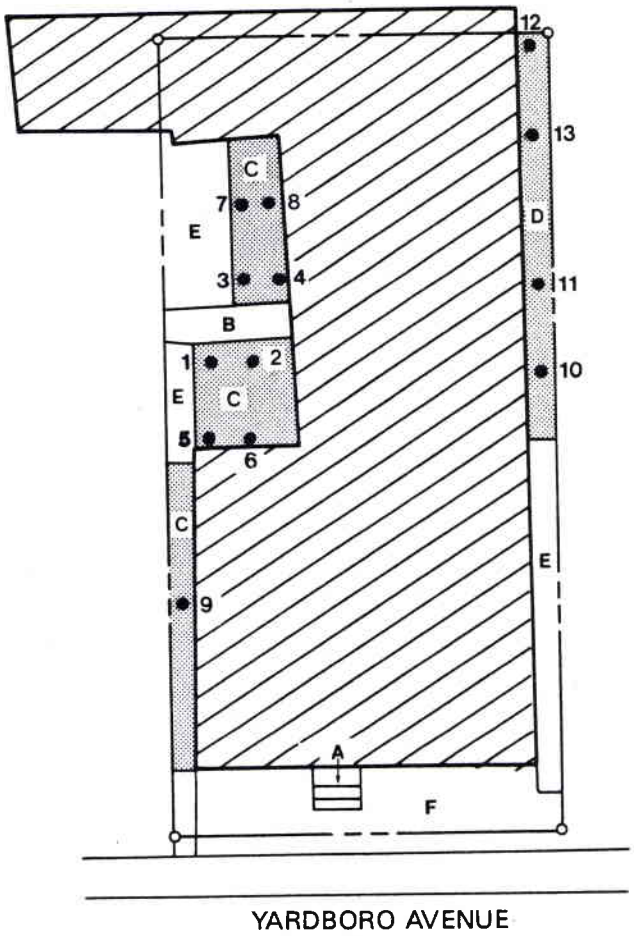
E-01281

TABLE 8

POST-REMEDIAL ACTION SAMPLING RESULTS

68 YARDBORO AVENUE

Sample No.	Concentrations (pCi/g) Uranium-238
1	<5.0
2	0.9 ± 0.5
3	4.3 ± 0.5
4	1.2 ± 0.6
5	1.4 ± 0.7
6	<5.0
7	1.4 ± 0.3
8	5.0 ± 0.3
9	3.3 ± 0.7
10	<1.7
11	<2.0
12	<1.5
13	1.7 ± 0.7
14	3.0 ± 0.6
15	2.5 ± 0.8
16	<1.7



A STEPS
B CONCRETE WALK
C GRASS REMOVED (3-IN. DEPTH) AND REPLACED
D GRAVEL REMOVED (3-IN. DEPTH) AND REPLACED
E GRAVEL
F ASPHALT

AREAS REQUIRING REMEDIAL ACTION

BUILDING

• NUMBERS INDICATE SOIL SAMPLING LOCATIONS

1" = 20'

FIGURE 9 REMEDIAL ACTION AT 74 YARDBORO AVENUE

TABLE 9

POST-REMEDIAL ACTION SAMPLING RESULTS

74 YARDBORO AVENUE

Sample No.	Concentrations (pCi/g) Uranium-238
1	0.7 ± 0.3
2	6.0 ± 0.4
3	3.0 ± 0.4
4	3.3 ± 0.3
5	1.0 ± 0.3
6	2.5 ± 0.3
7	7.5 ± 1.2
8	2.5 ± 0.6
9	5.1 ± 1.4
10	15.0 ± 0.4
11	6.0 ± 0.4
12	6.2 ± 0.3
13	5.3 ± 0.3

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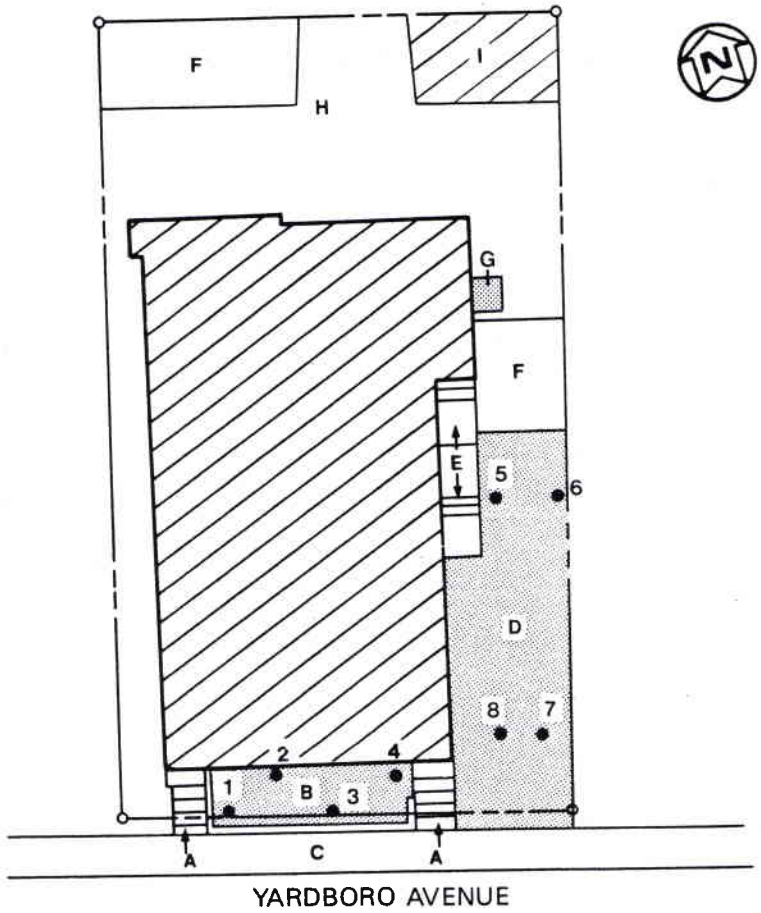


A STEPS
B GRASS REMOVED (3-IN. DEPTH) AND REPLACED
C SIDEWALK
D STONE DRIVEWAY REMOVED, REPLACED WITH CONCRETE
E CONCRETE PORCH AND STEPS
F GRAVEL
G COAL CHUTE DOOR WAS REPLACED
H CONCRETE
I WOOD SHED

AREAS REQUIRING REMEDIAL ACTION

BUILDING

• NUMBERS INDICATE SOIL SAMPLING LOCATIONS

1" = 20'

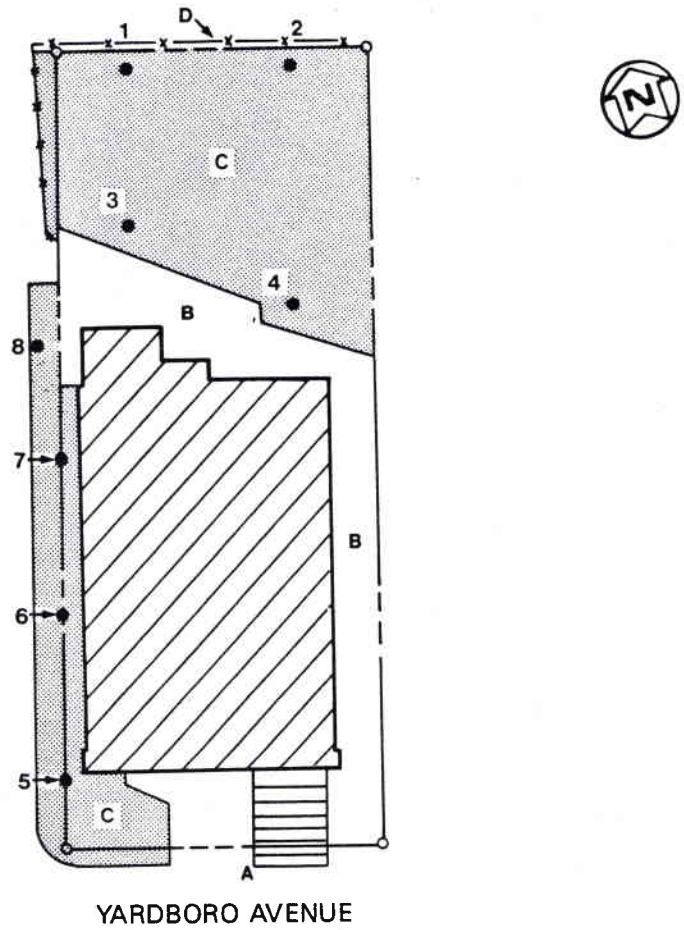
FIGURE 10 REMEDIAL ACTION AT 78 YARDBORO AVENUE

TABLE 10

POST-REMEDIAL ACTION SAMPLING RESULTS

78 YARDBORO AVENUE

Sample No.	Concentrations (pCi/g) Uranium-238
1	0.5 ± 0.1
2	1.4 ± 0.4
3	3.1 ± 0.3
4	3.0 ± 0.2
5	1.4 ± 0.3
6	3.0 ± 0.3
7	<1.5
8	0.7 ± 0.2



A STEPS
B CONCRETE
C GRASS REMOVED (3-IN. DEPTH) AND REPLACED
D FENCE

AREAS REQUIRING REMEDIAL ACTION

BUILDING

• NUMBERS INDICATE SOIL SAMPLING LOCATIONS

1" = 20'

FIGURE 11 REMEDIAL ACTION AT 80 YARDBORO AVENUE

TABLE 11

POST-REMEDIAL ACTION SAMPLING RESULTS

80 YARDBORO AVENUE

Sample No.	Concentrations (pCi/g) Uranium-238
1	1.0 ± 0.4
2	5.4 ± 0.3
3	2.2 ± 0.3
4	2.0 ± 0.3
5	11.0 ± 0.3
6	9.1 ± 0.6
7	6.0 ± 0.3
8	1.0 ± 0.2

REFERENCES

1. Teledyne Isotopes. A Survey of Uranium in Soil Surrounding the NL Bearings Plant, IWL-9488-461, October 31, 1980.

2. Oak Ridge National Laboratory. Results of the Radiological Survey at 1144 Central Avenue, Colonie, New York (AL 010), Oak Ridge, TN, March 1984.

3. Oak Ridge National Laboratory. Results of the Radiological Survey at 1144A Central Avenue, Colonie, New York (AL 010), Oak Ridge, TN, March 1984.

4. Oak Ridge National Laboratory. Results of the Radiological Survey at 33 Palmer Avenue, Albany, New York (AL 006), Oak Ridge, TN, March 1984.

5. Oak Ridge National Laboratory. Results of the Radiological Survey at 27/29 Yardboro Avenue, Albany, New York (AL 012), Oak Ridge, TN, March 1984.

6. Oak Ridge National Laboratory. Results of the Radiological Survey at 52 Yardboro Avenue, Albany, New York (AL 005), Oak Ridge, TN, March 1984.

7. Oak Ridge National Laboratory. Results of the Radiological Survey at 68 Yardboro Avenue, Albany, New York (AL 004), Oak Ridge, TN, March 1984.

8. Oak Ridge National Laboratory. Results of the Radiological Survey at 74 Yardboro Avenue, Albany, New York (AL 003), Oak Ridge, TN, March 1984.

9. Oak Ridge National Laboratory. Results of the Radiological Survey at 78 Yardboro Avenue, Albany, New York (AL 001), Oak Ridge, TN, March 1984.

10. Oak Ridge National Laboratory. Results of the Radiological Survey at 80 Yardboro Avenue, Albany, New York (AL 002), Oak Ridge, TN, March 1984.

11. Department of Energy. Remedial Action Work Plan for the Colonie Interim Storage Site, ORO-847, Revision 1, (Draft), Oak Ridge, TN, May 1985.

12. Memorandum, R.C. Robertson to File. "BNI/EAC Characterization Data for Remedial Action on Colonie Vicinity Properties During FY 1984," September 27, 1985.

13. Oak Ridge Associated Universities. Verification of 1984 Remedial Action, Vicinity Properties, Colonie Interim Storage Site, Colonie, New York, (Draft), Oak Ridge, TN, February 1986.

GLOSSARY

Alpha Radiation - See radiation.

Background Radiation - Background radiation refers to naturally occurring radiation emitted from either cosmic (e.g., from the sun) or terrestrial (e.g., from the earth) sources. Exposure to this type of radiation is unavoidable and its level varies greatly depending on geographic location; e.g., New York state receives 100 mrem/yr, Colorado receives about 300 mrem/yr, and some areas in South America receive up to 7000 mrem/yr. Naturally occurring terrestrial radionuclides include uranium, radium, potassium, thorium, etc.

Beta Radiation - See radiation.

Calibrated - Radiation detectors typically measure the number of radioactive particles that enter the detector. These are called "counts" because the detector counted a radioactive emission (which could be alpha, beta, or gamma). When measuring radioactivity in soil, the measurement is used to determine the concentration of the radionuclide in the soil in picocuries of radiation per gram of soil. Calibration of the detector is done so that the "counts" can be converted to picocuries per gram of soil. This is usually done by seeing how many "counts" the detector registers when measuring a known amount of radiation as determined under laboratory conditions.

Contamination - Contamination is used here to mean the same as saying "depleted uranium in the soil above the DOE guidelines."

cpm - Counts per minute refers to the number of radioactive emissions in a minute that are measured by a detector. The number of counts is calibrated as described above.

Depleted Uranium - Uranium is found in nature as an ore, similar to coal. When mined, it contains three major, slightly different

forms of uranium called uranium-234, uranium-235, and uranium-238. Uranium-235 is the type of uranium used to make fuel for nuclear power plants and for nuclear weapons. In nature, only 0.72 percent of uranium is uranium-235; uranium-238 (99.27 percent) and uranium-234 (0.0055 percent) account for the remainder. Depleted uranium is uranium that is left over after the uranium-235 and uranium-234 have been partially removed for other uses. In depleted uranium, 99.80 percent is uranium-238, 0.20 percent is uranium-235, and 0.0015 percent is uranium-234. Depleted uranium is about 35 percent less radioactive than naturally occurring uranium.

Dose - Dose is used to relate radiation exposure to an effect on the body. Dose is measured in mrem. Examples of dose are: a dose of 500,000 mrem to the whole body in a short time causes death in 50 percent of the people who receive it; a dose of 5,000,000 mrem may be delivered to a cancerous tumor during radiation treatment; normal background radiation results in an annual dose of about 100 mrem New York state; DOE radiation protection standards limit the dose to members of the general public to 100 mrem/yr above background levels; a typical chest x-ray gives a dose of about 40 mrem; living in a brick house results in a dose of about 75 mrem/yr.

Gamma Radiation - See radiation.

Gram - A gram is a metric unit for weight. It takes 454 grams to make 1 pound; 1 ounce equals 28 grams.

uCi - A microcurie is 1,000,000 picocuries (see picocuries for additional explanation).

ml - A milliliter is a unit of measure for volumes. There are 3785 ml in 1 gallon.

mrad - mrad is the unit of measure for dose absorbed per unit of mass. It is generally expressed in terms of a rate per hour, i.e., mrad/h.

mrem - mrem is the unit used to measure the effect of radiation doses to the body. The DOE limit is 100 mrem above background levels in any one year for members of the general public. For comparison, a typical medical x-ray is about 40 mrem. Naturally occurring radioactive substances in the ground result in an average yearly exposure to everyone in New York of about 100 mrem. To date, no difference can be detected in the health of population groups exposed to 100 mrem/yr above background levels and in the health of groups which are not exposed.

Pancake Type - A pancake-type detector primarily measures beta and gamma radiation. The detector is called a 'pancake' because it is round and fairly flat.

Picocuries - A picocurie is the unit of measure for radioactivity just as an ounce is a unit to measure weight. One picocurie means that one radioactive particle is released on the average of every 27 seconds.

Radiation - There are three primary types of radiation: alpha, beta, and gamma. Alpha radiation travels less than an inch in air before it stops. Alpha radiation cannot penetrate the outer layer of skin on the body. Beta radiation can penetrate the outer layers of skin, but cannot reach the internal organs of the body. Gamma radiation is the most penetrating type and can usually reach the internal organs. However, the gamma radiation given off by depleted uranium does not have much energy and therefore is less penetrating.

Radionuclide - A radionuclide is another word meaning a particular radioactive element. For example, uranium-235 is a radionuclide, uranium-238 is another, thorium-232 another, and so on.

Remedial Action - Remedial action is a general term used to mean "cleanup of contamination." It refers to any action required so

that a property can be released for unrestricted use as noncontaminated. In practice, this may mean removing grass and soil, cutting trees, removing asphalt, etc.

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Scabbling - Scabbling is the name of the process used to remove radioactive contamination from the upper layer of asphalt. A machine is used which grinds off the asphalt, usually the top 1/4 inch, in which the radioactive material was fixed.

Unrestricted Use - Unrestricted use means that a property can be used for any purpose without regard to the radioactivity which used to be on the property. These uses could include anything - farming, a residence, a playground, etc.

3.2 SCENARIO 2: WORKER INSIDE THE BUILDING

3.2.1 Assumptions

For the second scenario, it was assumed that a worker inside the building would be exposed only to external gamma radiation from the contaminated roof. Assumptions for estimating the potential dose to the worker inside the building are given below.

In determining the dose rate due to the roofing material, the same assumptions as were made in Scenario 1 were also used in evaluating Scenario 2. The gamma exposure rates are given in Table 3-3.

No beta-gamma radiation surveys were made inside the commercial structures. To estimate the potential dose resulting from external gamma radiation exposure to an office worker spending 3,000 h/yr (60 h/wk, 50 wk/yr) inside the building, the gamma radiation exposure rate was calculated based on conservative shielding estimates for the low-energy gamma radiation emitted by depleted uranium. The calculations in Section IV of Appendix A show that air and roofing material could be expected to attenuate roughly 75 percent of the gamma radiation.

3.2.2 External Exposure to an Office Worker From Roof Contamination

Assuming that the occupancy factor for a person working in the building is the exposure rate 1.4×10^{-3} mR/h at the work location (Table 3-3), the resulting exposure would be an annual dose of 4 mrem.

This dose is well below the DOE radiation protection standard of 100 mrem/yr and is approximately 5 percent of the natural beta-gamma background of 63 mrem/yr for the Colonie, New York, area (Ref. 9).

3.3 SCENARIO 3: ON-SITE RESIDENT

For the on-site resident scenario, there are two possible cases. The first case is that the resident occupies the building with the contaminated roof that is presently on-site. If the first case is used, the exposure due to the contamination would be calculated in a manner similar to Scenario 2. However, the occupancy factor would be approximately double that given for Scenario 2. Since the building is a large industrial structure, the assumption that the building would become a permanent residence is very unlikely.

The other possible case is that the roof is removed from the structure and contaminated material is buried on-site, becoming mixed with clean soil. Scenario 3 assumes that the contaminated soil is used in a garden and that all of the resident's grain, fruit, and vegetables are produced in the garden. This scenario, while still unlikely, represents a very conservative estimate of the dose that could result from the ingestion pathway. This case will be developed for Scenario 3.

3.3.1 Assumptions

For Scenario 3, it was assumed that the on-site resident would be exposed only to internal radiation from the ingestion of grains, fruits, and vegetables grown in contaminated soil. The assumptions for estimating the potential dose to an on-site resident are given below.

The dose resulting from exposure to external gamma radiation was calculated based on the method detailed in the supplement to the DOE guidelines (Ref. 4). Dose conversion factors used in the DOE supplement are based on data for an adult in the International Commission on Radiological Protection (ICRP) Publication 30 (Ref. 5).

Actual radionuclide concentrations in the roofing material (expressed in pCi/g) were not measured. Measurement of beta-gamma activity was considered to be the most accurate way of determining uranium concentration in the roofing material, since most of the alpha activity of the uranium that migrated into the tar would likely be shielded from measurement. The concentrations reported in Table 3-1 were calculated by converting the measured total beta-gamma activity (mR/h) values in Table 3-2 to pCi/g. This conversion procedure is explained and demonstrated in Appendix A. The calculated radionuclide concentration in the roofing material is based on isotopic analysis for depleted uranium.

The dilution factor of 10 was obtained by assuming the entire roof surface, approximately 152 m^2 (1,640 ft^2), is contaminated and that the thickness of the contaminated tar is 1 cm (0.39 in.). Thus, if the total volume of contaminated material was uniformly mixed with the soil from a 12 x 10 m garden to a depth of 15 cm (6 in.) [total volume of soil = 18 m^3 (23.5 yd^3)], a dilution of the contaminant concentration by approximately a factor of 10 would occur.

Most ingestion pathways associated with the contaminated roof are unrealistic because the contamination is fixed in place in the roofing material and the uranium oxide is fairly insoluble. This eliminates all foreseeable ingestion pathways as long as the material remains fixed in place on the roof. Removal of the roofing material still would not provide any significant pathways for exposure via ingestion. Much of the uranium would remain fixed in the roofing material and would, therefore, not be available for migration and uptake. Furthermore, the uranium oxide from the incineration of uranium metal is extremely insoluble, further reducing potential uptake.

3.3.2 Internal Exposure From Ingestion

If the equivalent of the average radionuclide concentration in roofing material, calculated on the basis of direct radiation measurements, is diluted with topsoil, the potential internal exposure from ingestion of vegetables, fruit, and grain grown in the soil would be only 1.7 mrem/yr effective dose equivalent. This calculation is conservatively based on the assumption that all the vegetables, fruit, and grain consumed (estimated at 160 kg/yr) are produced from the contaminated soil (Ref. 4).

This dose is approximately 2 percent of the DOE radiation protection standards.

4.0 SUMMARY AND CONCLUSIONS

Of the assessed pathways, the highest estimated potential dose from exposure to the contaminated roof of the commercial structure at 50 Yardboro Avenue would be received by a commercial worker inside the building. The only pathway of exposure to this worker would be the gamma radiation emanating from the roof surface. This maximum calculated potential total dose of 4 mrem/yr is approximately 4 percent of the DOE radiation protection standard of 100 mrem/yr (Ref. 2); a person living in a brick house (based on occupancy 75 percent of the time) would receive a dose of approximately 45 mrem/yr (Ref. 9).

The maximum calculated potential dose to a roofer engaged in removing the roof from the 50 Yardboro Avenue building is 0.2 mrem/yr, resulting primarily (75 percent) from exposure to external gamma radiation, as shown in Secenario 1. Exposure via the inhalation pathway would contribute approximately 25 percent of the dose. The total dose is only 0.2 percent of the DOE limit of 100 mrem/yr. The greatest potential exposure of 10 mrem/yr to the skin, which would be received by the roofer only in the event of constant skin contact with surface beta-gamma radiation, is only approximately 0.02 percent of the 50,000-mrem/yr DOE radiation protection standard for the skin (Ref. 8).

As described in Scenario 3, the likelihood of internal exposure resulting from ingestion of contaminated roofing material is minimal. However, an internal exposure of only 1.7 mrem/yr (approximately 2 percent of the radiation protection standard) would result, assuming that the maximum average concentration of radionuclides in the roofing material (at 50 Yardboro Avenue) would be diluted by a factor of 10 when mixed with garden topsoil and that a resident would obtain all his vegetables, fruit, and grain from the contaminated soil.

Each of these scenarios for all potential exposure pathways results in a dose that is well below the DOE radiation protection standard limiting the annual dose to an individual of the general public to 100 mrem.

REFERENCES

1. Letter, W. J. Condon, Bureau of Environmental Radiation Protection, New York Department of Health, to L. Campbell, Oak Ridge Operations Office, Department of Energy. February 9, 1984.

2. U.S. Department of Energy. U.S. Department of Energy Guidelines for Residual Radioactivity at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites, Revision 2, Washington, DC, March 1987.

3. Marley, J. L., Berven, B. A., and Cottrell, W. D. Results of the Radiological Survey at 50 Yardboro Avenue, Albany, New York (AL013), ORNL/RASA-84/111, Oak Ridge National Laboratory, June 1985.

4. Gilbert, T. L., et al. A Manual for Implementing Residual Radioactive Material Guidelines, Washington, D.C., January 1988 (In Press). A Supplement to U.S. Department of Energy Guidelines for Residual Radioactivity at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites.

5. International Commission on Radiological Protection. Limits for Intakes of Radionuclides by Workers, A Report of Committee 2 of the International Commission on Radiological Protection, ICRP Publ. 30, 1978.

6. Environmental Protection Agency. Proposed Guidance on Dose Limits for Persons Exposed to Transuranic Elements in the General Environment, EPA 520/4-77-016, September 1977.

7. Memorandum, R. C. Robertson, Bechtel National, Inc., to E. M. McNamee, Bechtel National, Inc., CCN 060272, March 29, 1989.

8. U.S. Department of Energy. Order 5480.11, Radiation Protection for Occupational Workers, Washington, DC, December 21, 1988.

9 Bechtel National, Inc. Colonie Interim Storage Site Annual Site Environmental Report, Colonie, New York, Calendar Year 1987, Appendix D, DOE/OR/20722-146, April 1988.

APPENDIX A

DOSE CALCULATION: PARAMETERS AND METHODOLOGY

APPENDIX A

DOSE CALCULATION: PARAMETERS AND METHODOLOGY

I. INTERNAL DOSE

A. Parameters used in calculating internal dose (committed effective dose equivalent) via inhalation and ingestion pathways

Parameter	Unit or Definition
Inhalation rate (Ref. A-1)	8,400 m^3/yr
Mass loading factor	1×10^{-4} g/m^3
Occupancy factor (Ref. A-1)	(Fraction of year spent in area)
Ingestion rate (vegetables, fruit, and grain) (Ref. A-1)	1.6×10^5 g/yr
Density of tar roof material (Ref. A-2)	1.28 g/cm^3
Concentration Factor for Uranium in Plants (B_{iv})* (Ref. A-1)	2.5×10^{-3}

*B_{iv} is the ratio of the radionuclide concentration in edible portions of the plant to the concentration in the dry soil (both in the same units) at the time of harvest.

	Dose Conversion Factors*			
Radionuclide	Ingestion (mrem/pCi)	f_1	Inhalation (mrem/pCi)	Lung Class
Uranium-238	2.55×10^{-4}	5×10^{-2}	1.18×10^{-1}	Y
Uranium-235	2.66×10^{-4}	5×10^{-2}	1.23×10^{-1}	Y
Uranium-234	2.83×10^{-4}	5×10^{-2}	1.32×10^{-1}	Y

*Dose conversion factors are for the adult. The fraction of a stable element entering the gastrointestinal tract that reaches bodily fluids is represented by f_1. Lung class for clearance of inhaled radioactive materials from the lung: Y corresponds to a retention half-time of greater than 100 days.

B. Methodology for calculating inhalation dose (Ref. A-1)

Dose (mrem/yr) = [concentration of radionuclide in tar (pCi/g)] [mass loading factor (g/m^3)] [occupancy factor] [inhalation rate (m^3/yr)] [dose conversion factor (mrem/pCi)]

C. Methodology for calculating ingestion dose (Ref. A-1)

Dose (mrem/yr) = [concentration of radionuclide in soil (pCi/g)] [concentration factor for plants (B_{iv})] [vegetable, fruit, and grain intake (g/yr)] [dose conversion factor (mrem/pCi)]

II. EXTERNAL GAMMA DOSE

A. Parameters used in calculating external gamma dose (effective dose equivalent) (Ref. A-1)

Parameter	Unit or Definition
Dose conversion factor (converts mR to effective dose equivalent in mrem)	0.95 mrem/mrad
Depth factor	1
Area factor	1
Occupancy factor	(average fraction of year spent in area)

B. Methodology for calculating external gamma dose from estimated gamma exposure rate (Ref. A-1)

Dose (mrem/yr) = [estimated gamma exposure at 1 m (mR/h)] [0.95 (dose conversion factor)] [occupancy (h/yr)]

III. CONVERSION OF MEASURED BETA-GAMMA ACTIVITY (mrad/h) TO ESTIMATED URANIUM CONCENTRATION (pCi/g):

A. Since the beta-gamma activity is due largely to the beta radiation from Pa-234m, a dose conversion factor of 3.17×10^{-3} Sv/yr/Bq/cm^2 is used in the conversion (Ref. A-4).

Example:

$$\frac{0.27\ \text{mrad}}{\text{h}} \quad \frac{1\ \text{Bq/cm}^2}{3.17\times10^{-3}\ \text{Sv/yr}} \quad \frac{\text{Sv}}{\text{Gy}} \quad \frac{1\ \text{Gy}}{10^5\ \text{mrad}} \quad \frac{8{,}760\ \text{h}}{\text{yr}} \quad \frac{60\ \text{dpm}}{\text{Bq}}$$

$$= 448\ \text{dpm/cm}^2$$

B. Total calculated concentration of depleted uranium in roofing material (Ref. A-2)

$$\text{Concentration (pCi/g)} = 448\ \text{dpm/cm}^2 \quad \frac{1}{2.22\ \text{dpm/pCi}}$$

$$\frac{1}{1\ \text{cm (depth)}} \quad \frac{1}{1.28\ \text{g/cm3 (density of roofing material)}}$$

$$= 158\ \text{pCi/g}$$

C. Depleted Uranium

Radionuclide	% of Atom	Specific Activity (Ci/g)	Total Activity (Ci/g)	% of Activity in 1 Ci of Depleted U
Uranium-238	99.79	3.3×10^{-7}	3.3×10^{-7}	76.27
Uranium-235	0.208	2.1×10^{-6}	4.5×10^{-9}	1.02
Uranium-234	0.0016	6.2×10^{-3}	9.9×10^{-8}	22.71
			4.4×10^{-7}	

IV. SHIELDING CALCULATIONS FOR DOSE TO OCCUPANT FROM EXPOSURE TO CONTAMINATION ON ROOF

Assume following shielding components:

Component	Thickness(t)(in.)	$\mu(cm^2/g)$*	$\rho(g/cm^3)$(Ref. A-2)
roofing (tar)	0.25	0.161 (carbon)	1.28
decking (wood)	0.5	0.161 (carbon)	0.6
attic air space	10.0	0.167 (air)	0.001293
ceiling (sheetrock)	0.5	0.365 (calcium)	2.31
air space in room	60.0	0.167 (air)	0.001293

$$I = I_o e^{-\Sigma\mu\rho t}$$

$$I = I_o(0.26)$$

*Assumes 80 keV average gamma energy since the majority of gamma radiation is due to thorium-234 decay (63 and 93 keV gamma rays)

DOE/OR/20722-92

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

POST-REMEDIAL ACTION REPORT FOR THE COLONIE INTERIM STORAGE SITE VICINITY PROPERTIES—1985

Colonie, New York

March 1988

Bechtel National, Inc.

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DOE/OR/20722-92

POST-REMEDIAL ACTION REPORT
FOR THE COLONIE INTERIM STORAGE SITE
VICINITY PROPERTIES - 1985
COLONIE, NEW YORK

MARCH 1988

Prepared for

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

By

Bechtel National, Inc.
Oak Ridge, Tennessee

Bechtel Job No. 14501

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ABBREVIATIONS

cpm*	counts per minute
ft	foot
ft^2	square foot
g	gram; gravity
h	hour
in.	inch
$in.^2$	square inch
μCi	microcurie
μCi/ml	microcurie per milliliter
ml	milliliter
mrad	millirad
mrad/h	millirad per hour
mrem	millirem
mrem/yr	millirem per year
pCi	picocurie
pCi/g	picocuries per gram
yr	year

*Words appearing in boldfaced print are explained in the glossary.

1.0 INTRODUCTION

The purpose of this report is to document post-remedial action sampling performed by Bechtel National, Inc. (BNI) at certain properties in the vicinity of the former National Lead (NL) Industries plant in Colonie, New York. This report briefly describes the origin of the radioactive contamination on the properties, the methods used to determine its extent, and the types of remedial action performed. It also provides the guidelines used in performing the remedial action and data on the current radiological status of the properties.

Background

The NL plant began working with depleted uranium in 1958, performing operations dealing with the casting, machining and milling of this uranium into various items. In subsequent years, the plant primarily made depleted uranium counterweights for airplanes and projectiles for the armed services. In 1980, the State of New York ordered the plant to reduce its level of production because uranium dust was being released into the air, and in the spring of 1984 operations were halted. Following plant closure, the Department of Energy (DOE) took possession of the plant to begin the cleanup process as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP) after Congress assigned the site to DOE under the 1984 Energy and Water Appropriations Act. FUSRAP is a DOE effort to identify, decontaminate, or otherwise control sites where residual radioactive contamination (exceeding current guidelines) remains from the early days of the nation's atomic energy program. Although the contamination at the Colonie properties did not result from the atomic energy program, it was included as part of FUSRAP by the DOE after Congress gave responsibility for the site to DOE. FUSRAP is currently being managed by DOE's Oak Ridge Operations Office. BNI serves as Project Management Contractor and is responsible to the DOE in the planning, management, and implementation of FUSRAP.

Radiological Surveys

Teledyne Isotopes (Ref. 1) surveyed the neighborhood surrounding the NL plant for radioactivity in 1980. Survey results indicated that uranium released into the air had become deposited on residential properties and structures and that most of the contamination was deposited in the direction of prevailing winds in the area.

Beginning in October 1983, Oak Ridge National Laboratory (ORNL) began performing more detailed radiological surveys of the individual properties surrounding the NL plant (including private residences) to identify all locations where uranium contamination exceeds DOE remedial action guidelines (Refs. 2 through 6).

2.0 REMEDIAL ACTION GUIDELINES

The cleanup guideline for the Colonie properties was derived based on site-specific information concerning the distribution of the uranium in the soil. Based on discussions with New York State and EPA officials, the DOE agreed to clean the properties to a uranium concentration of 35 pCi/g when averaged over any 10-m by 10-m area (Ref. 7). For spotty contamination, uranium concentrations should not exceed 100 pCi/g in any 1-m^2 area. All post-remedial action analysis results are reported as concentrations of uranium-238.

All soil contains trace amounts of naturally occurring radionuclides. Typically, soil contains about 1 pCi/g each of uranium, radium, and thorium. These amounts are called "background" levels, and do not originate from manufacturing operations using radioactive materials. The annual dose to a New York resident due to background radiation is typically 100 mrem.

For surfaces of structures and equipment, the radiation dose rate must be less than 0.2 mrad/h averaged over 10 ft^2 (1 m^2), or a maximum of 1.0 mrad/h in any 15-$in.^2$ (100-cm^2) area. This guideline is given in Table 1. In addition, to provide a cleanup standard for contamination on surfaces to which access is limited

(such as roofs), a supplemental guideline has been developed for selected vicinity properties. This supplemental guideline allows release of a property for unrestricted use if it is shown that the DOE radiation protection standard limiting the annual dose to an individual to 100 mrem is not exceeded. To determine whether the residual uranium contamination in the roofs would result in a dose of more than 100 mrem over a 1-year period, the doses from three potential exposure pathways were estimated. Based on the assumptions and exposure pathways considered in the analysis, the most significant route of exposure would be external gamma exposure received by individuals working inside the structures. Calculations indicate that the largest realistic annual dose would be 6 mrem, which is only 6 percent of the DOE radiation protection standard. The procedures used to calculate the estimated potential doses from the various pathways evaluated are contained in the hazard assessment report being prepared by BNI. Once compliance with these guidelines has been demonstrated, a property can be released for unrestricted use.

3.0 REMEDIAL ACTION

After a property was determined to be contaminated based on the ORNL survey, BNI began engineering design work based on the survey data (Ref. 8). BNI and its radiological support subcontractor, Thermo Analytical/Eberline (TMA/E), then performed another radiological survey to more precisely define the boundaries of contamination.

BNI/EAC Survey Methods

To conduct this survey, each property was subdivided into grids that were typically 6 ft by 6 ft. At each grid intersection, a radiation measurement was made using a Field Instrument for Detecting Low Energy Radiation (FIDLER). The FIDLER is a special type of instrument that can detect the very low-energy gamma radiation emitted by depleted uranium. The FIDLER was calibrated by measuring the radioactivity in the soil on the former NL plant site using the FIDLER, then removing the soil and having its uranium

content determined by TMA/E under laboratory conditions. From this calibration, it was determined that a FIDLER reading of 10,500 cpm represented a uranium concentration of 35 pCi/g in the soil (Ref. 9). The calibration line is shown in Figure 1. The FIDLER measurements were checked periodically by taking a soil sample and analyzing it at the TMA/E laboratory to ensure that the calibration remained consistent. The areas of above-guideline contamination were mapped by plotting all readings exceeding 10,500 cpm (Ref. 10).

To determine whether surfaces other than soil were contaminated (e.g., gutters, asphalt, concrete, or wood), a pancake-type beta-gamma detector was used. This detector was calibrated so that the readings in cpm could be converted into mrad/h and compared to the appropriate guideline. In general, radioactive contamination of building or structure surfaces was found only on properties immediately adjacent to the former NL plant. It was usually found on rough surfaces (e.g., wood or asphalt) where it had become trapped and would not wash off. In all cases, uranium contamination was found only on the outer surfaces of these materials.

Cleanup/Decontamination Activities

Drawings showing the extent of the contamination in the soil on each property were then given to the excavation subcontractor. The subcontractor removed the soil from the areas indicated, placed it in covered boxes, and transported it to the former NL plant, where it is being stored until a permanent disposal site is selected for this material. The shaded areas in Figures 2 through 26 indicate the limits of contamination and excavation for each property. The depth of most excavations was less than 3 in. The uranium released during plant operations was insoluble (i.e., would not dissolve in water) and was deposited in the top few inches of the soil. In a few cases, excavation was slightly deeper because the uranium had washed further down into the soil and had become deposited around roots of trees and shrubs. During excavation, the subcontractor was required to keep all areas free from dust and to avoid spilling the contaminated soil onto any clean areas. Personnel trained in

radiation protection observed all operations to ensure that safety procedures were followed. In addition, on-site remedial action activities were observed by New York state officials. Air monitoring showed that airborne uranium concentrations were below DOE guideline of 5×10^{-12} µCi/ml for uranium-238 in air (Ref. 11). Of the fifty-eight measurements obtained, concentrations ranged from 0.0007×10^{-12} to 0.8×10^{-12} µCi/ml.

Removal of contamination in areas other than soil was also required in order to comply with DOE remedial action guidelines for surface contamination. Methods used to remove this contamination included vacuuming of asphalt, scabbling of asphalt on two properties, and cleaning and replacement of gutters on seven properties. The notes on Figures 2 through 26 indicate the types remedial action performed.

4.0 POST-REMEDIAL ACTION SAMPLING

After the uranium-containing soil was removed, another radiological survey was conducted to ensure that the property was indeed clean; i.e., that there were no uranium-238 concentrations in excess of 35 pCi/g. This survey used two techniques. First, another FIDLER scan of the excavated areas was performed. If the FIDLER showed some remaining contamination, more soil was removed until the FIDLER indicated levels below 35 pCi/g. After each FIDLER scan, 15-cm-(6-in.-) deep soil samples were collected and analyzed by TMA/E. This process continued until the samples exhibited contamination levels below 35 pCi/g. In addition to the sampling performed by BNI for DOE, New York State officials performed an independent survey of some properties as they were cleaned.

The numbered locations in Figures 2 through 26 show where soil samples were collected after the cleanup had been performed. Tables 2 through 25 show the uranium-238 concentrations remaining at those locations after the completion of remedial action. Use of the "less than" (<) notation in reporting results indicates that the radionuclide was not present in concentrations that are quantitative with the instruments and techniques used. The less than value

represents the lower bound of the quantitative capacity of the instrument and technique used and is based on various factors, including the volume, size, and weight of the sample; the type of detector used; the counting time, and the background count rate. The actual concentration of the radionuclide is less than the value indicated. In addition, since radioactive decay is a random process, a correlation between the rate of disintegration and a given radionuclide concentration cannot be precisely established. For this reason, the exact concentration of the radionuclide cannot be determined. As such, each value that can be quantitatively determined has an associated uncertainty term ($\pm$), which represents the amount by which the actual concentration can be expected to differ from the value given in the table. The uncertainty term has an associated confidence level of 95 percent.

For those cases where surfaces other than soil required remedial action, the pancake beta-gamma detector was used to perform another survey after removal of the contaminated surface. If no additional contamination in excess of DOE guidelines was found, the surface was restored (when necessary) as indicated by the notes on the figures.

5.0 POST-REMEDIAL ACTION STATUS

As shown in Tables 2 through 25, analysis of the samples taken after removing the radioactive soil shows that there is no area where radioactive contamination exceeds the remedial action guideline of 35 pCi/g for uranium (when averaged over a 10-m^2 by 10-m^2 area) agreed upon by the State of New York and DOE (Ref. 7). An independent review of the remedial action performed by BNI on the subject properties was been conducted by the Oak Ridge Associated Universities Radiological Site Assessment Program to verify the data supporting the adequacy of the remedial action and to confirm the that the site is in compliance with remedial action guidelines agreed upon by the State of New York and DOE. Based on all data collected, these parcels conform to all applicable radiological guidelines established for release of these properties for unrestricted use (Ref. 12).

TABLE 1

REMEDIAL ACTION GUIDELINES FOR STRUCTURE SURFACES

Indoor/Outdoor Structure Surface Contamination

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

[a]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.

[b]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.

[c]Measurements of average contamination 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.

[d]The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h and 1.0 mrad/h, respectively, at 1 cm.

[e]The maximum contamination level applies to an area of not more than 100 cm^2.

[f]The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, measuring the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of surface area less than 100 cm^2 is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. The numbers in this column are maximum amounts.

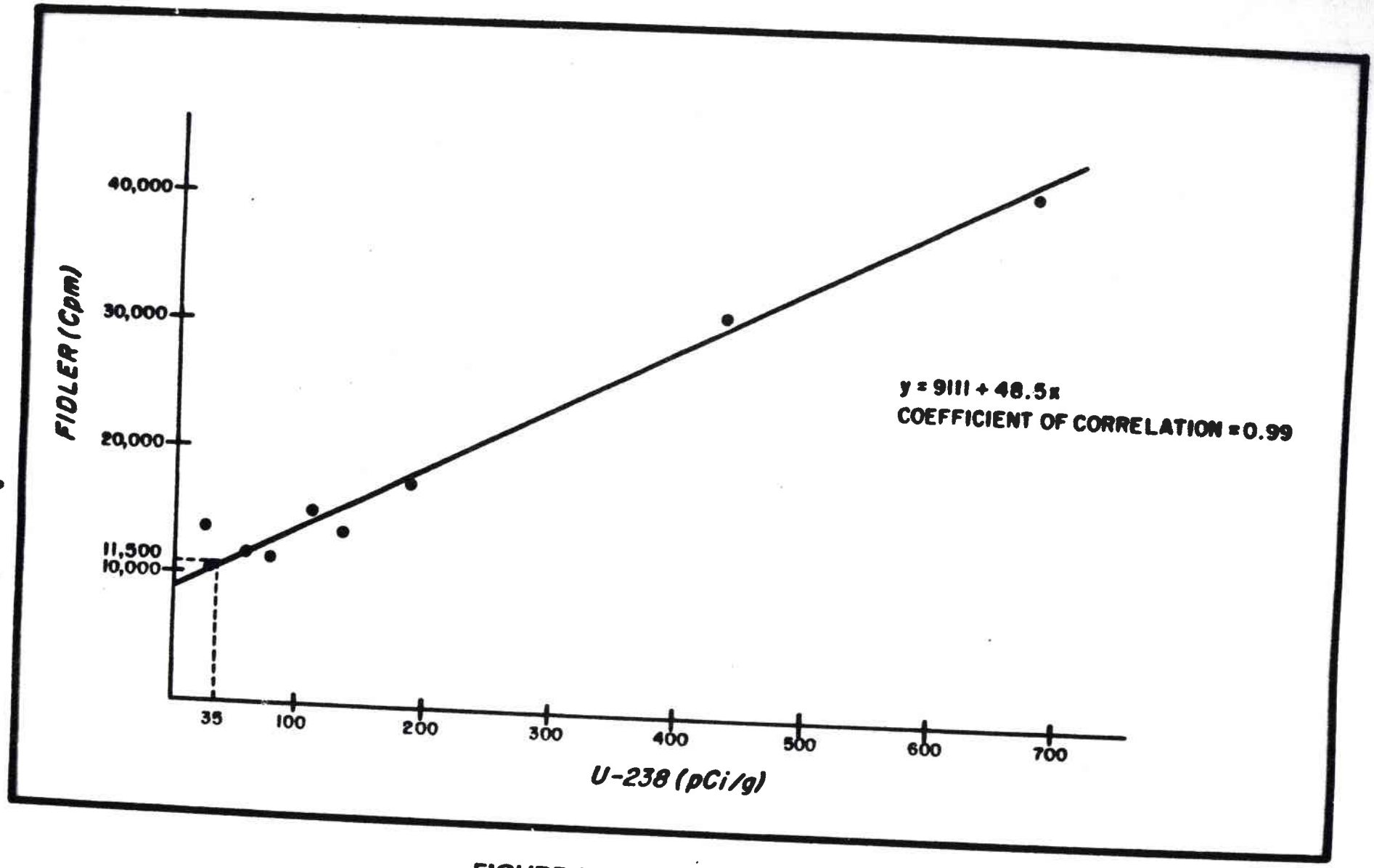


FIGURE 1 FIDLER CALIBRATION

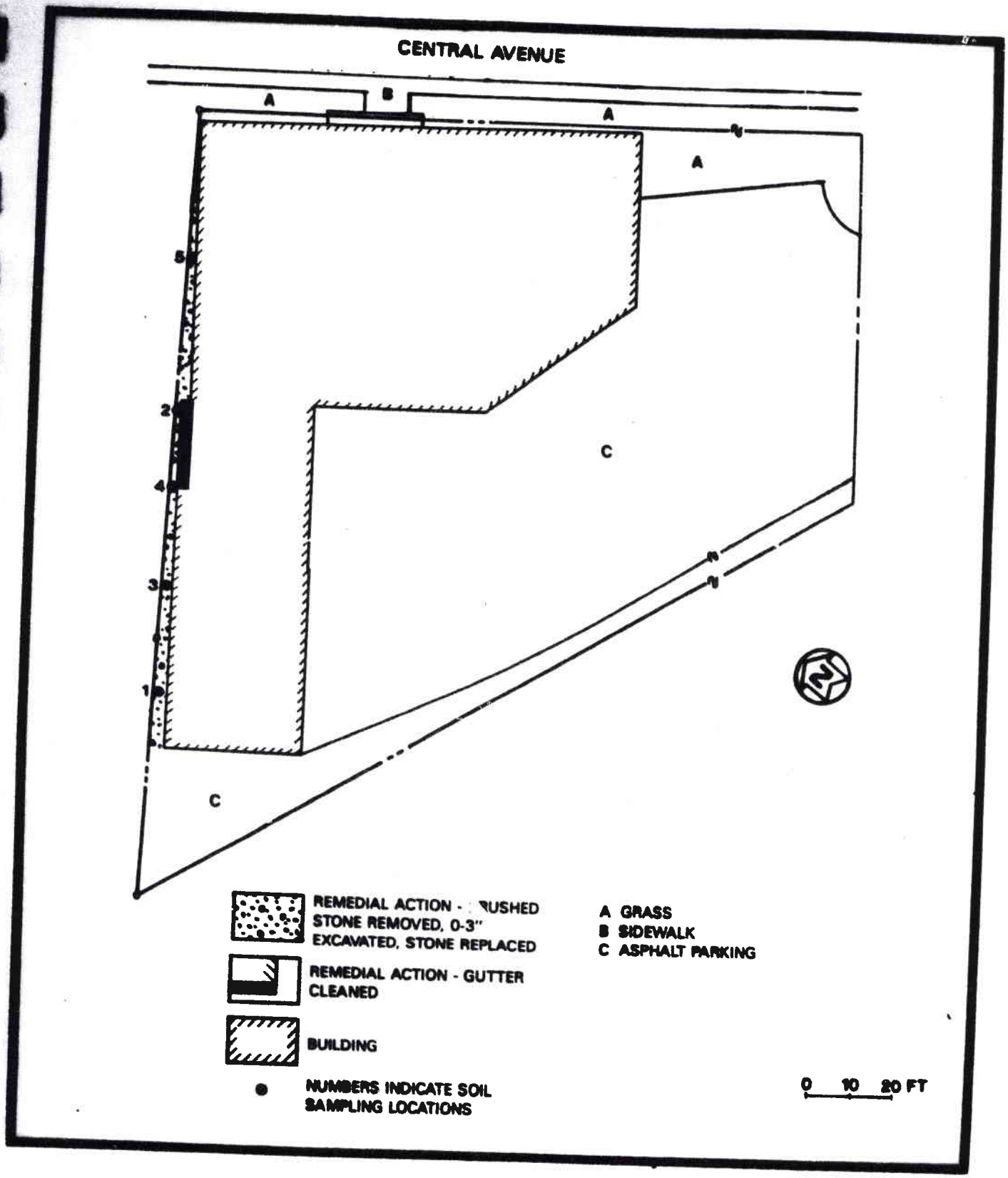


FIGURE 2 REMEDIAL ACTION AT 1100 CENTRAL AVENUE

TABLE 2

POST-REMEDIAL ACTION SAMPLING RESULTS
1100 CENTRAL AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	13.3 ± 5.0
2	22.1 ± 1.7
3	16.0 ± 1.4
4	32.6 ± 5.1
5	3.3 ± 0.5

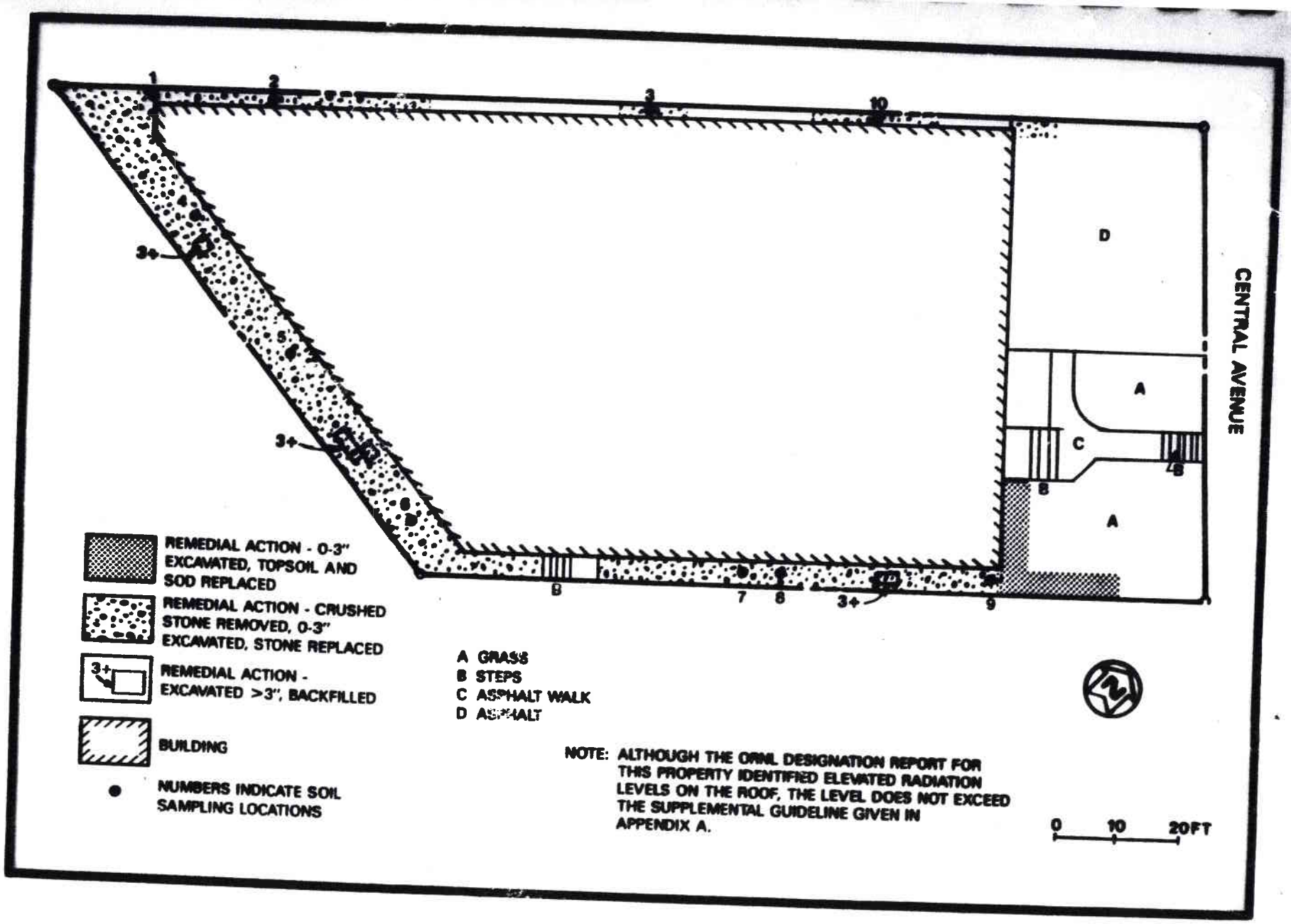


FIGURE 3 REMEDIAL ACTION AT 1104 CENTRAL AVENUE

TABLE 3

POST-REMEDIAL ACTION SAMPLING RESULTS

1104 CENTRAL AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	2.2 ± 0.6
2	2.4 ± 2.2
3	15.0 ± 3.0
4	11.1 ± 4.9
5	5.3 ± 1.4
6	26.7 ± 1.3
7	38.3 ± 0.7*
8	27.7 ± 5.5
9	3.3 ± 0.5
10	3.0 ± 0.6

*Sample meets 35-pCi/g guideline when averaged over a 100-m^2 area.

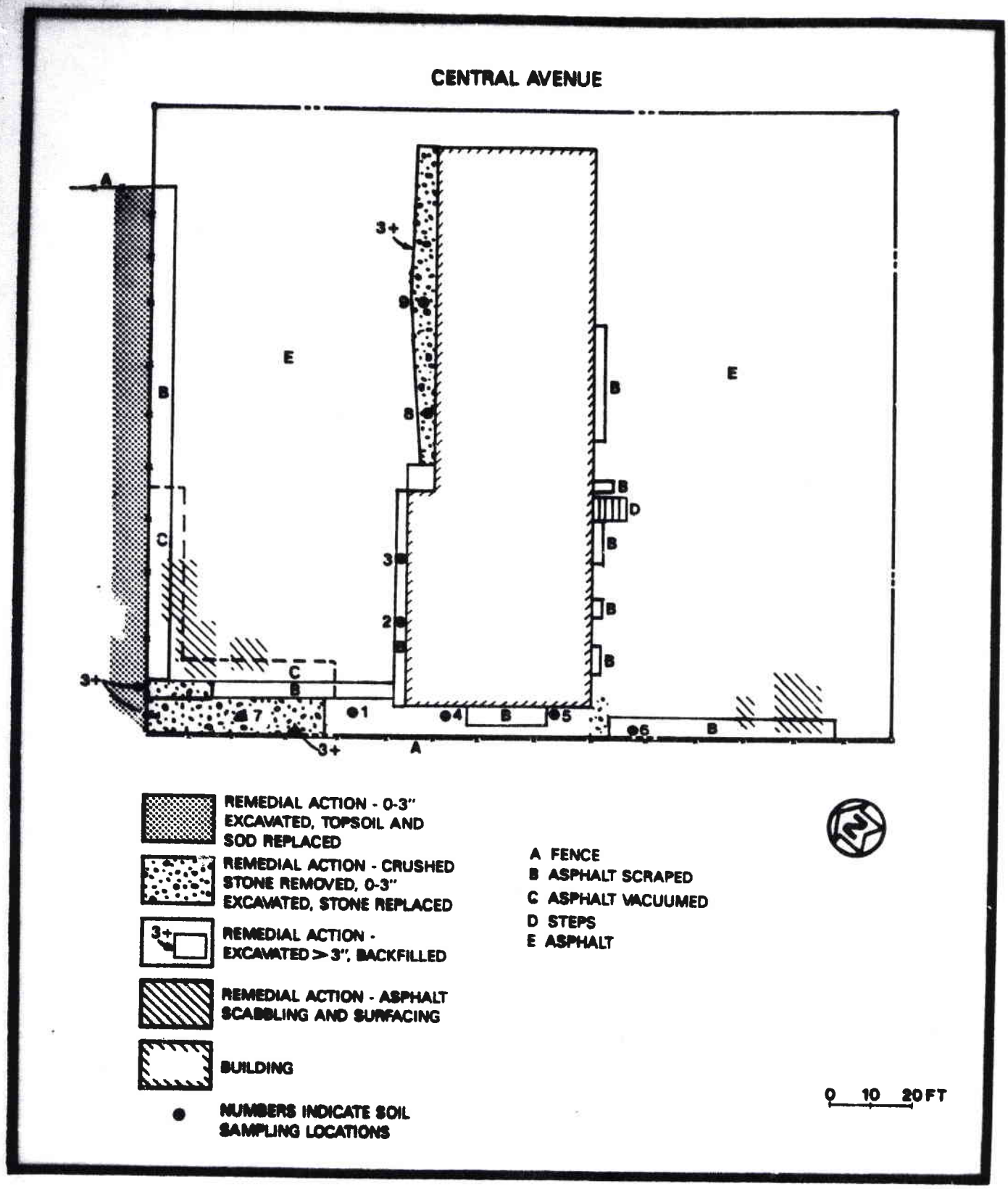


FIGURE 4 REMEDIAL ACTION AT 1118 CENTRAL AVENUE

TABLE 4

POST-REMEDIAL ACTION SAMPLING RESULTS
1118 CENTRAL AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	20.0 ± 4.0
2	2.9 ± 1.7
3	2.6 ± 0.3
4	1.7 ± 0.9
5	3.8 ± 1.1
6	29.6 ± 4.1
7	2.2 ± 0/2
8	<1.5
9	3.8 ± 2.5

SURFACE CONTAMINATION MONITORING

Type of Surface	Number of Measurements*	Average mrad/h	Range mrad/h
Asphalt	305	0.09	0.04-0.13

*The measurements were based on a 1-m grid with measurements taken on contact at the four corners and in the center of the grid block. The measurements were taken in the areas where the asphalt was remediated.

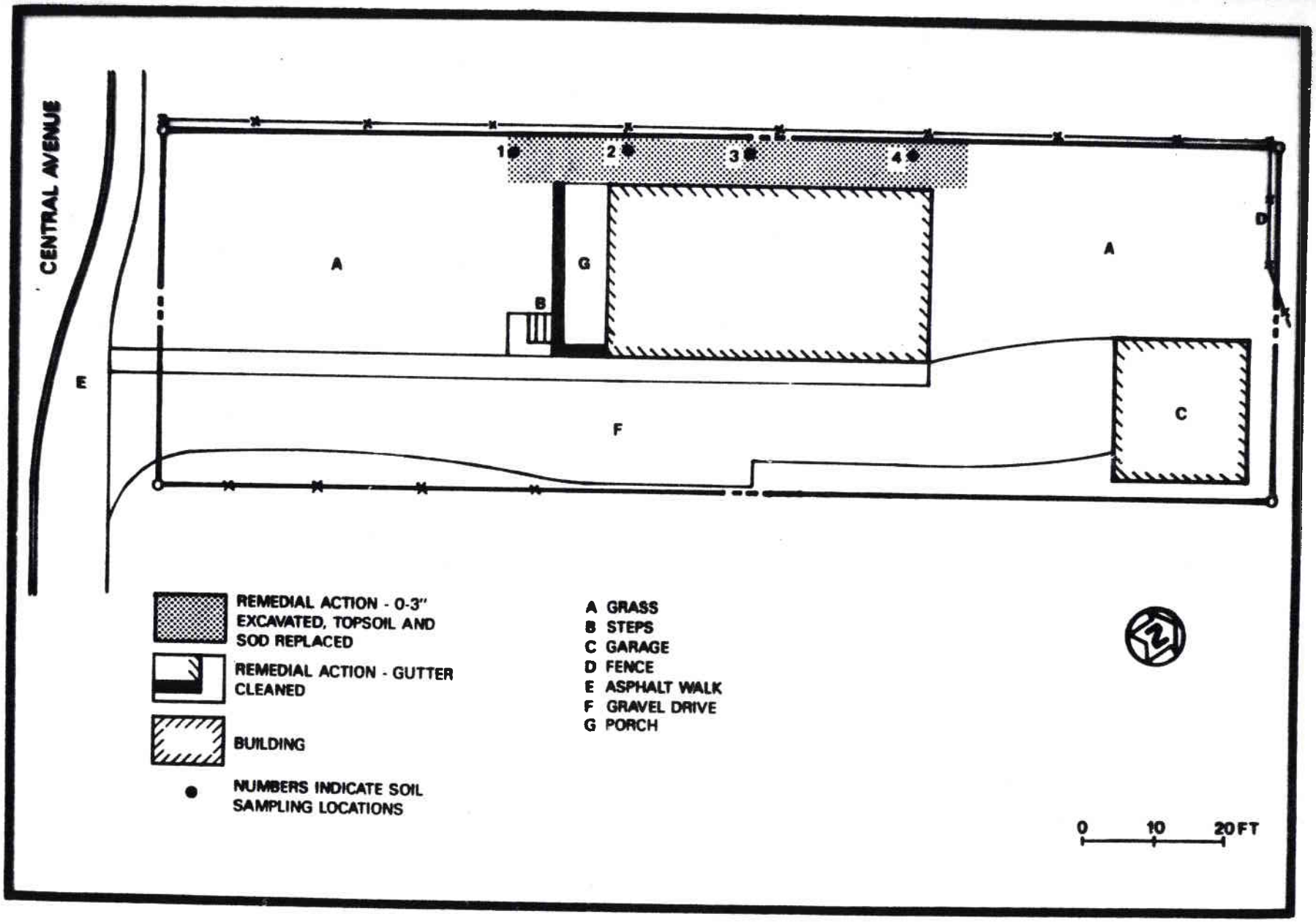


FIGURE 5 REMEDIAL ACTION AT 1129 CENTRAL AVENUE

TABLE 5

POST-REMEDIAL ACTION SAMPLING RESULTS
1129 CENTRAL AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	1.1 ± 0.8
2	0.5 ± 1.0
3	<0.9
4	<1.2

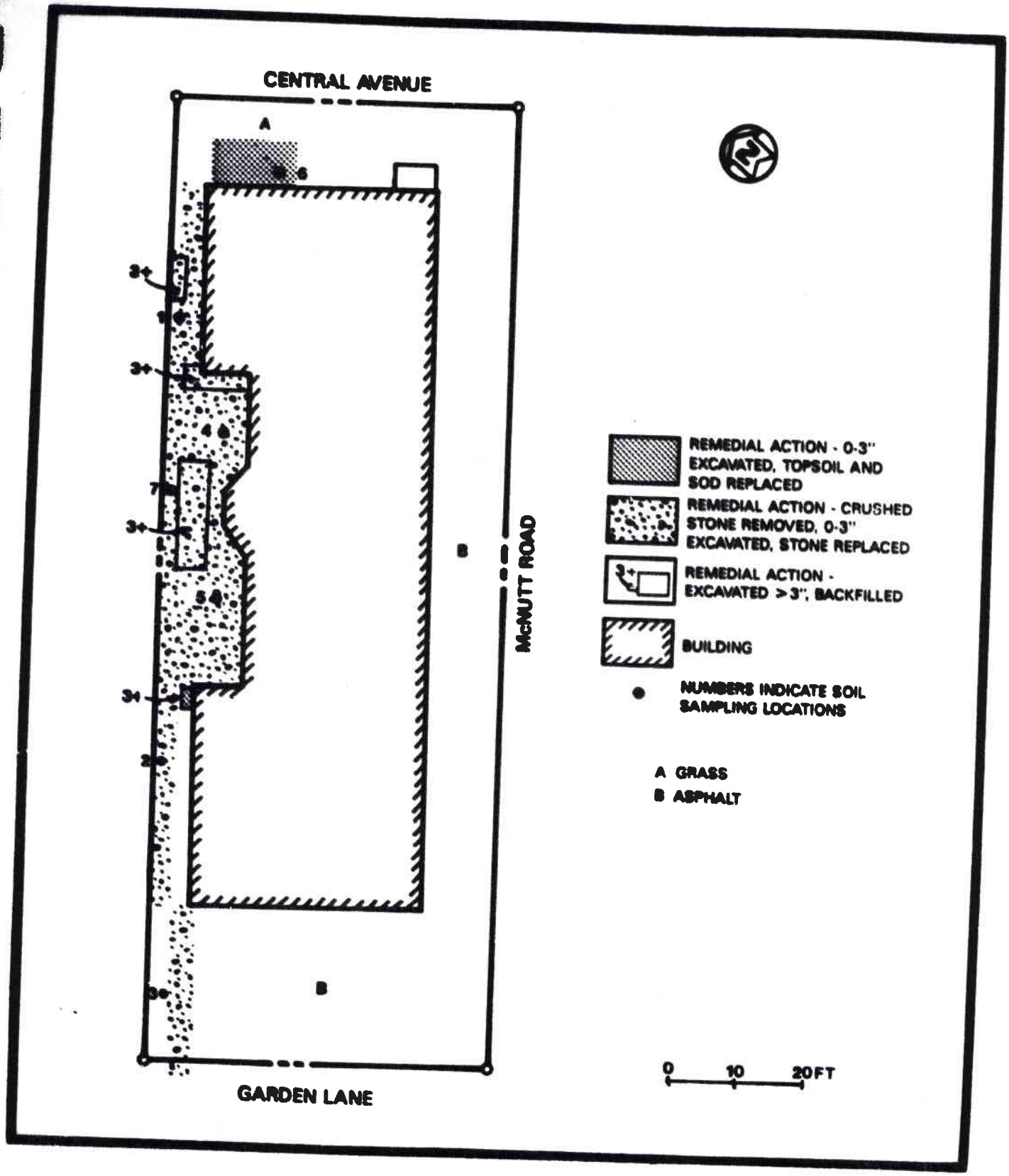


FIGURE 6 REMEDIAL ACTION AT 1146 CENTRAL AVENUE

TABLE 6

POST-REMEDIAL ACTION SAMPLING RESULTS
1146 CENTRAL AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	5.7 ± 2.2
2	11.5 ± 1.6
3	5.5 ± 1.4
4	7.0 ± 0.2
5	7.1 ± 1.1
6	10.2 ± 4.2
7	19.6 ± 4.5

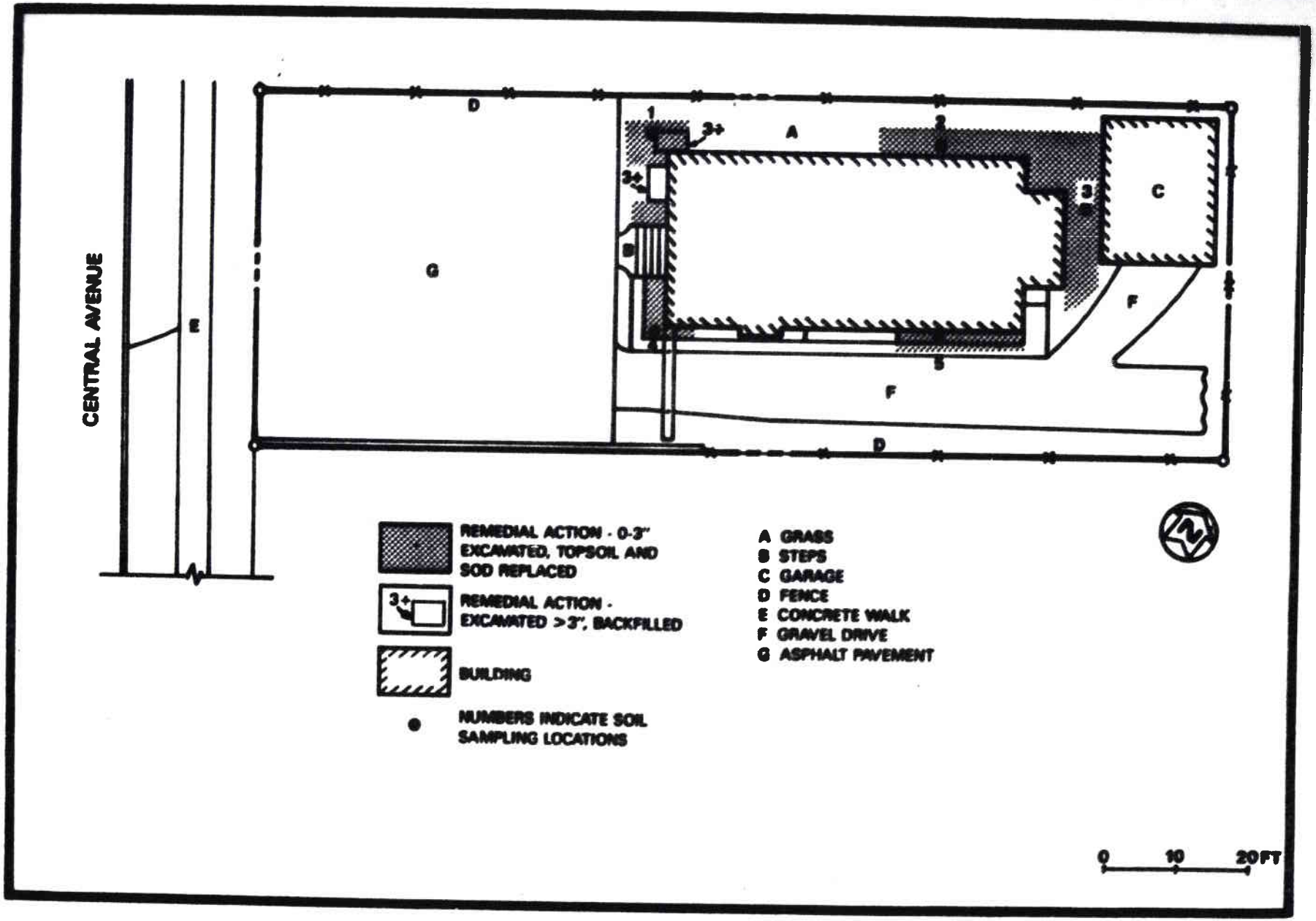


FIGURE 7 REMEDIAL ACTION AT 1147 CENTRAL AVENUE

TABLE 7

POST-REMEDIAL ACTION SAMPLING RESULTS
1147 CENTRAL AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	2.0 ± 0.3
2	2.7 ± 0.7
3	1.0 ± 0.5
4	3.1 ± 0.1
5	2.8 ± 1.1

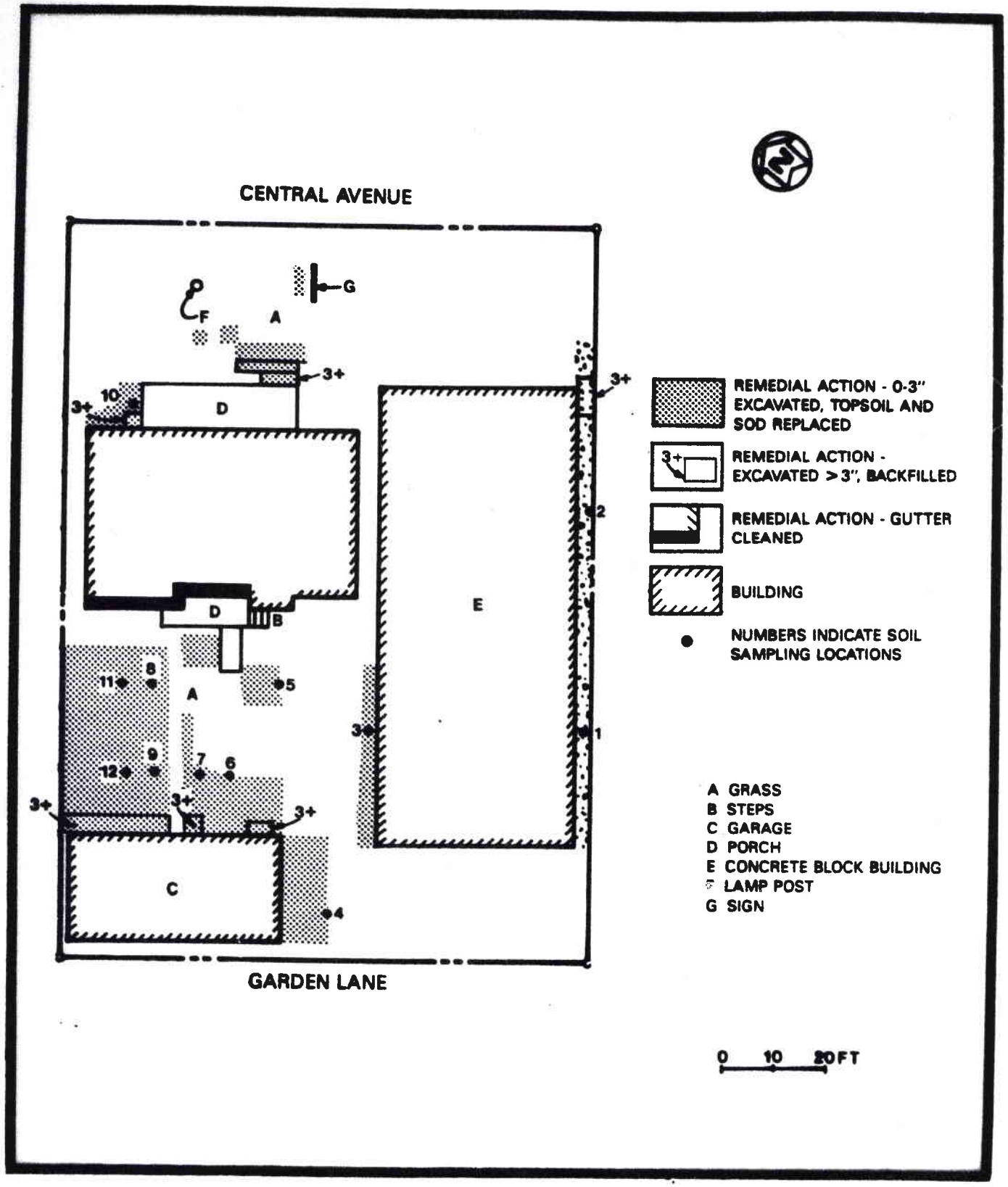


FIGURE 8 REMEDIAL ACTION AT 1148 CENTRAL AVENUE

TABLE 8

POST-REMEDIAL ACTION SAMPLING RESULTS
1148 CENTRAL AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	11.5 ± 1.6
2	11.6 ± 4.5
3	23.6 ± 4.4
4	20.2 ± 5.5
5	14.3 ± 1.5
6	20.2 + 6.4
7	15.5 ± 7.8
8	15.3 ± 3.2
9	7.8 ± 3.7
10	2.1 ± 0.3
11	13.6 ± 3.0
12	17.2 ± 3.9

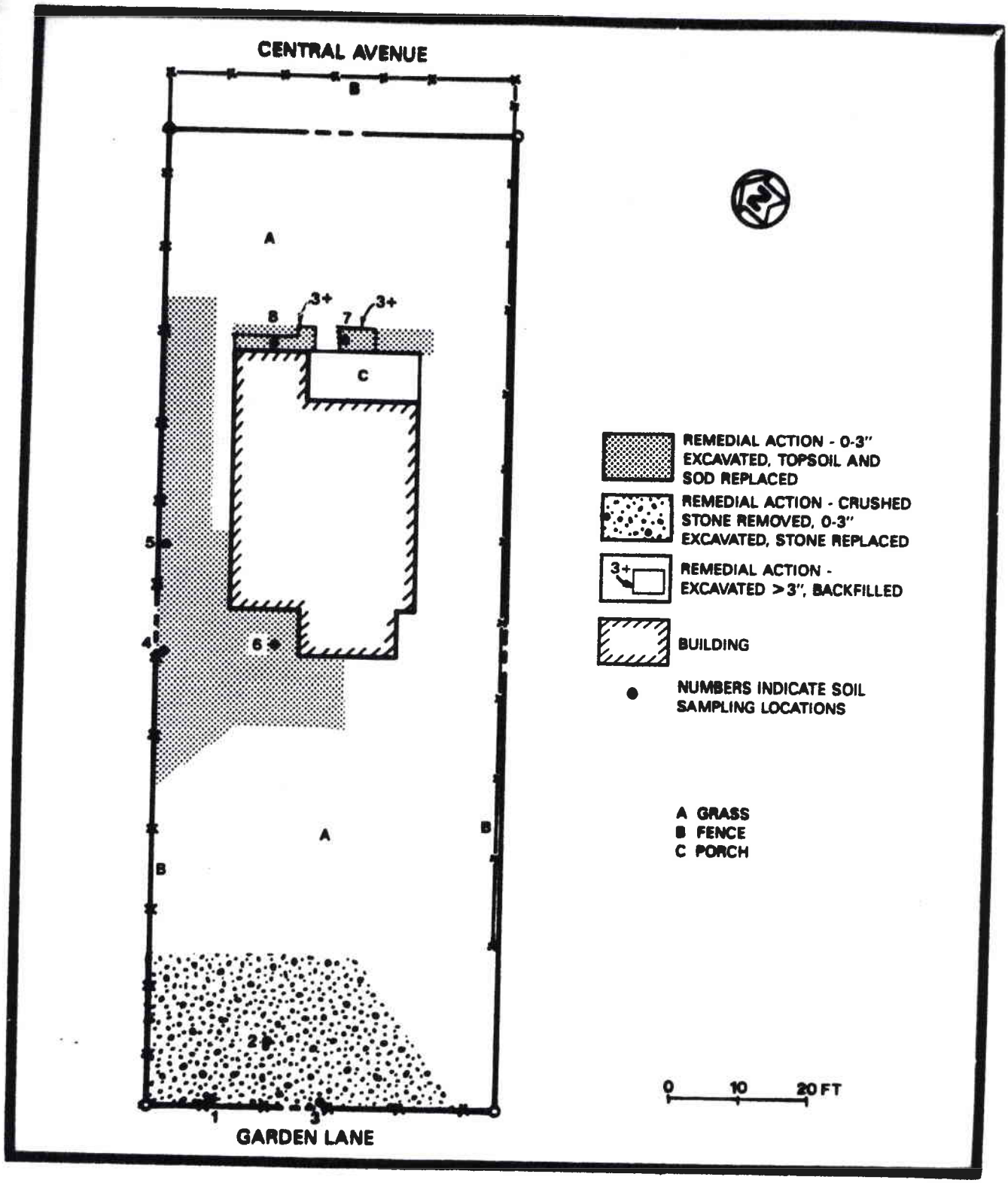


FIGURE 9 REMEDIAL ACTION AT 1150 CENTRAL AVENUE

TABLE 9

POST-REMEDIAL ACTION SAMPLING RESULTS
1150 CENTRAL AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	1.7 ± 1.7
2	2.8 ± 0.1
3	3.8 ± 1.3
4	12.6 ± 4.2
5	20.8 ± 4.9
6	5.9 ± 1.2
7	17.7 ± 7.8
8	2.5 ± 2.8

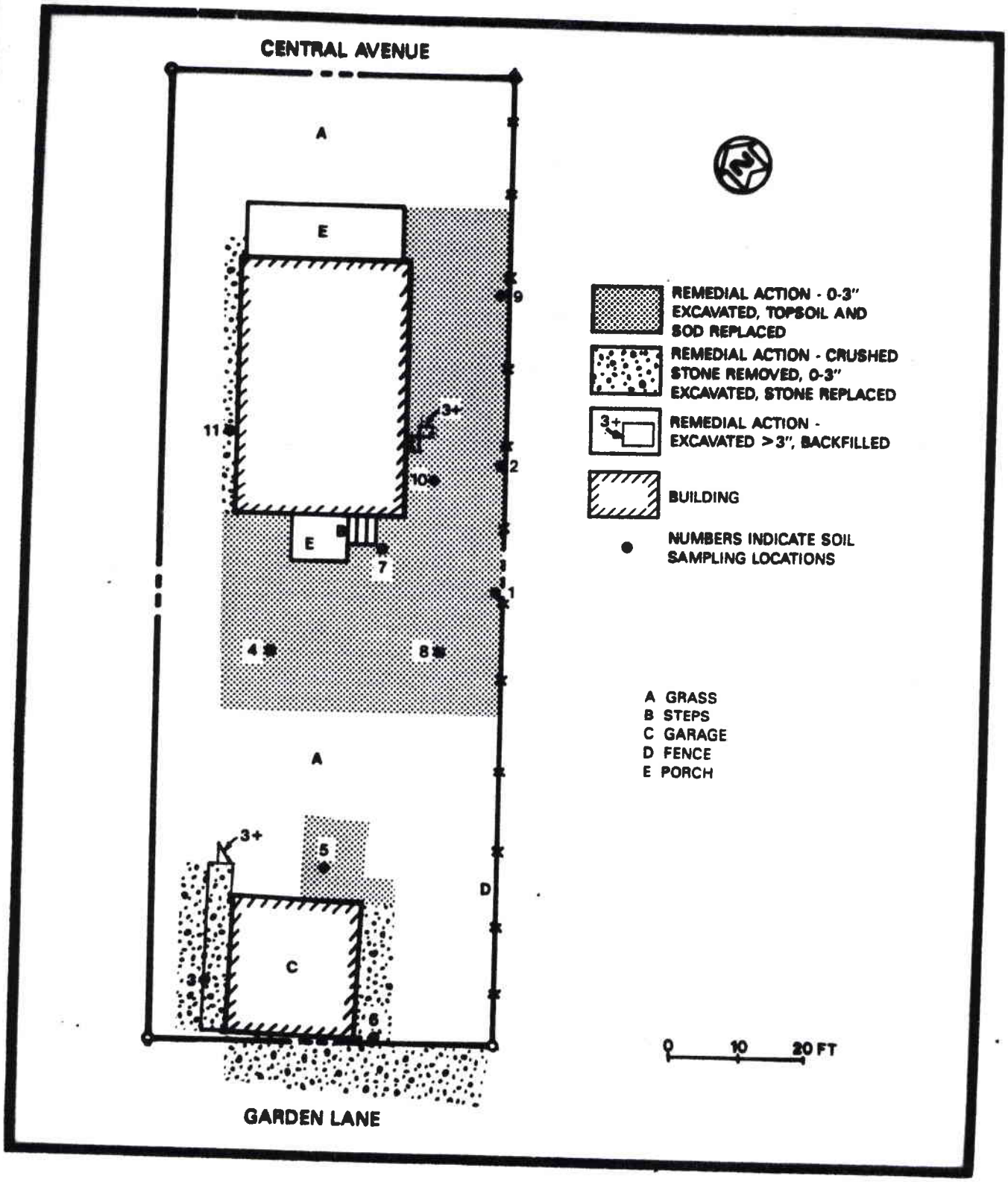


FIGURE 10 REMEDIAL ACTION AT 1152 CENTRAL AVENUE

TABLE 10

POST-REMEDIAL ACTION SAMPLING RESULTS
1152 CENTRAL AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	12.6 ± 4.2
2	20.8 ± 4.9
3	9.4 ± 2.6
4	13.1 ± 4.5
5	16.8 ± 6.5
6	15.7 ± 5.4
7	33.3 ± 8.0
8	2.2 ± 1.1
9	1.3 ± 0.9
10	11.3 ± 3.7
11	1.5 ± 0.2

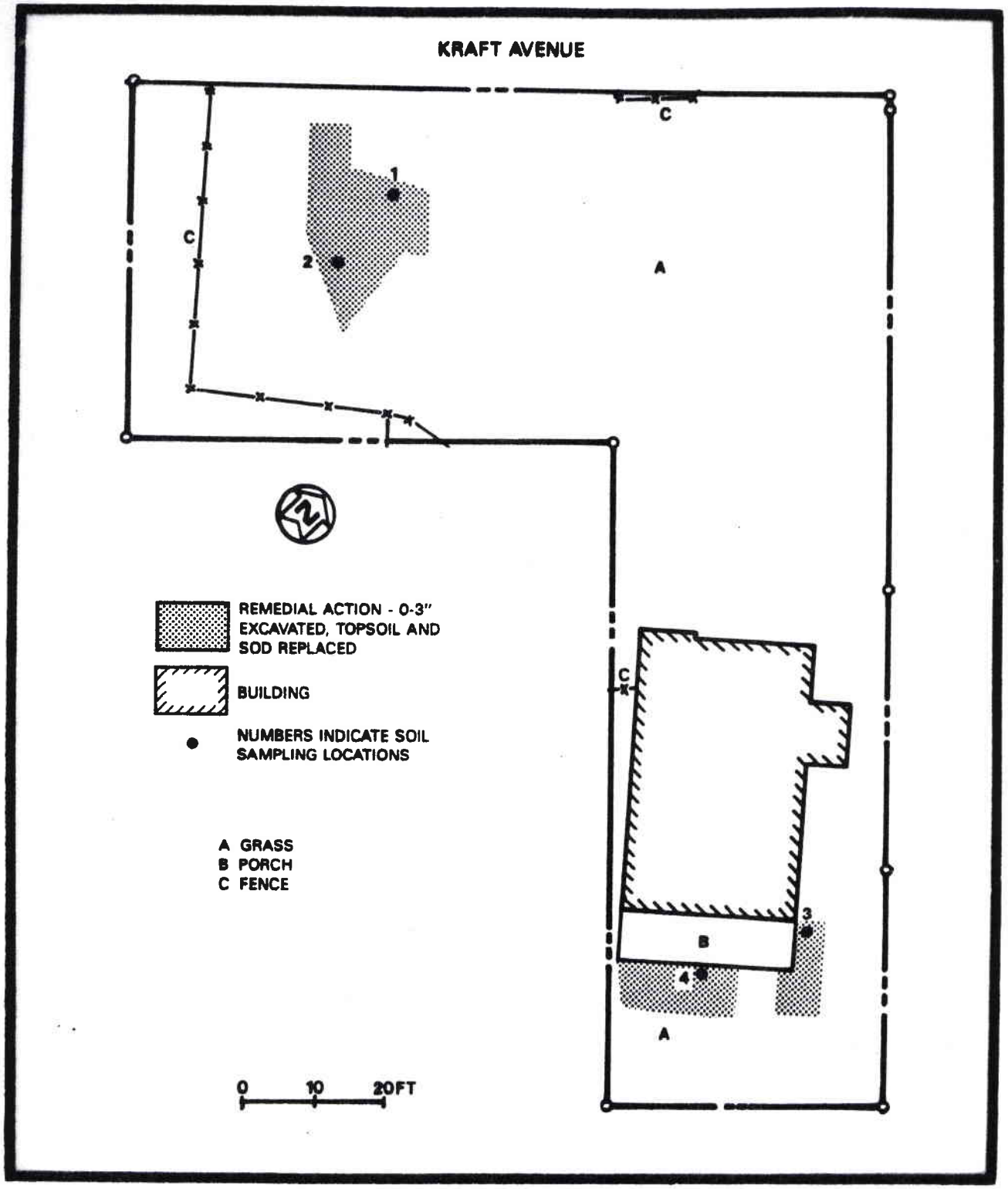


FIGURE 11 1160 (AL021) CENTRAL AVENUE

TABLE 11

POST-REMEDIAL ACTION SAMPLING RESULTS
1160 (AL021) CENTRAL AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	8.7 ± 0.1
2	4.1 ± 1.7
3	18.5 ± 0.2
4	5.0 ± 1.0

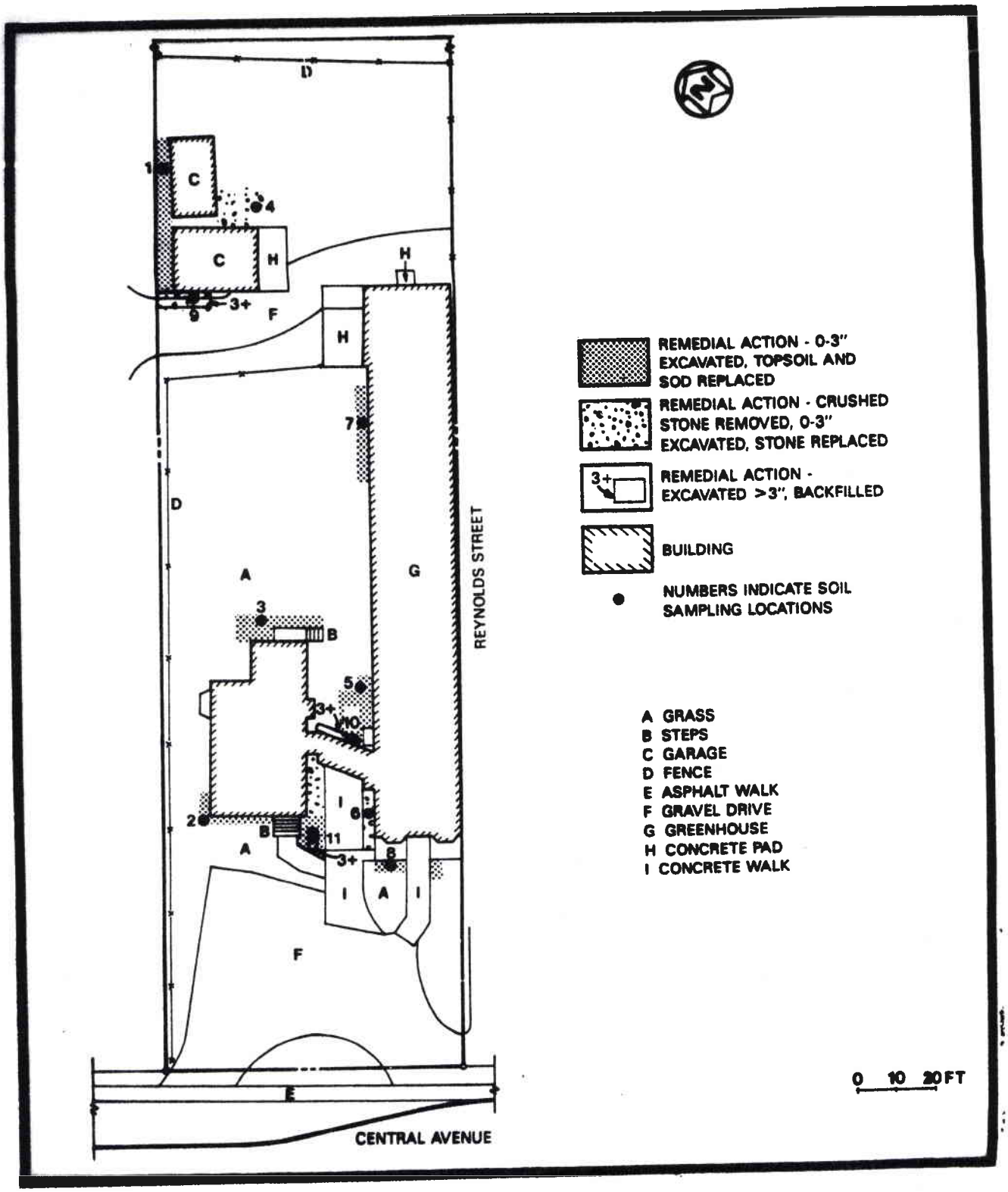


FIGURE 12 REMEDIAL ACTION AT 1161 CENTRAL AVENUE

TABLE 12

POST-REMEDIAL ACTION SAMPLING RESULTS
1161 CENTRAL AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	<1.7
2	2.0 ± 0.7
3	1.4 ± 0.3
4	11.2 ± 1.2
5	6.3 ± 0.3
6	21.3 ± 3.2
7	2.8 ± 0.9
8	5.5 ± 1.3
9	1.1 ± 0.9
10	1.3 ± 0.8
11	1.0 ± 0.8

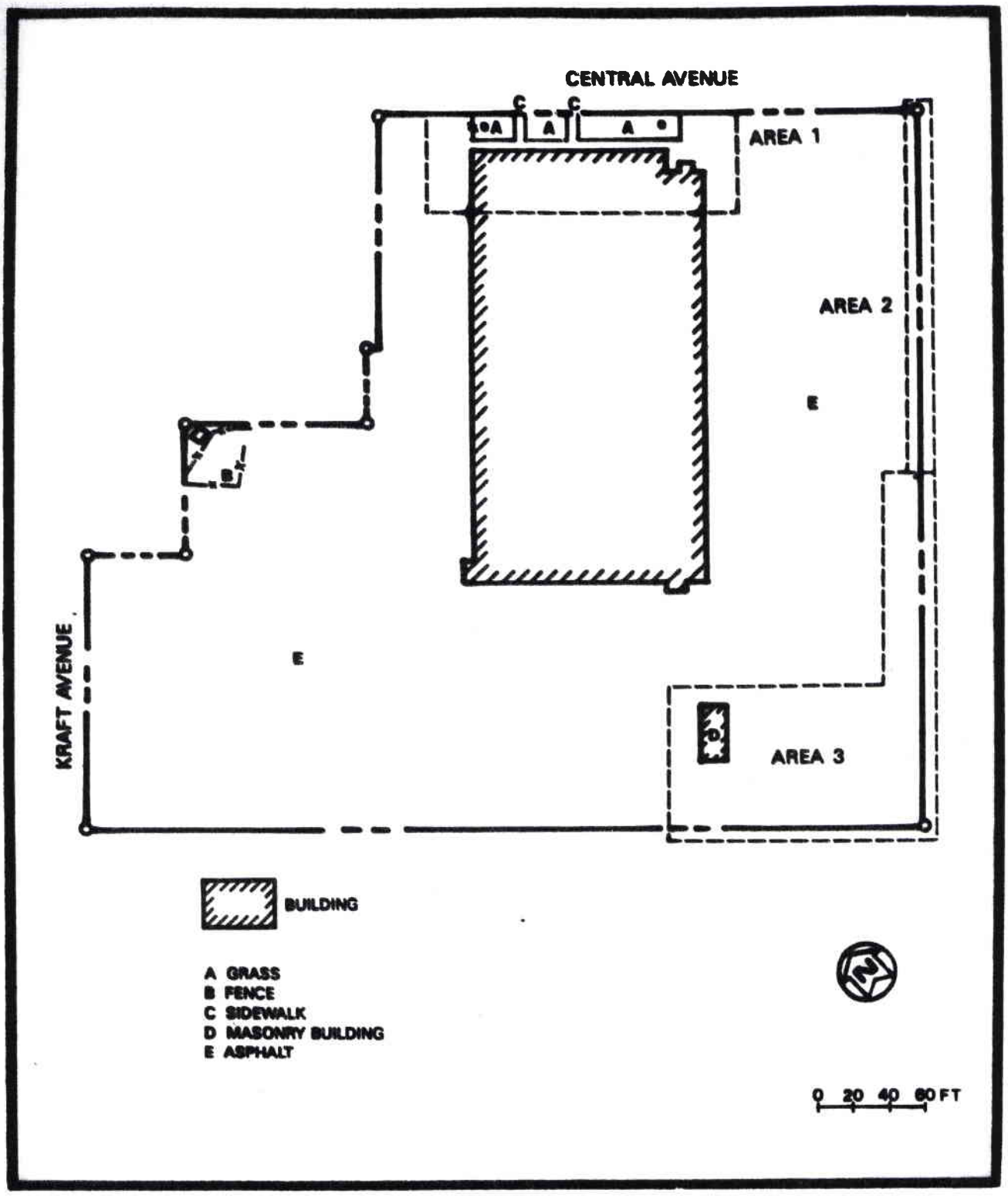


FIGURE 13 PROPERTY LAYOUT AT 1160/1162 (AL020) CENTRAL AVENUE

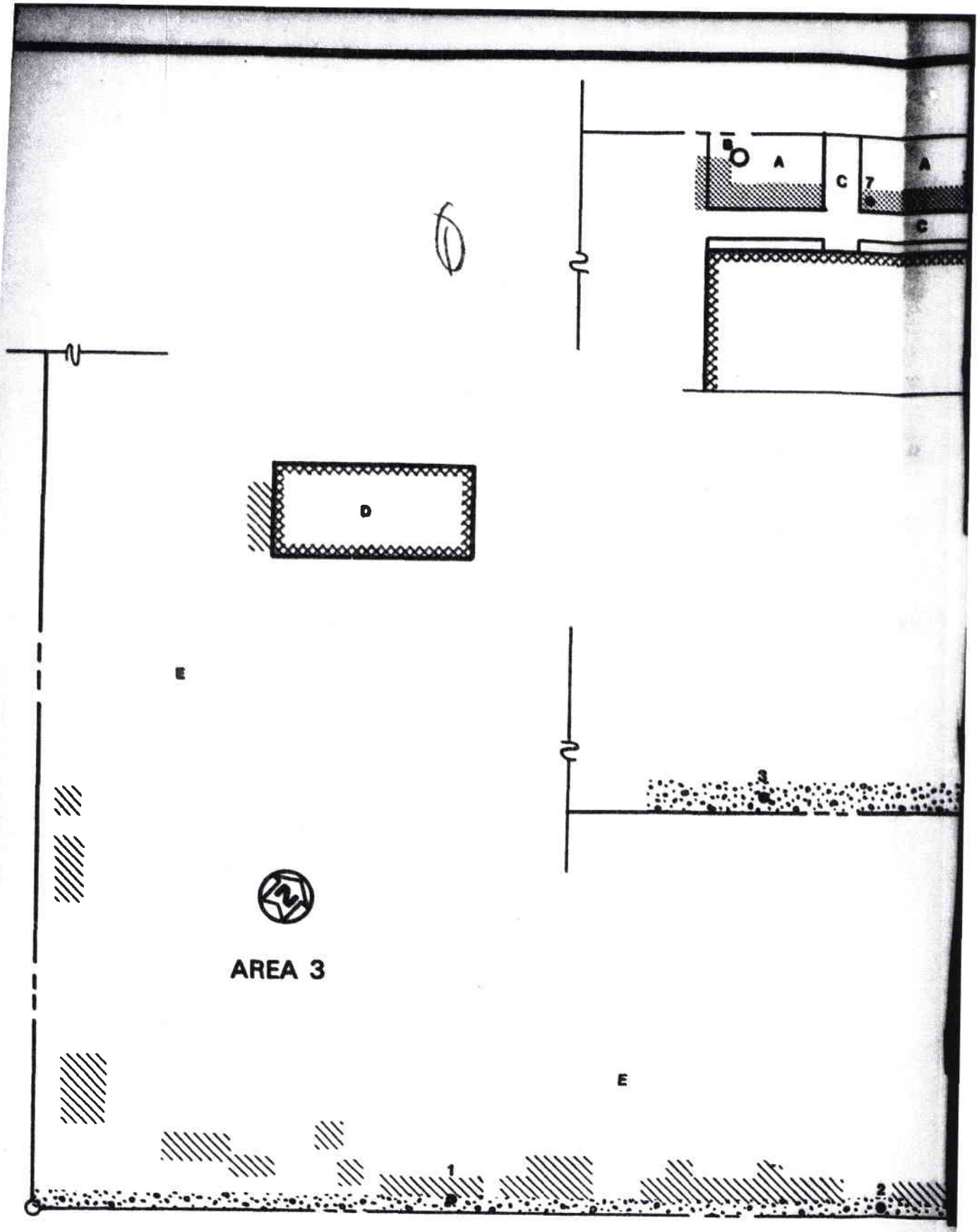
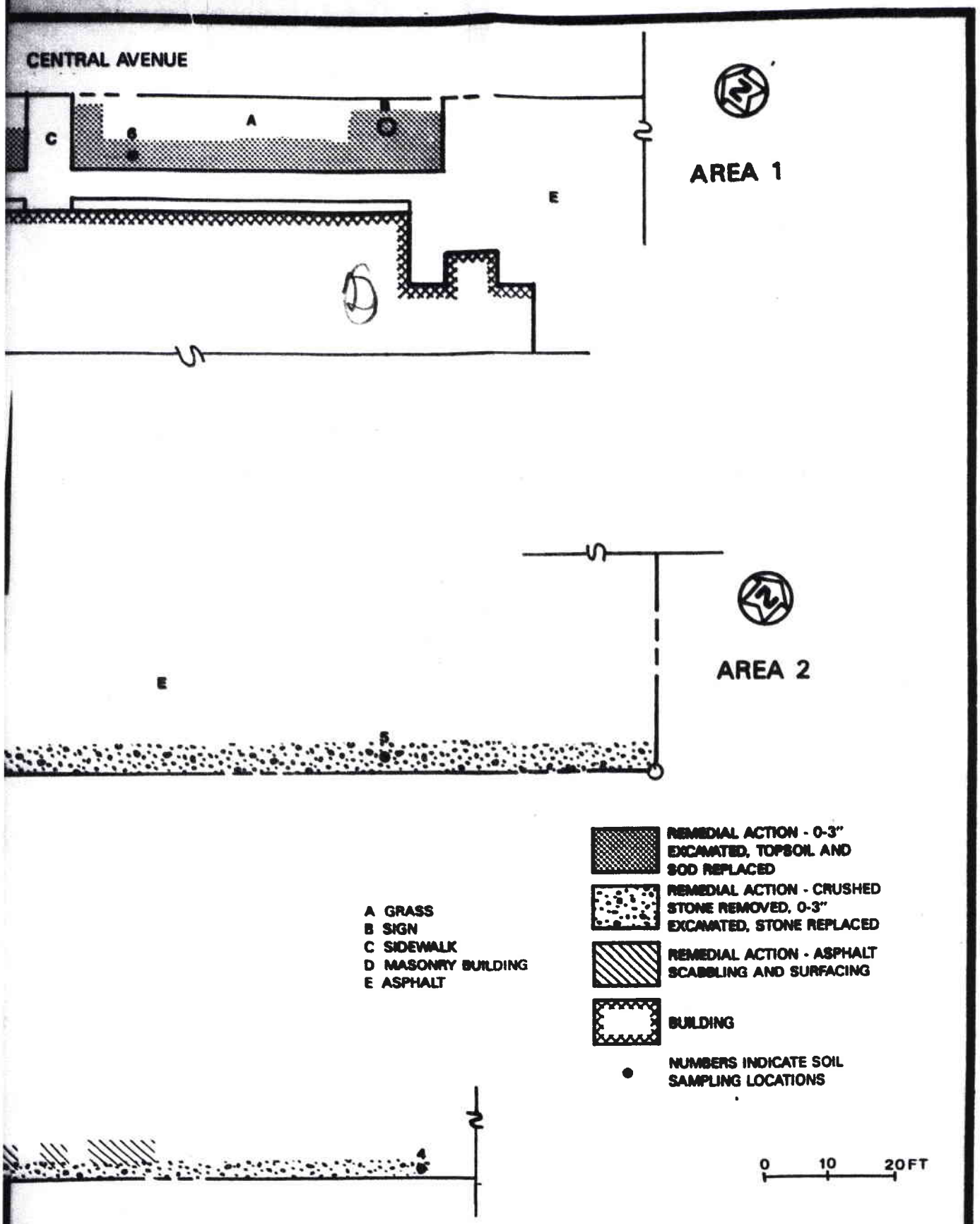


FIGURE 14 REMEDIAL ACTION AT 1160
AREAS 1, 2, AND 3



/1162 (AL020) CENTRAL AVENUE,

TABLE 13

POST-REMEDIAL ACTION SAMPLING RESULTS
1160/1162 (AL020) CENTRAL AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	13.2 ± 5.0
2	17.8 ± 6.3
3	13.2 ± 2.3
4	3.6 ± 1.2
5	17.5 ± 6.6
6	12.8 ± 0.9
7	14.2 ± 0.3

SURFACE CONTAMINATION MONITORING

Type of Surface	Number of Measurements*	Average mrad/h	Range mrad/h
Asphalt	315	0.07	0.04-0.12

*The measurements were based on a 1-m grid with measurements taken on contact at the four corners and in the center of the grid block. The measurements were taken in the areas where the asphalt was remediated.

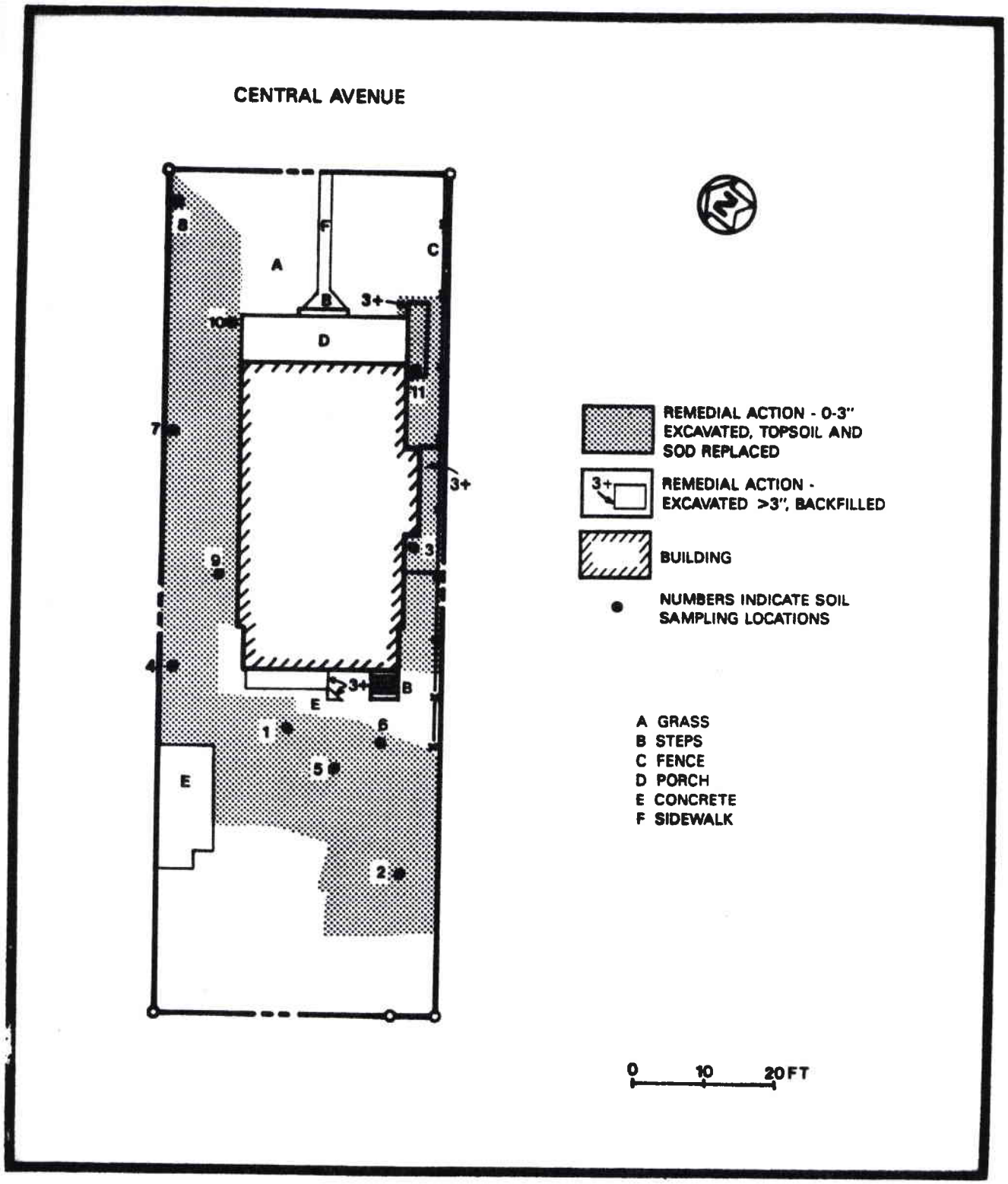


FIGURE 15 REMEDIAL ACTION AT 1166 CENTRAL AVENUE

TABLE 14

POST-REMEDIAL ACTION SAMPLING RESULTS
1166 CENTRAL AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	1.5 ± 0.9
2	2.1 ± 0.1
3	6.8 ± 1.7
4	7.0 ± 1.4
5	4.6 ± 0.5
6	8.9 ± 5.1
7	2.8 ± 1.2
8	12.1 ± 2.2
9	12.1 ± 5.7
10	28.5 ± 8.3
11	9.8 ± 3.5

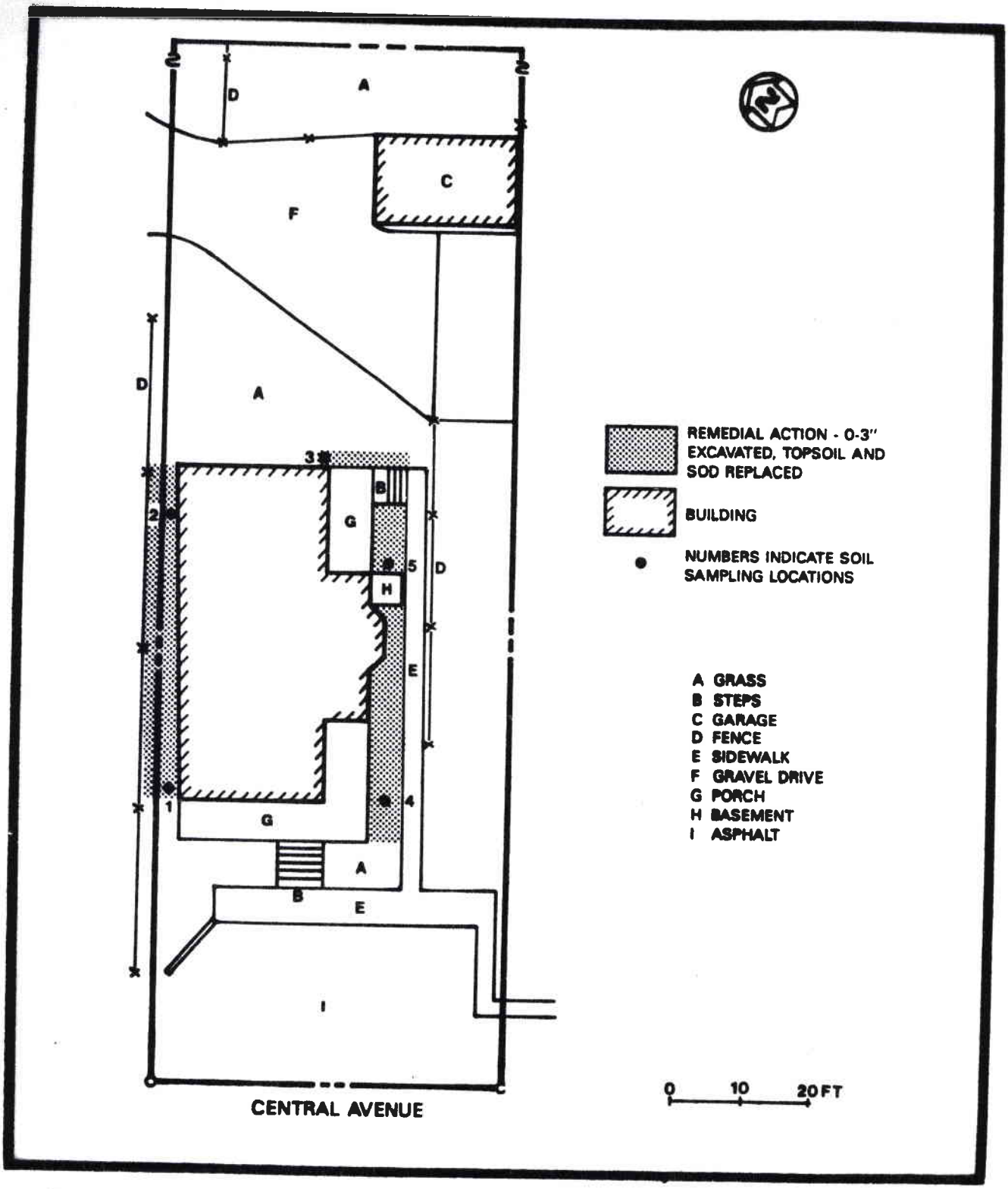


FIGURE 16 REMEDIAL ACTION AT 1167 CENTRAL AVENUE

TABLE 15

POST-REMEDIAL ACTION SAMPLING RESULTS
1167 CENTRAL AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	2.6 ± 1.1
2	1.8 ± 1.2
3	4.4 ± 1.2
4	4.4 ± 0.2
5	3.0 ± 1.1

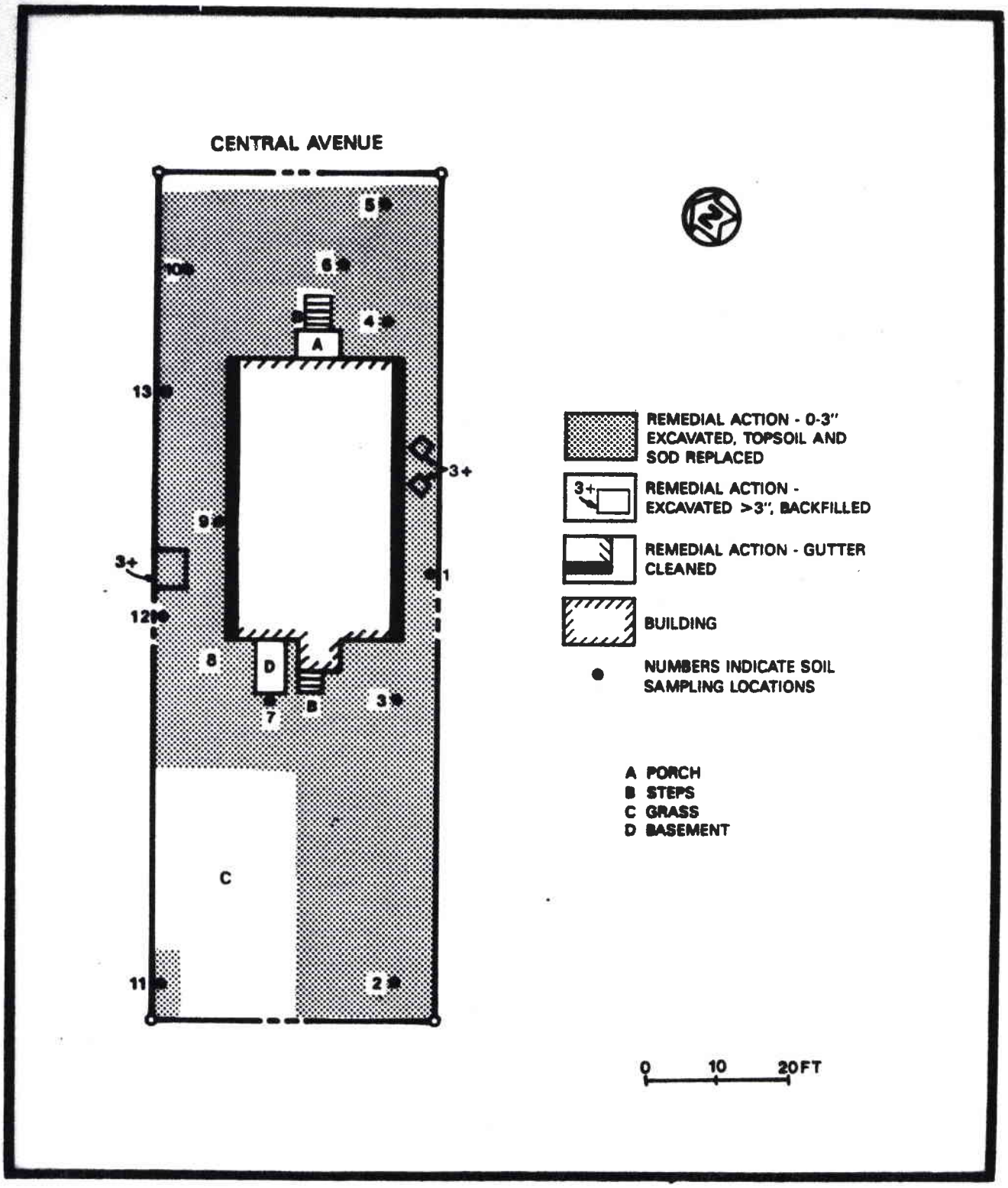


FIGURE 17 REMEDIAL ACTION AT 1168 CENTRAL AVENUE

TABLE 16

POST-REMEDIAL ACTION SAMPLING RESULTS
1168 CENTRAL AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	14.7 ± 0.9
2	1.4 ± 1.1
3	13.7 ± 4.2
4	1.4 ± 0.9
5	8.2 ± 2.2
6	5.1 ± 1.7
7	4.7 ± 1.7
8	4.9 ± 1.1
9	2.6 ± 1.3
10	8.0 ± 3.5
11	10.1 ± 5.7
12	2.3 ± 0.9
13	6.8 ± 3.3

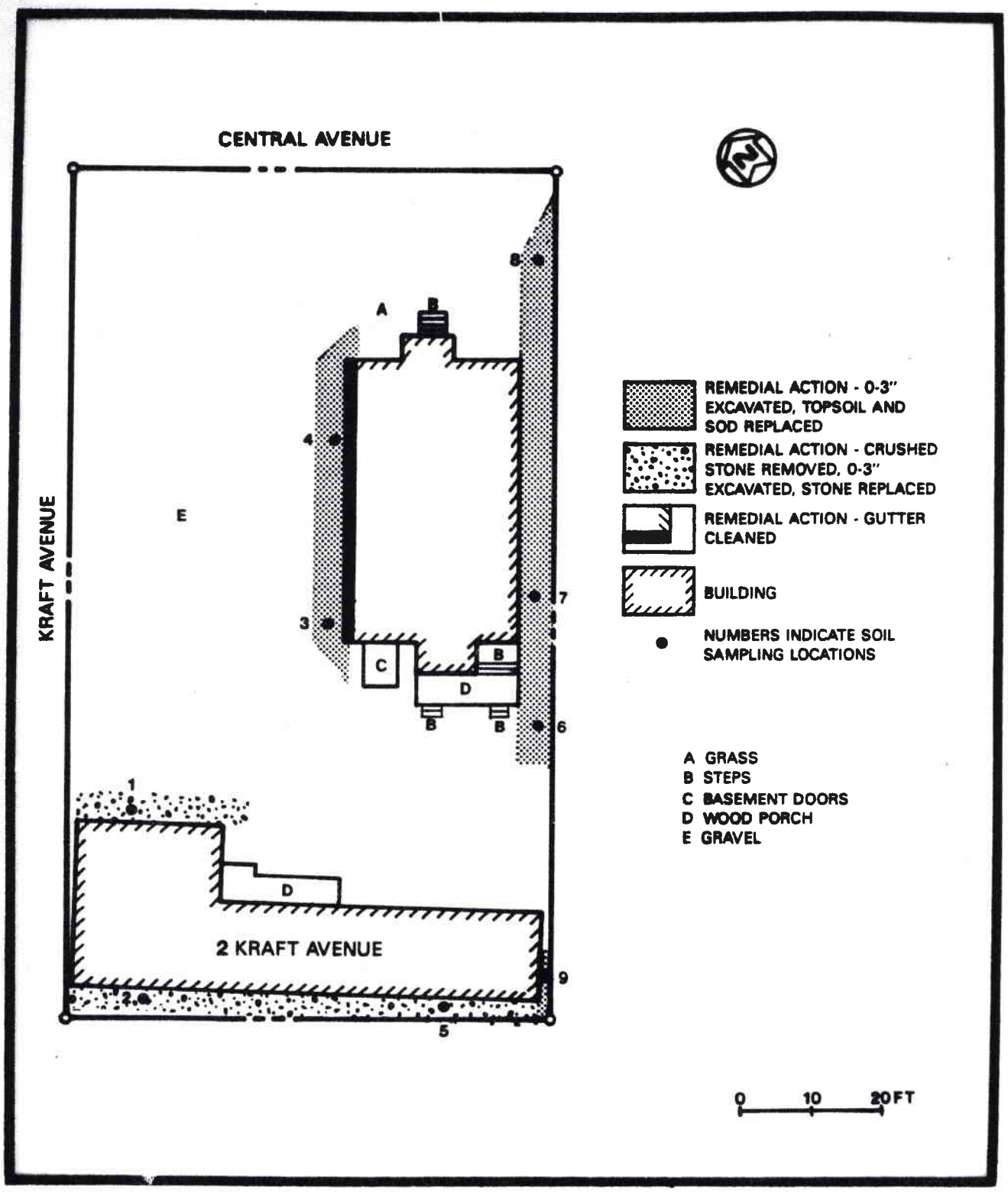


FIGURE 18 REMEDIAL ACTION AT 1170 CENTRAL AVENUE

TABLE 17

POST-REMEDIAL ACTION SAMPLING RESULTS
1170 CENTRAL AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	3.2 ± 0.2
2	15.4 ± 1.5
3	5.9 ± 0.1
4	1.6 ± 0.4
5	2.9 ± 1.2
6	5.0 ± 0.7
7	3.4 ± 0.9
8	8.7 ± 0.2
9	5.0 ± 0.1

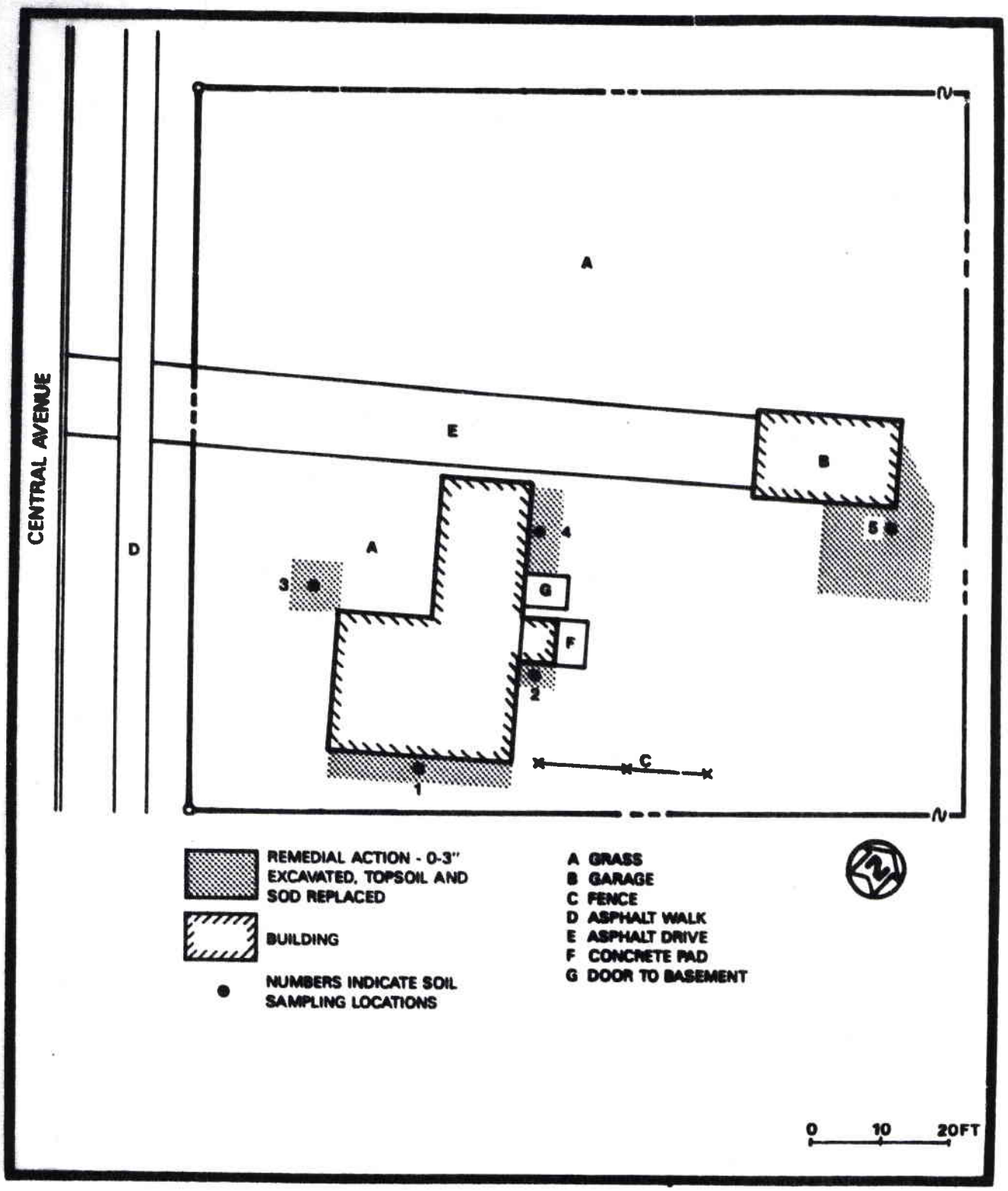


FIGURE 19 REMEDIAL ACTION AT 1185 CENTRAL AVENUE

TABLE 18

POST-REMEDIAL ACTION SAMPLING RESULTS
1185 CENTRAL AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	1.0 ± 0.7
2	<1.3
3	1.6 ± 1.1
4	1.4 ± 0.4
5	2.2 ± 1.1

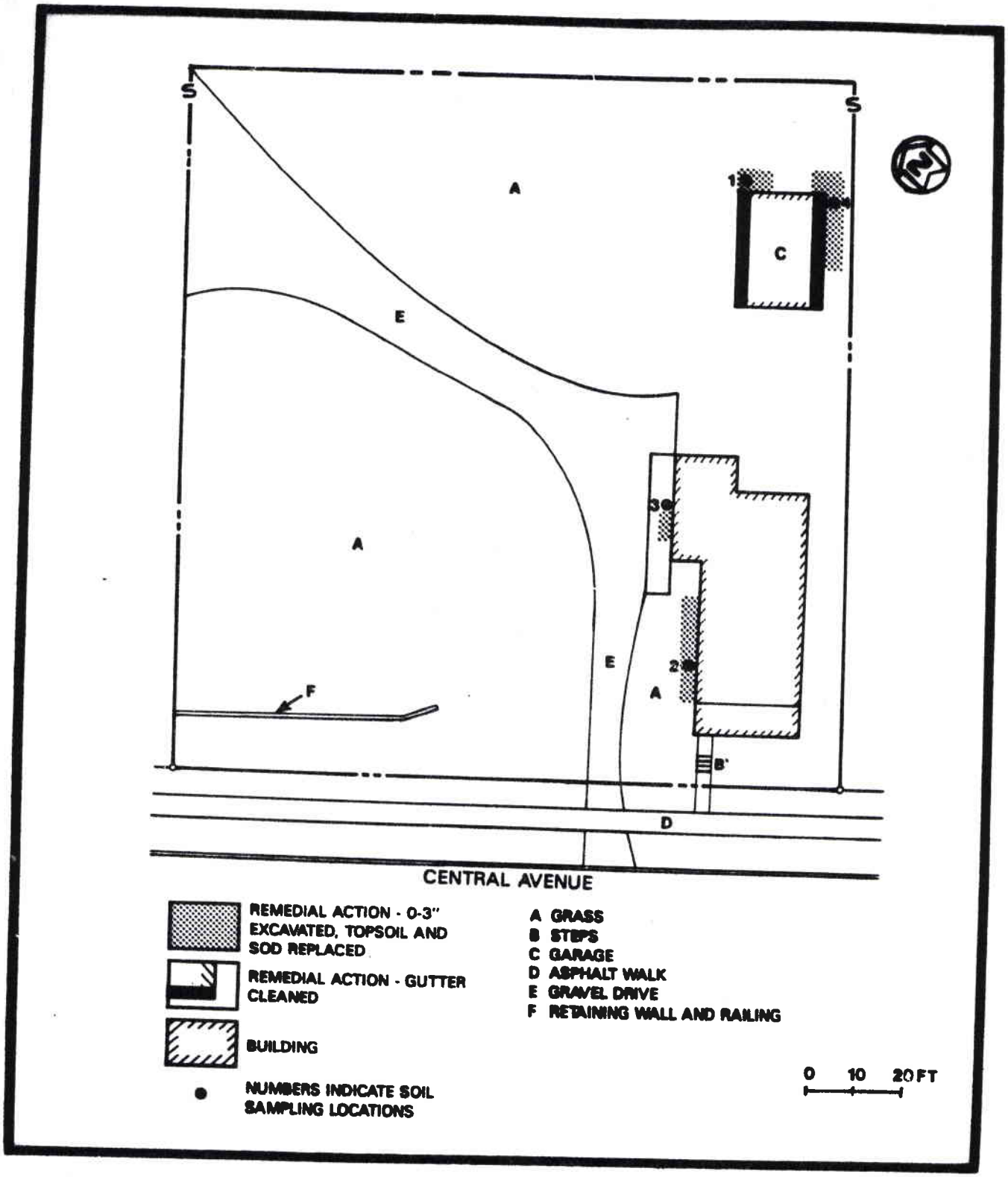


FIGURE 20 REMEDIAL ACTION AT 1195 CENTRAL AVENUE

TABLE 19

POST-REMEDIAL ACTION SAMPLING RESULTS
1195 CENTRAL AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	<1.3
2	<2.2 ± 0.7
3	0.8 ± 0.8
4	7.8 ± 0.1

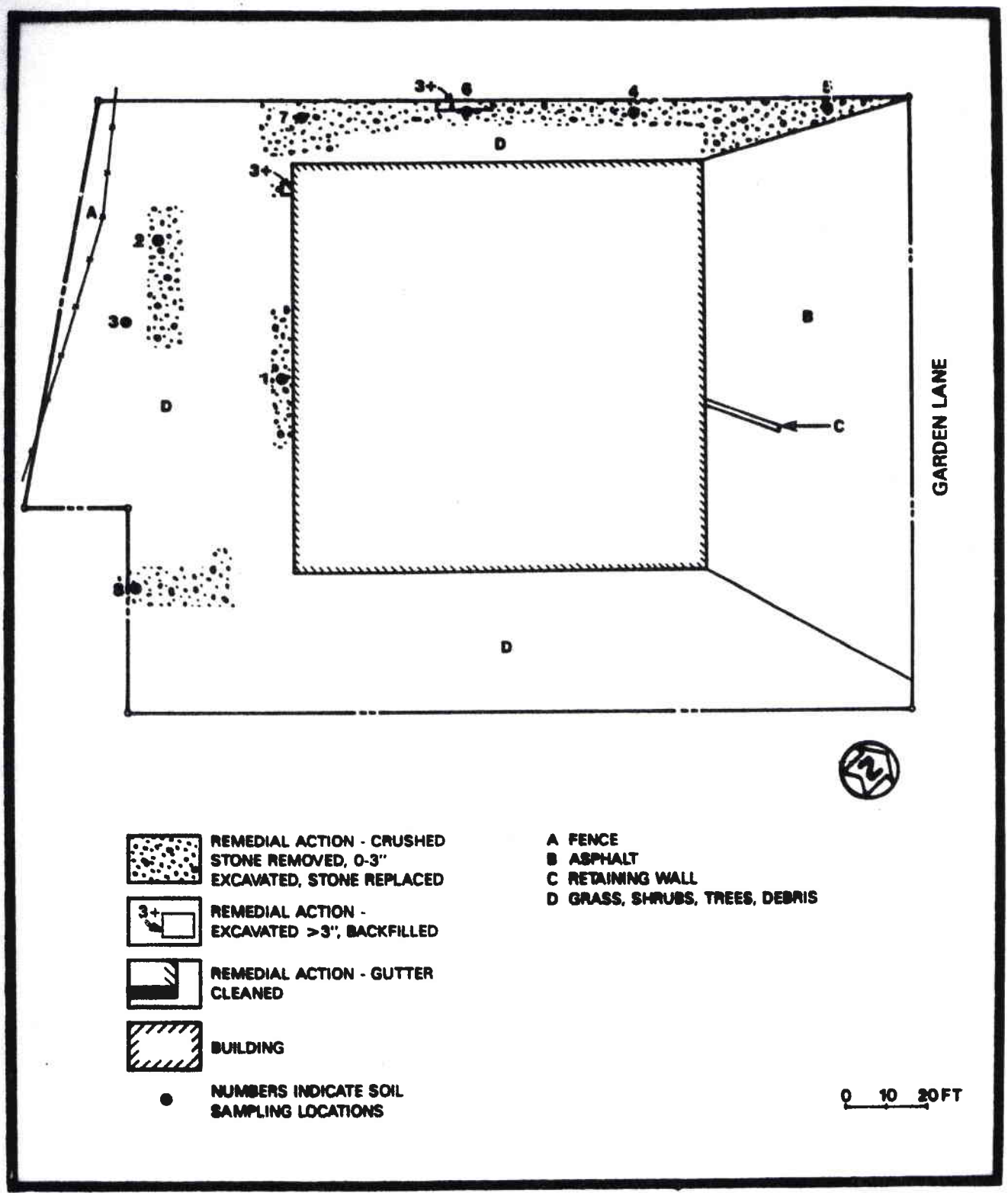


FIGURE 21 REMEDIAL ACTION AT 10 GARDEN LANE

TABLE 20

POST-REMEDIAL ACTION SAMPLING RESULTS
10 GARDEN LANE

Sample No.	Concentration (pCi/g) Uranium-238
1	4.7 ± 0.3
2	11.7 ± 0.4
3	2.1 ± 0.1
4	16.3 ± 1.6
5	8.0 ± 1.5
6	26.8 ± 1.7
7	1.2 ± 0.4
8	1.4 ± 0.7

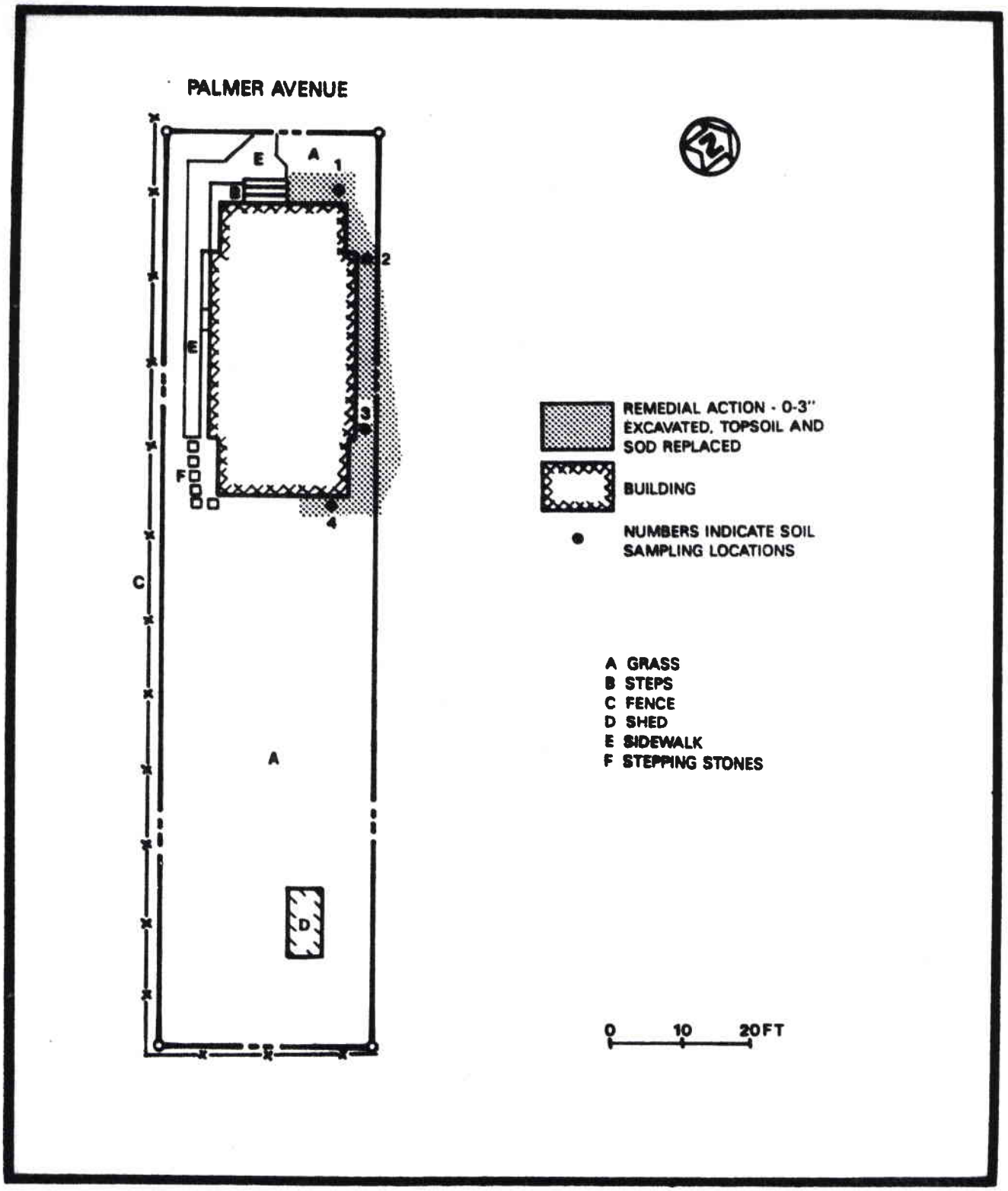


FIGURE 22 REMEDIAL ACTION AT 7 PALMER AVENUE

TABLE 21

POST-REMEDIAL ACTION SAMPLING RESULTS
7 PALMER AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	1.8 ± 0.6
2	9.0 ± 4.5
3	6.7 ± 1.5
4	2.7 ± 2.2

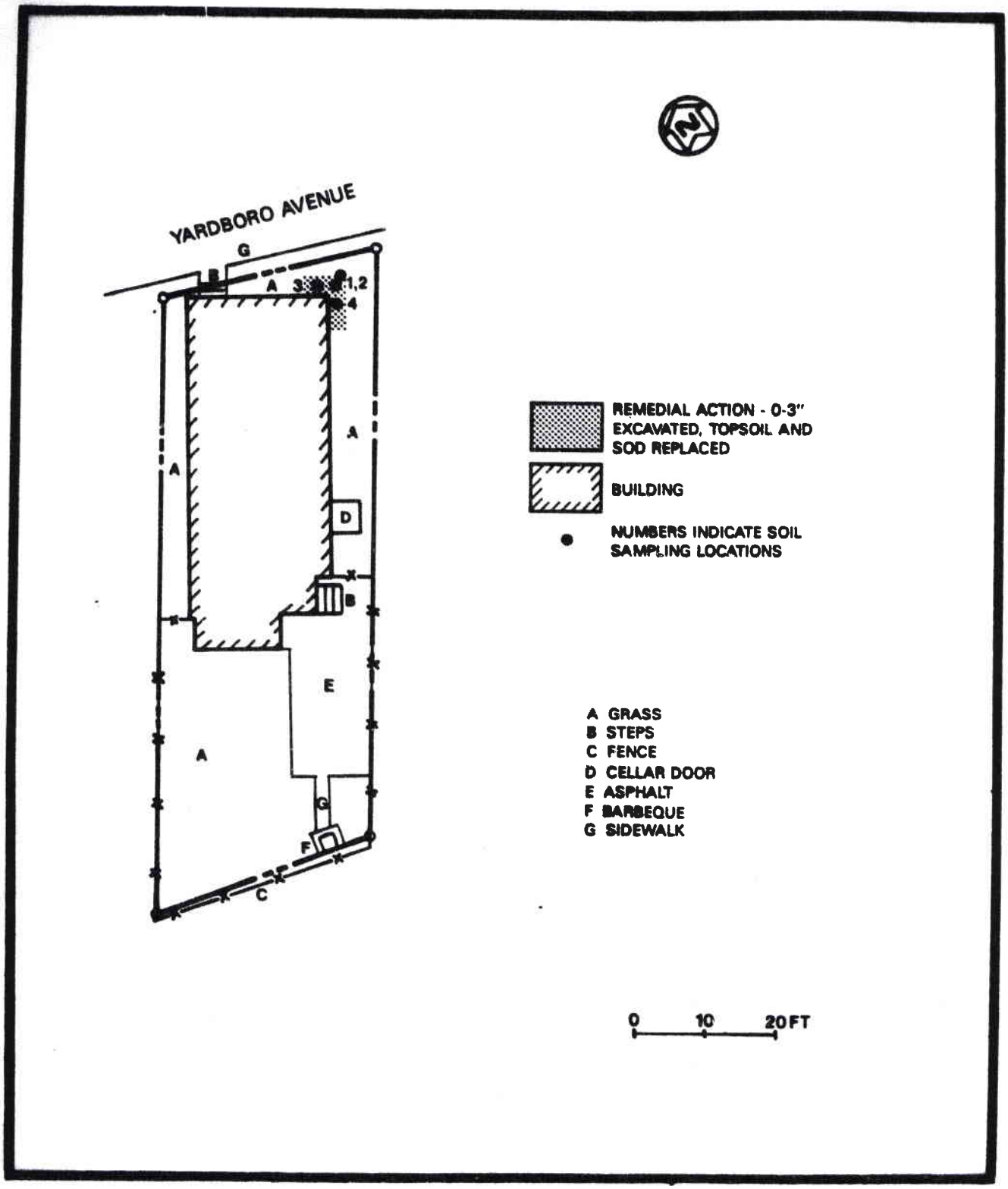


FIGURE 23 REMEDIAL ACTION AT 5 YARDBORO AVENUE

TABLE 22

POST-REMEDIAL ACTION SAMPLING RESULTS
5 YARDBORO AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	2.2 ± 2.0
2	2.5 ± 1.3
3	2.0 ± 0.8
4	1.1 ± 0.9

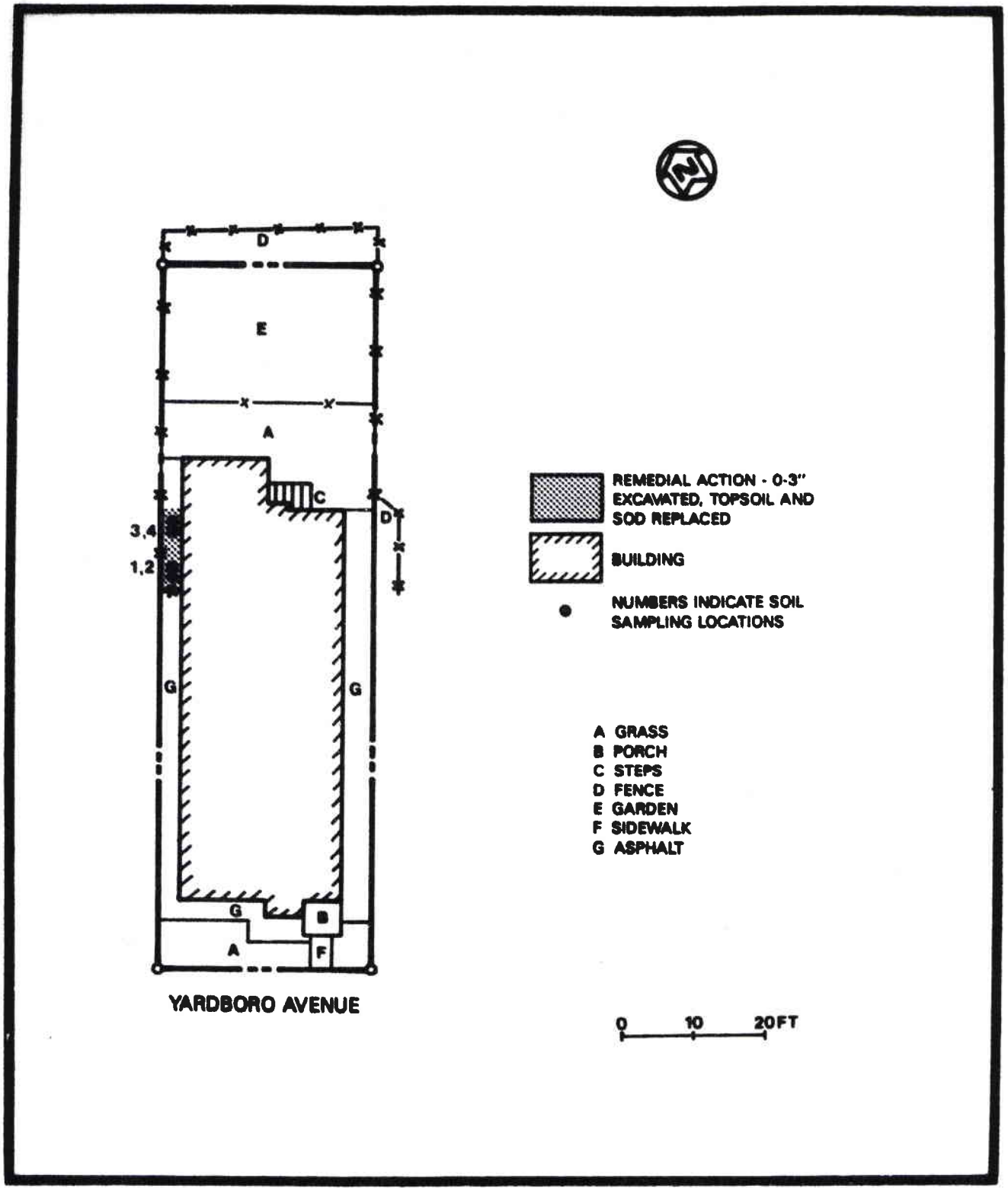


FIGURE 24 · REMEDIAL ACTION AT 24 YARDBORO AVENUE

TABLE 23

POST-REMEDIAL ACTION SAMPLING RESULTS
24 YARDBORO AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	15.2 ± 6.7
2	9.9 ± 3.0
3	7.4 ± 0.9
4	2.4 ± 0.2

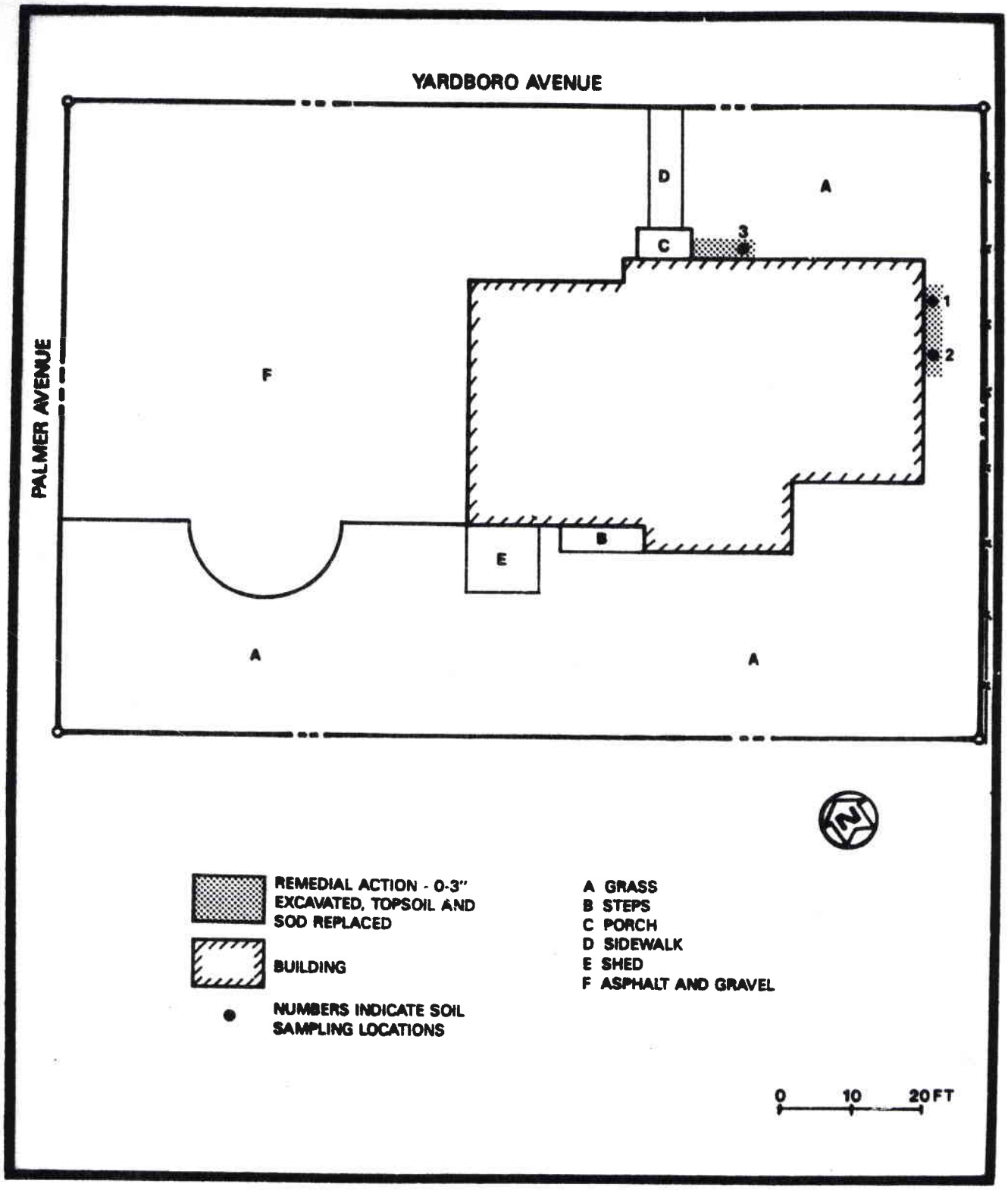


FIGURE 25 REMEDIAL ACTION AT 25/27 YARDBORO AVENUE

TABLE 24

POST-REMEDIAL ACTION SAMPLING RESULTS
25/27 YARDBORO AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	3.8 ± 0.6
2	3.2 ± 0.7
3	5.7 ± 0.5

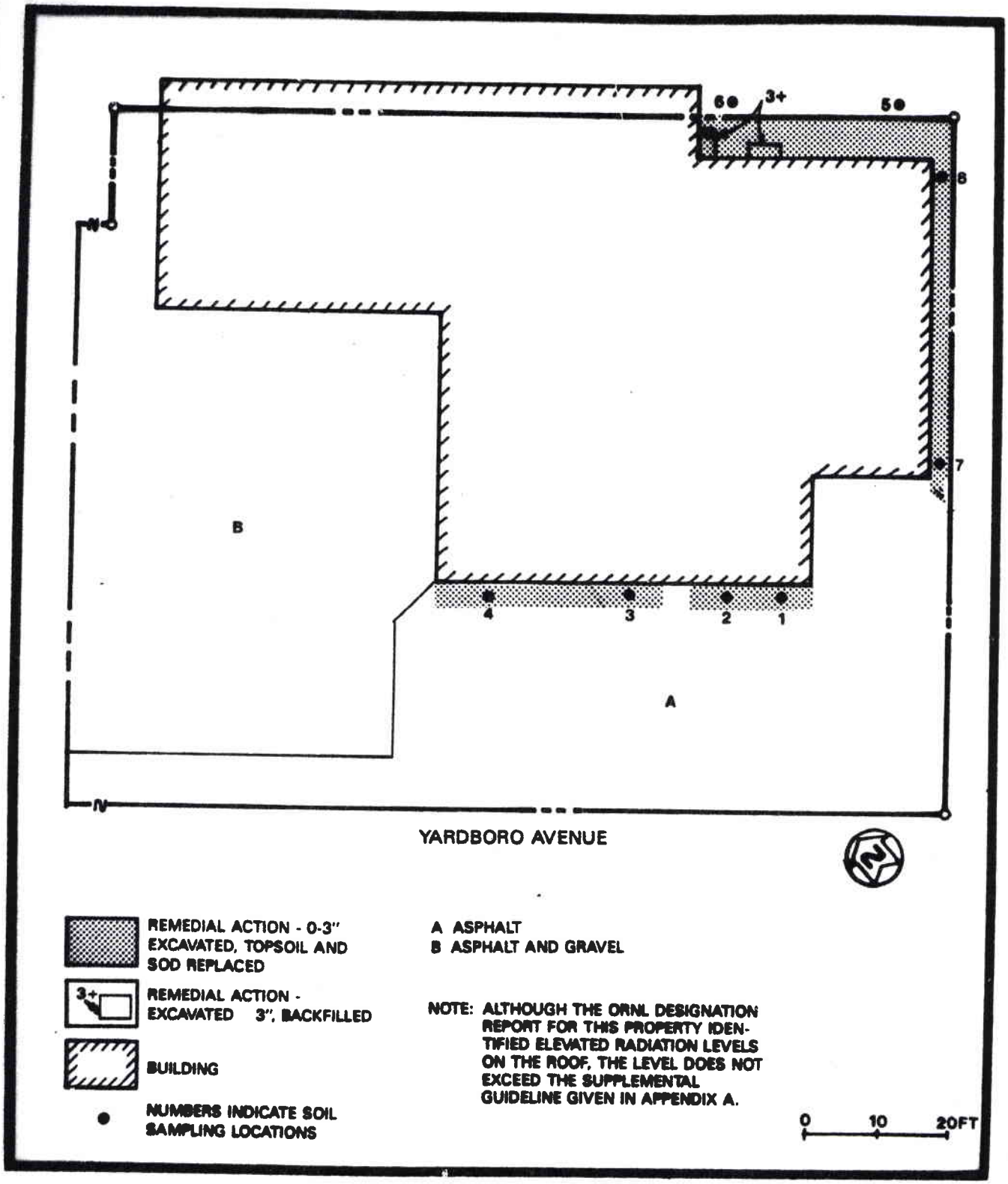


FIGURE 26 REMEDIAL ACTION AT 50 YARDBORO AVENUE

TABLE 25

POST-REMEDIAL ACTION SAMPLING RESULTS
50 YARDBORO AVENUE

Sample No.	Concentration (pCi/g) Uranium-238
1	2.4 ± 1.1
2	1.6 ± 1.6
3	3.6 ± 0.7
4	7.8 ± 2.0
5	3.3 ± 0.2
6	1.6 ± 0.1
7	1.3 ± 0.8
8	2.0 ± 0.8

REFERENCES

1. Teledyne Isotopes. A Survey of Uranium in Soil Surrounding the NL Bearings Plant, IWL-9488-461, October 31, 1980.

2. Oak Ridge National Laboratory. Results from a Radiological Survey on Yardboro Avenue, Albany, and Central Avenue, Colonie, New York Properties AL013 - AL028, Oak Ridge, TN, September 1984.

3. Oak Ridge National Laboratory. Preliminary Data from Radiological Survey 3 in Albany and Colonie, New York Properties AL029 - AL050, Oak Ridge, TN, December 1984.

4. Oak Ridge National Laboratory. Preliminary Data from Radiological Survey 4 in Albany and Colonie, New York Properties AL051 - AL066, Oak Ridge, TN, January 1984.

5. Letter. B.A. Berven (ORNL) to A.J. Whitman (DOE), "ORNL/RASA - Assessment Surveys Data - Albany/Colonie, New York," July 31, 1984.

6. Memorandum. A.J. Whitman (DOE/HQ) to J.F. Wing (DOE/TSD), "Designation of 10 Garden Lane, Colonie, New York (AL023)," October 28, 1985.

7. Letter, W.J. Condon, Bureau of Environmental Radiation Protection, New York Department of Health, to L. Campbell, Oak Ridge Operations Office, Department of Energy, February 9, 1984.

8. Department of Energy. Remedial Action Work Plan for the Colonie Interim Storage Site, ORO-847, Revision 2, (Draft), Oak Ridge, TN, January 1986.

9. Memorandum, F.F. Haywood, Eberline, to R.D. Glenn, Bechtel National, Inc. "Field Calibration of FIDLER Probe at the Colonie Interim Storage Site," BNI CCN 022652, October 2, 1984.

10. Memorandum, C.P. Leichtweis to File. "BNI/EAC Characterization Data for Remedial Action on Colonie Vicinity Properties During FY 1985," (CCN 34431), January 31, 1986.

11. U.S. Department of Energy. Order 5480.1B, "Environmental, Safety, and Health Program for Department of Energy (DOE) Operations, Attachment 1, Order 5480.11, Requirements for Radiation Protection," Washington, D.C., September 23, 1986.

12. Letter, J.D. Berger, Manager, Radiological Assessment Program, Oak Ridge Associated Universities, to E.G. DeLaney, Director, Division of Facilities and Site Decommissioning Projects, Office of Nuclear Energy, Department of Energy Headquarters. "Independent Verification - 1985 Remedial Action of Colonie Vicinity Properties: Colonie, New York," November 21, 1986.

GLOSSARY

Alpha Radiation - See radiation.

Background Radiation - Background radiation refers to naturally occurring radiation emitted from either cosmic (e.g., from the sun) or terrestrial (e.g., from the earth) sources. Exposure to this type of radiation is unavoidable and its level varies greatly depending on geographic location; e.g., New York state receives 100 mrem/yr, Colorado receives about 300 mrem/yr, and some areas in South America receive up to 7000 mrem/yr. These dose levels do not include the concentrations of naturally occurring radon inside buildings. Naturally occurring terrestrial radionuclides include uranium, radium, potassium, and thorium.

Beta Radiation - See radiation.

Calibrated - Radiation detectors typically measure the number of radioactive particles that enter the detector. These are called "counts" because the detector counts a radioactive emission (which could be alpha, beta, or gamma). When measuring radioactivity in soil, the measurement is used to determine the concentration of the radionuclide in the soil in picocuries of radiation per gram of soil. Calibration of the detector is performed so that the "counts" can be converted to picocuries per gram of soil. This is usually done by seeing how many "counts" the detector registers when measuring a known amount of radiation as determined under laboratory conditions.

Contamination - Contamination is used here to mean depleted uranium present in the soil in concentrations exceeding the guidelines agreed upon by DOE and the State of New York for remedial action at Colonie.

Counts per minute (cpm) - Counts per minute refers to the number of radioactive emissions that occur in a minute as measured by a detector. The number of counts is calibrated as described above.

Depleted Uranium - Uranium is found in nature as an ore (like iron and various other metals). When mined, it contains three major, slightly different forms of uranium called uranium-234, uranium-235, and uranium-238. Uranium-235 is the type of uranium used to make fuel for nuclear power plants and for nuclear weapons. In nature, only 0.72 percent (by weight) of uranium is uranium-235; uranium-238 (99.27 percent) and uranium-234 (0.0055 percent) account for the remainder. Depleted uranium is uranium that is left over after the uranium-235 and uranium-234 have been partially removed for other uses. In depleted uranium, 99.80 percent is uranium-238, 0.20 percent is uranium-235, and 0.0015 percent is uranium-234. Depleted uranium is about 35 percent less radioactive than naturally occurring uranium.

Dose - Dose as used in this report is actually dose equivalent and is used to relate absorbed dose (mrad) to an effect on the body. Dose is measured in mrem. Examples of dose are: a dose of 500,000 mrem to the whole body in a short time causes death in 50 percent of the people who receive it; a dose of 5,000,000 mrem may be delivered to a cancerous tumor during radiation treatment; normal background radiation results in an annual dose of about 100 mrem in New York state; the DOE radiation protection standard limits the dose to members of the general public to 100 mrem/yr above background levels; a typical chest x-ray gives a dose of about 20 mrem; living in a brick house results in a dose of about 75 mrem/yr above background.

Exposure rate - Exposure rate is the rate at which radiation imparts energy to the air. Exposure is typically measured in microroentgens (μR) and the exposure rate is typically given as μR/h. The dose to the whole body can be approximated by multiplying the exposure rate by the number of hours of exposure. For example, if an individual were exposed to gamma radiation at a rate of 20 μR/h for 168 hours per week (continuous exposure) for 52 weeks per year, the whole-body dose would be 170 mrem.

Gamma Radiation - See radiation.

Gram (g) - A gram is a metric unit for weight. It takes 454 grams to make 1 pound; 1 ounce equals 28 grams.

Microcurie (μCi) - A microcurie is the equivalent of 1,000,000 picocuries (see the definition of **picocuries** for additional explanation).

Milliliter (ml) - A milliliter is a unit of measure for volumes. There are 3785 ml in 1 gallon.

Millirad (mrad) - Millirad is the unit of measure for dose absorbed per unit of mass. It is generally expressed in terms of a rate per hour, i.e., mrad/h.

Millirem (mrem) - Millirem is the unit used to measure radiation dose to the body. The DOE limit for the annual dose to members of the general public is 100 mrem above the background radiation level. Naturally occurring radioactive substances in the ground result in an average yearly exposure of about 100 mrem to residents of the state of New York. To date, no difference can be detected in the health of population groups exposed to 100 mrem/yr above background levels and in the health of groups that are not exposed.

Pancake Type - A pancake-type detector measures primarily beta and gamma radiation. The detector is called a "pancake" because it is round and fairly flat.

Picocurie (pCi) - A picocurie is the unit of measure for radioactivity, just as an ounce is a unit of measure for weight. A measurement of 1 picocurie means that one radioactive particle is released on the average of every 27 seconds.

Radiation - There are three primary types of radiation: alpha, beta, and gamma. Alpha radiation travels less than an inch in air before it stops. Alpha radiation cannot penetrate the outer layer

of skin on the body. Beta radiation can penetrate the outer layers of skin, but cannot reach the internal organs of the body. Gamma radiation is the most penetrating type and can usually reach the internal organs.

Radionuclide - A radionuclide is another word meaning a particular radioactive element. For example, uranium-235 is a radionuclide, uranium-238 is another, thorium-232 another, and so on.

Remedial Action - Remedial action is a general term used to mean "cleanup of contamination." It refers to any action required so that a property can be released for unrestricted use as noncontaminated. In practice, this may mean removing grass and soil, cutting trees, removing asphalt, etc.

Scabbling - Scabbling is the process used to remove the upper layer of asphalt. A machine is used that grinds off the asphalt (usually the top 1/4 inch) in which the radioactive material was fixed. Removing this top layer of asphalt removes the radioactive contamination that is contained in it.

Unrestricted Use - Unrestricted use means that a property can be used for any purpose without regard to the radioactivity that was on the property prior to remedial action. In other words, the property could be used for a residential, commercial, recreational, or any other purpose.

35271

DIVISION

REVISION NOTICE NO. 3

DESIGN CRITERIA

PAGE 1 OF 1

DEPARTMENT OF ENERGY
FORMERLY UTILIZED SITES
REMEDIAL ACTION PROGRAM
BECHTEL JOB 14501 (FUSRAP)

ISSUE DATE: 03/07/86

TO: Tech Writer MANUAL NUMBER 15

Please replace Table of Contents, Rev. 2 in your Design Criteria for Formerly Utilized Sites Remedial Action Program (FUSRAP) and Surplus Facilities Management Program (SFMP) which has a typographical error and format change, with the attached corrected Table of Contents, Rev. 2.

Please sign this revision notice in duplicate, retaining one copy for the front of your folder, returning one copy to the address indicated below:

PLEASE NOTE: As indicated on Table of Contents, Appendicies A, B, and D are still at Rev. 0.

PLEASE SIGN, DATE, AND RETURN THIS ENTIRE SHEET TO:

Bechtel National, Inc.
800 Oak Ridge Turnpike
Oak Ridge, TN 37830 ATTN: B. WOOD

ACKNOWLEDGEMENT:

MY COPY HAS BEEN BROUGHT TO CURRENT STATUS AND SUPERSEDED MATERIAL HAS BEEN REMOVED AND DESTROYED

☒ MY ADDRESS IS THE SAME

☐ MY ADDRESS IS AS FOLLOWS

SIGNATURE Jeannette M. Hoffman DATE 4/3/86 MANUAL NO. 15 VERIFY

14501-00-DC-01
REV. 1

DESIGN CRITERIA FOR FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM (FUSRAP) AND SURPLUS FACILITIES MANAGEMENT PROGRAM (SFMP)

FEBRUARY 1986

Prepared by
U.S. DEPARTMENT OF ENERGY
OAK RIDGE OPERATIONS OFFICE

14501-00-DC-01-15

Rev. 1

DESIGN CRITERIA
FOR
FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM (FUSRAP)
AND
SURPLUS FACILITIES MANAGEMENT PROGRAM (SFMP)

(ISSUED FOR CLIENT APPROVAL)

FEBRUARY 1986

Approved by: E. L. Keller, Director
Technical Services Division
Oak Ridge Operations Office

2-24-86
Date

Approved by: John T. Milloway
Assistant Manager for
Construction and Engineering
Oak Ridge Operations Office

2-24-86
Date

PREFACE TO DESIGN CRITERIA

These design criteria have been written in a generic form that summarizes criteria applicable for remedial action and long-term management activities associated with the radioactive wastes at the FUSRAP and SFMP sites. Site-specific information is provided in the appendices to this generic document. As a specific scope of work for a site is determined, design bases and work plans for each of the sites will be developed.

Appendix A contains definitions of terms used in these design criteria and referenced documents. Appendix B provides a listing of FUSPAP and SFMP sites by WBS number and contains estimated waste quantities at the sites. Appendix C contains the residual contamination and waste control criteria. Appendix D lists site information for specific sites which will be required as a remedial action for the specific site is developed. This information will be included in the work plan for each site.

The design criteria will be referenced by the designation 14501-00-DC-01.

These design criteria will be periodically revised, as appropriate, to reflect new practices, additional information, revisions of applicable regulations, and standard revisions.

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- 1.4 Changes to Criteria

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1.0 INTRODUCTION

1.1 SCOPE

This document defines the design criteria for the identification of materials, evaluation of remedial action alternatives, selection of design parameters for site cleanup remedial actions and interim storage, and long-term management methods for handling FUSRAP and SFMP radioactive wastes.

1.2 OBJECTIVE

The primary objective of the Formerly Utilized Sites Remedial Action Program (FUSRAP) and Surplus Facilities Management Program (SFMP) projects is to stabilize, decontaminate, and/or dispose of FUSRAP and SFMP derived wastes in such a manner as to minimize the radiological risks posed by these wastes and to enable certification of the cleaned up FUSRAP and SFMP sites for unrestricted future use. At some sites, remedial action may be in situ long-term management with monitoring as necessary to detect any contaminant migration from the site in excess of radiological design criteria. At other sites, an interim storage program may be established until a decision for final disposition is made.

1.3 DEFINITIONS

Appendix A contains definitions of terms that are used in these design criteria as well as in the referenced documents.

1.4 CHANGES TO CRITERIA

The criteria for FUSRAP and SFMP remedial actions set forth in this document are based on elements of various federal orders, regulations, and standards that may be subject to change. This document will be revised to reflect changed criteria as authorized and approved by DOE.

2.0 APPLICABLE DOCUMENTS

2.1 GENERAL

The intent of these design criteria is to use DOE Orders where applicable. Applicable orders, regulations and standards, and sections thereof, as well as industry standards, will be investigated on a site-specific basis to formulate the design bases for the specific site.

2.2 FEDERAL ORDERS, REGULATIONS, AND STANDARDS

The following federal orders, regulations, and standards contain elements that are generally applicable to the FUSRAP and SFMP projects, and are summarized for these criteria.

2.2.1 Quality Assurance

DOE Order 5700.6A--Quality Assurance and DOE/OR-FUSRAP-82-001 Plan for Quality Assurance. The Project Quality Assurance Program complies with DOE Order 5700.6A, and the FUSRAP Plan for Quality Assurance (DOE/OR-FUSRAP-82-001).

For each remedial action site, and interconnecting activities (such as transportation), a formal evaluation (Quality Assurance Assessment) will be made of the consequences of failure of equipment and facilities to perform satisfactorily in service. This Assessment, which will be an adjunct to design engineering with subsequent modifications as may be required, will give full consideration to safety, environment, costs, schedule delays, programmatic goals, public reaction, or any other factor important to achieving project objectives.

When the formal evaluation indicates that consequences of failure may be unacceptable, significant, or unknown and the probability of failure is high or unknown, additional deliberate actions to find

and prevent quality problems are mandatory. The additional actions to assure quality of design and engineering, and particularly to assure implementation of that design and engineering, will be documented using a Quality Action Plan.

2.2.2 Radiation Protection

DOE Order 5480.1A. This order establishes control over the environmental protection, safety, and health protection programs. Chapter XI, Requirements for Radiation Protection, Attachment XI-1, defines radiation protection guides for concentration in air and water above natural background which will be used as criteria for releases from DOE's FUSRAP and SFMP operations. Chapter XII, Prevention, Control, and Abatement of Environmental Pollution, provides requirements for the control of sources of environmental pollution in accordance with the substantive and procedural aspects of all applicable federal, state, and local pollution control standards.

DOE Order 5480.2--Hazardous and Radioactive Mixed Waste Management. This order establishes hazardous waste management procedures for facilities operated under authority of the Atomic Energy Act of 1954, as amended (AEA). The procedures will follow, to the extent practicable, regulations issued by the Environmental Protection Agency (EPA) pursuant to the Resource Conservation and Recovery Act of 1976 (RCRA).

DOE Order 5481.1--Safety Analysis and Review System. This DOE Order establishes requirements for the preparation and review of safety analyses for each DOE operation, including: identification of hazards and their elimination or control; assessment of risk; documented management authorization of operation; and transportation of hazardous materials.

2.2.3 Land Disposal of Radioactive Wastes

Elements of the DOE Orders and federal regulations mentioned in the following sections provide technical guidelines for long-term, near-surface land burial facilities and ancillary facilities.

DOE Order 6430.1--General Design Criteria Manual. This order contains basic architectural and engineering design requirements for new DOE facilities; provides technical specification requirements; and outlines planning and design requirements for new facilities, facility additions, facility alterations, and building acquisitions to achieve economy of construction, operation, and maintenance.

40 CFR 192--Standards for Remedial Action at Inactive Uranium Processing Sites. This regulation defines remedial action criteria for inactive uranium processing sites. Some elements of these standards are applicable to the FUSRAP and SFMP programs. Service life of a mill tailings disposal site is defined in this regulation and has been adopted for FUSRAP and SFMP projects. Specific service life and release control requirements for interim storage sites and long-term management sites are noted in Section 3.2 of these Design Criteria.

2.2.4 Handling, Transportation, and Storage

DOE Order 1540.1--Materials Transportation and Traffic Management. Hazardous materials at FUSRAP and SFMP sites shall be shipped in accordance with DOE Order 1540.1. This document outlines DOE's policies and procedures for the management of materials transportation to ensure that it is accomplished in a manner commensurate with:

(1) Operational requirements for transportation services

(2) Established practices and procedures for transportation safety, economy, efficiency, and cargo security

(3) The National Transportation Policy as established by Congress and cognizant federal agencies

(4) Applicable federal, state, local, and international transportation regulations.

Intra-building and intra-site transfers are excluded from the provisions of this order.

DOE Order 5480.1A--Environmental Protection, Safety, and Health Protection Program for DOE Operations. Chapter 3 of this Order contains safety requirements for packaging of fissile and radioactive material. It also defines the requirements for design, evaluation, and testing of containers used for the transport of DOE's fissile and radioactive materials.

49 CFR 171-179--Transportation of Hazardous Materials. These regulations specify requirements for bulk shipments of uranium or thorium ores and physical or chemical concentrations of those ores and uranium metal or natural thorium metal, or alloys of these materials.

2.2.5 Health and Safety

Occupational Safety and Health Administration (OSHA) 29 CFR 1910. This section contains the health and safety regulations for general industry.

Occupational Safety and Health Administration (OSHA) 29 CFR 1926. This section establishes the general health and safety regulations for construction.

2.2.6 Surveys

Surveys for characterization and remedial action will be performed in accordance with the following specifications.

National Oceanic and Atmospheric Administration (NOAA).

- "Classification, Standards of Accuracy, and General Specifications of Geodetic Control Surveys"
- "Specification to Support Classification, Standards of Accuracy, and General Specifications of Geodetic Control Surveys"
- "Manual of Geodetic Triangulation," "Specification Publication No. 247

U.S. Department of Interior (USDI) "Manual of Instructions for the Survey of Public Lands of the United States," 1973, Bulletin 6.

2.2.7 Weather

National Oceanic and Atmospheric Administration. "Comparative Climatic Data for the United States through 1982," 1983.

2.3 STATE AND LOCAL REGULATIONS

State and local regulations governing handling, transportation, and storage of radioactive materials generally follow federal orders and regulations, but may vary depending on whether the particular state is an "Agreement State" under the Atomic Energy Act of 1954, as amended. DOE regulations will be followed, and state and local regulations will be reviewed on a site-specific basis.

2.4 DESIGN CODES, GUIDES, AND STANDARDS

The following industry and national codes, standards, and guides, as applicable, will also serve as guidelines for the Design Criteria for FUSRAP and SFMP:

- American Association of State Highway and Transportation Officials (AASHTO)
- American Concrete Institute (ACI)

- American Conference of Government Industrial Hygienists (ACGIH)
- American Institute of Steel Construction (AISC)
- American National Standards Institute (ANSI)
- American Nuclear Society (ANS)
- American Petroleum Institute (API)
- American Railway Engineering Association (AREA)
- American Society for Testing and Materials (ASTM)
- American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
- American Society of Mechanical Engineers (ASME)
- American Water Works Association (AWWA)
- American Welding Society (AWS)
- Institute of Electrical and Electronic Engineers (IEEE)
- Interstate Commerce Commission (ICC)
- Illuminating Engineering Society (IES)
- National Electrical Code (NEC)
- National Electrical Manufacturers' Association (NEMA)
- National Electrical Safety Code (NESC)
- National Fire Protection Association (NFPA) "National Fire Code"
- National Geodetic Survey (NGS)
- National Standard Plumbing Code (NSPC)
- Occupational Safety and Health Standards (OSHA)
- Underwriters' Laboratory (UL)
- Uniform Building Code (UBC)
- U.S. Army Corps of Engineers Dredging Documents
- U.S. Geological Survey (USGS)

3.0 DESIGN REQUIREMENTS

3.1 GENERAL

FUSRAP work may involve remedial action at a number of sites. The currently designated FUSRAP and SFMP sites are listed in Appendix B; waste characteristics and estimated volumes at each site are also given.

Additional sites may be added or deleted with passage of federal legislation; therefore, the list of sites may be subject to revision. The specific type and quantity of contaminated material at each site, as well as geologic, meteorologic, and other site conditions affecting the design and design approach, differ from site to site.

3.2 RADIOLOGICAL DESIGN CRITERIA

The proposed DOE Interim Residual Contamination and Waste Control Guidelines for FUSRAP and SFMP sites are summarized in Appendix C. This criteria should be followed in defining cleanup requirements, developing remedial action plans, and performing and verifying field remedial actions.

3.3 SPECIFIC SITE CONDITIONS

The following information is required for each site and will be completed before or during detailed design and engineering of disposal facilities.

3.3.1 Scope of Work

The Scope of Work for the needed remedial actions must be clearly defined. This may be initiated with the preparation of the Preliminary Engineering Evaluation Report for each site with a

Design Basis, or as a separate document. It will be in accordance with the waste management plan outlined in Section 3.3.4 of these Design Criteria.

3.3.2 State and Local Regulations

In consultation with appropriate DOE-ORO personnel, applicable state and local regulations and ordinances will be reviewed to determine requirements to achieve compliance with health, safety, and environmental regulations. Construction permits and local property access agreements will be obtained as required. Any permits, licenses, or other authorization required by federal, state, or local environmental protection statutes, or any other legal authorizations required by DOE, will be obtained by DOE, Oak Ridge Operations.

3.3.3 Site Information

Define the site conditions for each site as necessary for design decisions. Parameters that may be needed include the following (see Appendix D for detailed requirements):

- Property surveys, easements, and datum
- Water levels
- Precipitation
- Humidity
- Groundwater table
- Frost penetration
- Ice conditions
- Air temperature
- Noise levels
- Winds
- Seismology

- Soil and foundation conditions
- Site historical information (including past and current use; as-built design drawings of buried utilities, structures, and systems; and existing monitoring systems).

3.3.4 Waste Characterization

Complete information on the type, quantity, and existing disposition of the radioactive wastes at any given site will usually be required prior to initiation of the Preliminary Engineering Evaluation Report or detailed design. If data and information in existing reports is not complete, or possibly out of date, additional characterization survey work may be required. Examples of additional characterization, to be planned by Bechtel and approved by DOE on a site specific basis and according to a predetermined need, include the following:

- Location and depth of buried wastes.
- Radiological, physical, and chemical characteristics of wastes in ponds, under surface water, and/or in groundwater.
- Extent of radiological migration, groundwater flow patterns, and seasonal variations.
- Wastes/contamination in building structures that may be scheduled for dismantlement or demolition.

3.3.5 Support Facilities

The identification of the needed temporary and/or permanent support facilities will be made and may include the following:

- Security
- Contamination control
- Structures
- Equipment
- Water treatment and control

- Utilities
- Access routes
- Monitoring system
- Document control
- Administration

3.3.6 Waste Transportation

The following facets for transporting the waste materials will be investigated as applicable:

- Waste form and quantity to be transported
- Mode of transportation
- Packaging and control
- Transportation routes
- Local traffic patterns and impact on community.

APPENDIX A

DEFINITIONS

Abbreviations/Terms	Definitions
AEC	Atomic Energy Commission
alpha particle	A positively charged particle emitted from certain radioactive material. It consists of two protons and two neutrons, hence is identical with the nucleus of the helium atom. It is the least penetrating of common radiation, hence is not dangerous unless alpha-emitting substances have entered the body.
background radiation	Naturally occurring low-level radiation to which all life is exposed. Background radiation levels vary from place to place on the earth.
beta particle	A particle emitted from some atoms undergoing radioactive decay. A negatively charged beta particle is identical to an electron. A positively charged beta particle is called a position. Beta radiation can cause skin damage, and beta emitters are harmful if they enter the body.
BNI	Bechtel National, Inc.

buffer zone	A portion of the land disposal site that is controlled by the licensee and that lies between the disposal unit and the boundary of the site.
CFR	Code of Federal Regulations
Ci	Curie (the unit of radioactivity of any nuclide, which decays at a rate of 3.7×10^{10} disintegrations/second)
contamination	The radioactive substance which is not a portion of the material into and onto which it is now dispersed.
daughter product	The nuclide remaining after a radioactive atom (parent) has undergone radioactive decay. A daughter atom also may be radioactive, producing further daughter products.
decontamination	The removal of radioactive material by chemical or mechanical means from an undesirable location and placement of the removed radioactive material in an acceptable form and location.
dismantlement	The organized manner by which a system or structure is segmented into component pieces which can be managed.

disposal	Isolation of waste from the biosphere with no intent of retrieval in a manner which does not permit easy access to the waste after its emplacement, and does not require perpetual maintenance and monitoring.
disposal site	A portion of a land disposal facility which is used for disposal of waste. It consists of disposal units and a buffer zone.
disposal unit	For near-surface disposal, a "disposal unit" means a discrete portion of the disposal site into which waste is placed for disposal.
DOE	Department of Energy
dpm	Disintegrations per minute
egr	External gamma radiation (gamma radiation emitted from a source(s) external to the body, as opposed to internal gamma radiation emitted from ingested or inhaled sources)
engineered barrier	Man-made structures or devices that are intended to prevent an intruder from inadvertent exposure to radiation from certain waste or to prevent escape of radionuclides to the environment.
EPA	Environmental Protection Agency
exposure	Magnitude of radiation. It is defined and measured in terms of electrical charge produced per unit mass of air.

FUSRAP	Formerly Utilized (MED/AEC) Sites Remedial Action Program
gamma background	Natural gamma ray activity everywhere present, originating from two sources: (1) cosmic radiation bombarding the earth's atmosphere continually, and (2) terrestrial radiation. Whole body absorbed dose equivalent in the U.S. due to natural gamma background ranges from about 60 to 125 mrem/yr.
gamma ray	High energy electromagnetic radiation emitted from the nucleus of a radioactive atom, with specific energies for the atoms of different elements and having high penetrating power.
ground water	Subsurface water in the zone of full saturation.
half-life	The period of time required for one-half of the original amount of a radioisotope to decay into a daughter product.
health effect	An adverse physiological response to environmental pollutants. While physiological responses include sickness, genetic defects, and death, for FUSRAP/SFMP one health effect is defined as one death resulting from cancer caused by exposure to radiation.

hydrogeologic unit	Any soil or rock unit or zone which, by virtue of its porosity or permeability or lack thereof, has a distinct influence on the storage or movement of ground water.
inadvertent intruder	A person who might occupy the disposal site unknowingly after closure and engage in normal activities, such as agriculture, dwelling construction, and other pursuits in which the person might be exposed to radiation from the waste.
interim storage	A short-term disposal having control and stabilization features designed to ensure, to the extent reasonably achievable, an effective life of 50 years and, in any case, at least 25 years at which time ultimate disposal will be made.
intruder barrier	A sufficient depth of cover over the waste that exposure to radiation by an inadvertent intruder will meet the standards for protection against radiation specified in DOE Manual 5820.1 and in 10 CFR 61, or engineered structures that provide equivalent protection to the inadvertent intruder.
land disposal facility	The land, buildings, and equipment which are intended to be used for the disposal of radioactive wastes beneath the surface of the land.

long-term management	A form of ultimate disposal and storage involving near-surface burial of FUSRAP and SFMP radioactive wastes. Includes monitoring and corrective action, as necessary, to ensure that contaminants are not migrating from the site in excess of design criteria, and an institutional control period not less than that specified in 40 CFR 192. Control and stabilization features are designed to ensure to the extent reasonably achievable, an effective life of 1,000 years and, in any case, at least 200 years.
LSA	Low Specific Activity - A class of radioactive material as defined in 49 CFR 173.389(c).
umhos/cm	Micromhos per centimeter (10^{-6} mho/cm)
uR/hr	Microroentgens per hour (10^{-6} R/hr)
mR/hr	Milliroentgens per hour (10^{-3} R/hr)
mrad/hr	Millirads per hour (10^{-3} rad/hr)
MED	Manhattan Engineer District
mho	A unit of electrical conductance, the reciprocal of electrical resistance.
MPC	Maximum permissible concentration as defined per 10 CFR 20.103.

near-surface disposal facility	A land disposal facility in which radioactive waste is disposed within the upper 15-20 meters of the earth's surface.
NEPA	National Environmental Policy Act
NRC	Nuclear Regulatory Commission
nuclide	A general term applicable to all atomic forms of the elements; nuclides comprise all the isotopic forms of all the elements. Nuclides are distinguished by their atomic number, atomic mass, and energy state.
pCi/l	Picocurie per liter (10^{-12} Ci/l)
R	Roentgen (a unit of exposure to ionizing radiation). It is that amount of gamma or x-rays required to produce an electrical charge that is numerically equal to 2.58 x 10^{-4} coulombs/kg.
rad	The basic unit of absorbed dose of ionizing radiation. A dose of one rad means the absorption of 100 ergs of radiation energy per gram of absorbing material.
radioactivity	The spontaneous decay or disintegration of an unstable atomic nucleus, usually accompanied by the emission of ionizing radiation.

radioactive decay chain	A succession of nuclides, each of which transforms by radioactive disintegration into the next, until a stable nuclide results. The first member is called the parent, the intermediate members are called daughters, and the final stable member is called the end product.
radon	A radioactive, chemically inert gas having a half-life of 3.8 days (radium-222); formed as a daughter product of radium (radium-226).
radon background	Low levels of radon gas found in an area due to the presence of uranium or radium in soil and building materials.
radon daughter	One of the several short-lived radioactive daughter products of radon. (Several of the daughters emit alpha particles.)
remedial action	Steps and processes that are undertaken to physically identify, decontaminate, stabilize, or otherwise provide long-term management of radioactive materials to permit certification for unrestricted public use of the area or site.
rdc	Radon daughter concentration (the concentration in air of short-lived radon daughters, usually expressed in pCi/l; also measured in terms of working level (WL).

rem	Roentgen equivalent man. The unit of dose equivalence for all types of ionizing radiation which expresses the effectiveness of the absorbed dose on a common scale. The rem is the basic unit used to record the accumulated dose equivalent to personnel.
site closure and stabilization	Those actions that are taken upon completion of operations that prepare the disposal site for custodial care and that assure that the disposal site will remain stable and will not need ongoing, active maintenance.
SFMP	Surplus Facilities Management Program
surveillance	Observation of the disposal site for purposes of visual detection of need for maintenance, custodial care, evidence of intrusion, and compliance with other license and regulatory requirements.
WL	Working level. A unit of radon daughter exposure, equal to any combination of short-lived radon daughters in 1 liter of air, that will result in the ultimate emission of 1.3×10^5 MeV of potential alpha energy. This level is equivalent to the energy produced in the decay of the daughter products that are present under equilibrium conditions in a liter of air containing 100 pCi of radium-222. It does not include decay of lead-210 (22-year half-life) and subsequent daughter products.

WLM	Working Level Month - An exposure to a one-WL concentration for 170 hours per month.
WBS NO.	Work Breakdown Structure identification sequence number designated by DOE. (See Appendix B for list of identification numbers for the specific sites.)

APPENDIX B

LIST OF FUSRAP AND SFMP SITES

AND

ESTIMATED WASTE QUANTITIES(7/82)

FUSRAP SITES

MRS No.	Site Name	State	Radioisotope	Estimated Volume (yd^3)	Concentration (pCi/g)	Radioactivity (Ci)	References	Remarks
101	Acid/Pueblo	NM	Plutonium-239	390*	110	4.8×10^{-2}	Remedial Action Completed	Soils
102	Albany Research	OR	Natural Uranium Uranium-238 Natural Uranium Radium-226	3,000[b]	a	a	b	Radiological characterization not complete
104	Bayo Canyon	NM	Strontium-90	1,520*	-	-	FB&DU 409-317	No Excavation Required - Marker Placed
105	Chupadera	NM	-	N/A	-	-	Remedial Action Not Required	
108	E. I. duPont	NJ	Uranium-238 Uranium-238 Uranium-238	7,000	1,400 1,100 6,600	2.7 0.5 0.9	DOE/EV-0005/8	Contam. Soils & Drainage Ditch
114	Kellex	NJ	-	175*	-	-		Completed
115	Niagara Falls Vicinity Properties	NY	Radium-226	48,000	a	a	BMI-2045, 2061, 2074	
117	Middlesex Landfill	NJ	Radium-226	33,000	11	1.4	DOE/EV-0005/20	
118	Middlesex Sampling Plant	NJ	Radium-226 Radium-226	- 57,000	- -	3.5 10.5 -	DOE/EV-0005/1	
121	Palos Park	IL	Hydrogen-3	4,030	-	3.0×10^3	DOE/EV-0005/7	
153	St. Louis Airport	MO	Radium-226	86,000	30	3.8	DOE/EV-0005/16	

APPENDIX B (Cont'd)

FUSRAP SITES

NRS No.	Site Name	State	Radioisotope	Estimated Volume (yd^3)	Concentration (pCi/g)	Radioactivity (Ci)	References	Remarks
125	Shpack	MA	Radium-226 Uranium-238	400	109 125	5.5 6.3	ORNL-5799 DOE/EV-0005/31	
126	Universal Cylops	PA	-	30	-	-	ORO-777	
129	Linde Air Products	NY	Radium-226 Uranium-238 Actinium-227	26,000	9.3 349 2.3	8.0×10^{-2} 2.88 2.0×10^{-2}	DOE/EV-0005/5 FB&DU 409-323	
130	Univ. of Calif.	CA	-	30*	-	-	Completed 9/82	
131	Univ. of Chicago	IL	-	75*	-	-		
134	SLAPSS (Vic. Prop)	MO	-	13,000	-	-		
137	Wayne/Pequannock	NJ	Uranium-238 Thorium-232 Thorium-228 Radium-226	50,000	a	a		
138	Raymond	NJ	Uranium-238 Uranium-235 Uranium-234 Thorium-230 Thorium-232 Thorium-228 Radium-226	218,000	a	a		
139	Colonie	NY	Uranium-238	30,000	a	a		Radiological Characterization Not Complete
140	Hazelwood	MO	Thorium-230 Radium-226 Uranium-238 Uranium-235 Uranium-234	61,000	a	a		Radiological Survey Not Available
		Total Volume FUSRAP		638,650				

APPENDIX B (Cont'd)

SFMP SITES

WMS No.	Site Name	State	Radioisotope	Estimated Volume (yd^3)	Concentration (pCi/g)	Radioactivity (Ci)	References	Remarks
201	Weldon Spring Storage Site	MO						
	o Raffinate Pits		Natural Uranium and Thorium, Radium-226	220,500	-	824	DOE/OR/20722-5	Sludge volume
	o Quarry		Natural Uranium and Thorium, Radium-226	130,800	-	-	-	
	o Vicinity Properties		Natural Uranium Radium-226	102,00	-	-	-	
202	Niagara Falls Storage Site	NY	Radium-226 Uranium-238	218,000	-	940	DOE/OR/20722-1	(Includes contaminated residues, soils and rubble)
		Total Volumes SFMP		671,300				

[a]Actual waste volume

[b]Volumes are from Project Plan

[c]Information is unknown at this time.

APPENDIX C

U.S. DEPARTMENT OF ENERGY GUIDELINES FOR RESIDUAL RADIOACTIVITY AT FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM AND REMOTE SURPLUS FACILITIES MANAGEMENT PROGRAM SITES

(Rev. 1, July 1985)

A. INTRODUCTION

This document presents U.S. Department of Energy (DOE) radiological protection guidelines for cleanup of residual radioactive materials and management of the resulting wastes and residues. It is applicable to sites identified by the Formerly Utilized Sites Remedial Action Program (FUSRAP) and remote sites identified by the Surplus Facilities Management Program (SFMP).* The topics covered are basic dose limits, guidelines and authorized limits for allowable levels of residual radioactivity, and requirements for control of the radioactive wastes and residues.

Protocols for identification, characterization, and designation of FUSRAP sites for remedial action; for implementation of the remedial action; and for certification of a FUSRAP site for release for unrestricted use are given in a separate document (U.S. Dept. Energy 1984). More detailed information on applications of the guidelines presented herein, including procedures for deriving site-specific guidelines for allowable levels of residual radioactivity from basic dose limits, is contained in a supplementary document--referred to herein as the "supplement" (U.S. Dept. Energy 1985).

"Residual radioactivity" includes: (1) residual concentrations of radionuclides in soil material,** (2) concentrations of airborne radon decay products, (3) external gamma radiation level, and (4) surface contamination. A "basic dose limit" is a prescribed standard from which limits for quantities that can be monitored and controlled are derived; it is specified in terms of the effective dose equivalent as defined by the International Commission on Radiological Protection (ICRP 1977, 1978). Basic dose limits are used explicitly for deriving guidelines for residual concentrations of radionuclides in soil material, except for thorium and radium. Guidelines for

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*A remote SFMP site is one that is excess to DOE programmatic needs and is located outside a major operating DOE research and development or production area.

**The term "soil material" refers to all material below grade level after remedial action is completed.

residual concentrations of thorium and radium and for the other three quantities (airborne radon decay products, external gamma radiation level, and surface contamination) are based on existing radiological protection standards (U.S. Environ. Prot. Agency 1983; U.S. Nucl. Reg. Comm. 1982). These standards are assumed to be consistent with basic dose limits within the uncertainty of derivations of levels of residual radioactivity from basic limits.

A "guideline" for residual radioactivity is a level of residual radioactivity that is acceptable if the use of the site is to be unrestricted. Guidelines for residual radioactivity presented herein are of two kinds: (1) generic, site-independent guidelines taken from existing radiation protection standards, and (2) site-specific guidelines derived from basic dose limits using site-specific models and data. Generic guideline values are presented in this document. Procedures and data for deriving site-specific guideline values are given in the supplement.

An "authorized limit" is a level of residual radioactivity that must not be exceeded if the remedial action is to be considered completed. Under normal circumstances, expected to occur at most sites, authorized limits for residual radioactivity are set equal to guideline values. Exceptional conditions for which authorized limits might differ from guideline values are specified in Sections D and F. A site may be released for unrestricted use only if the residual radioactivity does not exceed guideline values at the time remedial action is completed. Restrictions and controls on use of the site must be established and enforced if the residual radioactivity exceeds guideline values. The applicable controls and restrictions are specified in Section E.

DOE policy requires that all exposures to radiation be limited to levels that are as low as reasonably achievable (ALARA). Implementation of ALARA policy is specified as procedures to be applied after authorized limits have been set. For sites to be released for unrestricted use, the intent is to reduce residual radioactivity to levels that are as far below authorized limits as reasonable considering technical, economic, and social factors. At sites where the residual radioactivity is not reduced to levels that permit release for unrestricted use, ALARA policy is implemented by establishing controls to reduce exposure to levels that are as low as is reasonably achievable. Procedures for implementing ALARA policy are described in the supplement. ALARA policies, procedures, and actions must be documented and filed as a permanent record upon completion of remedial action at a site.

B. BASIC DOSE LIMITS

The basic limit for the annual radiation dose received by an individual member of the general public is 500 mrem/yr for a period of exposure not to exceed 5 years and an average of 100 mrem/yr over a lifetime. The committed effective dose equivalent, as defined in ICRP Publication 26 (ICRP 1977) and calculated by dosimetry models described in ICRP Publication 30 (ICRP 1978), shall be used for determining the dose.

C. GUIDELINES FOR RESIDUAL RADIOACTIVITY

C.1 Residual Radionuclides in Soil Material

Residual concentrations of radionuclides in soil material shall be specified as above-background concentrations averaged over an area of 100 m^2. If the concentration in any area is found to exceed the average by a factor greater than 3, guidelines for local concentrations shall also be applicable. These "hot spot" guidelines depend on the extent of the elevated local concentrations and are given in the supplement.

The generic guidelines for residual concentrations of Th-232, Th-230, Ra-228, and Ra-226 are:

- 5 pCi/g, averaged over the first 15 cm of soil below the surface
- 15 pCi/g, averaged over 15-cm-thick layers of soil more than 15 cm below the surface

These guidelines take into account ingrowth of Ra-226 from Th-230 and of Ra-228 from Th-232, and assume secular equilibrium. If either Th-230 and Ra-226 or Th-232 and Ra-228 are both present, not in secular equilibrium, the guidelines apply to the higher concentration. If other mixtures of radionuclides occur, the concentrations of individual radionuclides shall be reduced so that the dose for the mixtures will not exceed the basic dose limit. Explicit formulas for calculating residual concentration guidelines for mixtures are given in the supplement.

The guidelines for residual concentrations in soil material of all other radionuclides shall be derived from basic dose limits by means of an environmental pathway analysis using site-specific data. Procedures for deriving these guidelines are given in the supplement.

C.2 Airborne Radon Decay Products

Generic guidelines for concentrations of airborne radon decay products shall apply to existing occupied or habitable structures on private property that are intended for unrestricted use; structures that will be demolished or buried are excluded. The applicable generic guideline (40 CFR 192) is: In any occupied or habitable building, the objective of remedial action shall be, and reasonable effort shall be made to achieve, an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 WL.* In any case, the radon decay product concentration (including background) shall not exceed 0.03 WL. Remedial actions are not required in order to comply with this guideline when there is reasonable assurance that residual radioactive materials are not the cause.

C.3 External Gamma Radiation

The average level of gamma radiation inside a building or habitable structure on a site to be released for unrestricted use shall not exceed the background level by more than 20 μR/h.

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*A working level (WL) is any combination of short-lived radon decay products in one liter of air that will result in the ultimate emission of 1.3×10^5 MeV of potential alpha energy.

C.4 Surface Contamination

The following generic guidelines, adapted from standards of the U.S. Nuclear Regulatory Commission (1982), are applicable only to existing structures and equipment that will not be demolished and buried. They apply to both interior and exterior surfaces. If a building is demolished and buried, the guidelines in Section C.1 are applicable to the resulting contamination in the ground.

Radionuclides†2	Allowable Total Residual Surface Contamination (dpm/100 cm²)†1		
	Average†3,†4	Maximum†4,†5	Removable†4,†6
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	5,000α	15,000α	1,000α
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above	5,000β-γ	15,000β-γ	1,000β-γ

†1 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 measured by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

†2 Where surface contamination by both alpha- and beta-gamma-emitting radionuclides exists, the limits established for alpha- and beta-gamma-emitting radionuclides should apply independently.

†3 Measurements of average contamination should not be averaged over an area of more than 1 m². For objects of less surface area, the average should be derived for each such object.

†4 The average and maximum dose rates associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h and 1.0 mrad/h, respectively, at 1 cm.

†5 The maximum contamination level applies to an area of not more than 100 cm².

†6 The amount of removable radioactive material per 100 cm² of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and measuring the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of surface area less than 100 cm² is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. The numbers in this column are maximum amounts.

b. Above-Background Rn-222 concentrations in the atmosphere above facility surfaces or openings shall not exceed: (1) 100 pCi/L at any given point, (2) an annual average concentration of 30 pCi/L over the facility site, and (3) an annual average concentration of 3 pCi/L at or above any location outside the facility site (DOE Order 5480.1A, Attachment XI-1).

c. Concentrations of radionuclides in the groundwater or quantities of residual radioactive materials shall not exceed existing federal, state, or local standards.

d. Access to a site shall be controlled and misuse of onsite material contaminated by residual radioactivity shall be prevented through appropriate administrative controls and physical barriers--active and passive controls as described by the U.S. Environmental Protection Agency (1983--p. 595). These control features should be designed to ensure, to the extent reasonable, an effective life of at least 25 years. The federal government shall have title to the property.

E.2 Interim Management

a. A site may be released under interim management when the residual radioactivity exceeds guideline values if the residual radioactivity is in inaccessible locations and would be unreasonably costly to remove, provided that administrative controls are established to ensure that no member of the public shall receive a radiation dose exceeding the basic dose limit.

b. The administrative controls, as approved by DOE, shall include but not be limited to periodic monitoring, appropriate shielding, physical barriers to prevent access, and appropriate radiological safety measures during maintenance, renovation, demolition, or other activities that might disturb the residual radioactivity or cause it to migrate.

c. The owner of the site or appropriate federal, state, or local authorities shall be responsible for enforcing the administrative controls.

E.3 Long-Term Management

Uranium, Thorium, and Their Decay Products

a. Control and stabilization features shall be designed to ensure, to the extent reasonably achievable, an effective life of 1,000 years and, in any case, at least 200 years.

b. Control and stabilization features shall be designed to ensure that Rn-222 emanation to the atmosphere from the waste shall not: (1) exceed an annual average release rate of 20 pCi/m^2/s, and (2) increase the annual average Rn-222 concentration at or above any location outside the boundary of the contaminated area by more than 0.5 pCi/L. Field verification of emanation rates is not required.

c. Prior to placement of any potentially biodegradable contaminated wastes in a long-term management facility, such wastes shall be properly conditioned to ensure that (1) the generation and escape of biogenic gases will not cause the requirement in paragraph b of this section (E.3) to be exceeded, and (2) biodegradation within the facility will not result in premature structural failure in violation of the requirements in paragraph a of this section (E.3).

d. Groundwater shall be protected in accordance with 40 CFR 192.20(a)(2) and 192.20(a)(3), as applicable to FUSRAP and remote SFMP sites.

e. Access to a site should be controlled and misuse of onsite material contaminated by residual radioactivity should be prevented through appropriate administrative controls and physical barriers--active and passive controls as described by the U.S. Environmental Protection Agency (1983--p. 595). These controls should be designed to be effective to the extent reasonable for at least 200 years. The federal government shall have title to the property.

Other Radionuclides

f. Long-term management of other radionuclides shall be in accordance with Chapters 2, 3, and 5 of DOE Order 5820.2, as applicable.

F. EXCEPTIONS

Exceptions to the requirement that authorized limits be set equal to the guidelines may be made on the basis of an analysis of site-specific aspects of a designated site that were not taken into account in deriving the guidelines. Exceptions require approvals as stated in Section D. Specific situations that warrant exceptions are:

a. Where remedial actions would pose a clear and present risk of injury to workers or members of the general public, notwithstanding reasonable measures to avoid or reduce risk.

b. Where remedial actions--even after all reasonable mitigative measures have been taken--would produce environmental harm that is clearly excessive compared to the health benefits to persons living on or near affected sites, now or in the future. A clear excess of environmental harm is harm that is long-term, manifest, and grossly disproportionate to health benefits that may reasonably be anticipated.

c. Where the cost of remedial actions for contaminated soil is unreasonably high relative to long-term benefits and where the residual radioactive materials do not pose a clear present or future risk after taking necessary control measures. The likelihood that buildings will be erected or that people will spend long periods of time at such a site should be considered in evaluating this risk. Remedial actions will generally not

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be necessary where only minor quantities of residual radioactive materials are involved or where residual radioactive materials occur in an inaccessible location at which site-specific factors limit their hazard and from which they are costly or difficult to remove. Examples are residual radioactive materials under hard-surface public roads and sidewalks, around public sewer lines, or in fence-post foundations. In order to invoke this exception, a site-specific analysis must be provided to establish that it would not cause an individual to receive a radiation dose in excess of the basic dose limits stated in Section B, and a statement specifying the residual radioactivity must be included in the appropriate state and local records.

d. Where the cost of cleanup of a contaminated building is clearly unreasonably high relative to the benefits. Factors that shall be included in this judgment are the anticipated period of occupancy, the incremental radiation level that would be effected by remedial action, the residual useful lifetime of the building, the potential for future construction at the site, and the applicability of remedial actions that would be less costly than removal of the residual radioactive materials. A statement specifying the residual radioactivity must be included in the appropriate state and local records.

e. Where there is no feasible remedial action.

G. SOURCES

Limit or Guideline	Source
Basic Dose Limits	
Dosimetry Model and Dose Limits	International Commission on Radiological Protection (1977, 1978)
Generic Guidelines for Residual Radioactivity	
Residual Concentrations of Radium and Thorium in Soil Material	40 CFR 192
Airborne Radon Decay Products	40 CFR 192
External Gamma Radiation	40 CFR 192
Surface Contamination	Adapted from U.S. Nuclear Regulatory Commission (1982)
Control of Radioactive Wastes and Residues	
Interim Storage	DOE Order 5480.1A
Long-Term Management	DOE Order 5480.1A; 40 CFR 192

H. REFERENCES

International Commission on Radiological Protection. 1977. Recommendations of the International Commission on Radiological Protection (Adopted January 17, 1977). ICRP Publication 26. Pergamon Press, Oxford. [As modified by "Statement from the 1978 Stockholm Meeting of the ICRP." Annals of the ICRP, Vol. 2, No. 1, 1978.]

International Commission on Radiological Protection. 1978. Limits for Intakes of Radionuclides by Workers. A Report of Committee 2 of the International Commission on Radiological Protection. Adopted by the Commission in July 1978. ICRP Publication 30. Part 1 (and Supplement), Part 2 (and Supplement), Part 3 (and Supplements A and B), and Index. Pergamon Press, Oxford.

U.S. Environmental Protection Agency. 1983. Standards for Remedial Actions at Inactive Uranium Processing Sites; Final Rule (40 CFR Part 192). Fed. Regist. 48(3):590-604 (January 5, 1983).

U.S. Department of Energy. 1984. Formerly Utilized Sites Remedial Action Program. Summary Protocol: Identification - Characterization - Designation - Remedial Action - Certification. Office of Nuclear Energy, Office of Terminal Waste Disposal and Remedial Action, Division of Remedial Action Projects. April 1984.

U.S. Department of Energy. 1985. Supplement to U.S. Department of Energy Guidelines for Residual Radioactivity at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites. A Manual for Implementing Residual Radioactivity Guidelines. Prepared by Argonne National Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, and Pacific Northwest Laboratory for the U.S. Department of Energy. (In preparation.)

U.S. Nuclear Regulatory Commission. 1982. Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material. Division of Fuel Cycle and Material Safety, Washington, DC. July 1982.

APPENDIX D

SITE INFORMATION FOR SPECIFIC SITES
(See Design Criteria, Section 3.3.3)

1.0 GENERAL

This appendix is a general outline of the information that will be obtained for a FUSRAP/SFMP site through historical research and/or field investigation activities during site characterization. This information will be used as a starting point for preparation of Design Bases for the sites. The data unique to a particular site are enclosed between single asterisks (*..*).

2.0 SURVEYS AND DATUM

Information on site description, surveys, plant coordinates, plant datum, plant grade, horizontal and vertical survey control points, plant grid north, site boundary, access roads, railroads, etc., will be obtained.

3.0 WATER LEVELS

For sites located on rivers, lakes, or at the ocean, the probable maximum and minimum water levels and their fluctuations will be obtained. The design maximum flood elevations, as noted below, will be investigated and recorded for the site:

	Elevation Above Mean Sea Level (MSL) (*,.*)
Maximum recorded high water	ft
100-year projected flood	ft
Probable maximum flood	ft
Maximum projected water level for plant safety	ft
Design high water	ft
Design low water	ft

(In general, the 100-year flood shall be used for design.)

4.0 PRECIPITATION (*..*)

Rainfall

Average annual	in.
Daily maximum	in.
Design hourly maximum (100-year storm)	in.
Probable maximum precipitation (PMP) per hour	in.

Flash floods caused by thunderstorm may occur and are to be considered in the design. (Note value to be used in flood design as *..* in. per hour.)

SNOWFALL (*..*)

Average annual	in.
Season maximum	in.
Maximum for month of *..*	in.
Daily maximum	in.
Design snow load	lb/sq. ft.

5.0 GROUNDWATER TABLE

The high water table to be used in design will be stated.

For the design of all underground structures, the high water table will be assumed as elevation *..* ft.

Average groundwater level is approximately at *..* ft.

6.0 FROST PENETRATION

Depth below grade *..* in.

7.0 ICE

If applicable, ice pack formation will be described giving appropriate design loads.

8.0 AIR TEMPERATURE (*..*)

Maximum design	°F
Minimum design	°F
Average annual	°F
Average wet bulb	°F
Average dry bulb	°F

9.0 NOISE LEVELS

Noise level measurement and monitoring during construction will be maintained for sites as required by local authorities.

10.0 WINDS

Based on 100-year recurrence interval, the design wind velocity shall be *..* mph at *..* feet above grade in accordance with the Uniform Building Code (UBC). The prevailing wind is in *..* direction. Wind velocity will be adjusted as appropriate for structure height and gust factors. The effects of tornadoes will be investigated as required by site conditions.

11.0 SEISMOLOGY

The site is in UBC Zone *..*. Seismic loads shall be considered in accordance with Section 2312 of UBC criteria.

Verification of whether a higher zoning than that required by UBC may be more appropriate for the particular site will be made.

12.0 GEOTECHNICAL INVESTIGATIONS

Subsurface investigations will provide a description of the soil and geological and hydrological conditions and other data for the preparation of "Soil and Geological Investigation Report". The design basis will list from the report the hydraulic gradient of ground water, soil profile, location of bedrock, determination of confined and unconfined aquifers, establishment of monitoring wells, test results of soil and rock properties, allowable bearing and/or pile capacities (as applicable) for foundation design, active and passive lateral earth pressure, etc. Compaction criteria and maximum slopes for excavation will also be specified.

13.0 GUIDELINES FOR RESIDUAL RADIOACTIVITY

To be developed for each site. Refer to Appendix C.

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ACTION DESCRIPTION MEMORANDUM

PROPOSED FY 1984 REMEDIAL ACTIONS FOR VICINITY PROPERTIES AT THE COLONIE, NEW YORK, FUSRAP SITE

Prepared by

Environmental Research Division
Argonne National Laboratory
Argonne, Illinois

Draft: April 10, 1984
Final: May 4, 1984

Prepared for

U.S. Department of Energy
Oak Ridge Operations
Technical Services Division
Oak Ridge, Tennessee

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1. SUMMARY OF PROPOSED ACTIONS

As part of the research and development project authorized by Congress pursuant to the FY 1984 Energy and Water Appropriations Act (U.S. Congress 1983), the U.S. Department of Energy (DOE) proposes to carry out some remedial actions during 1984 at vicinity properties near the NL Industries, Inc., facility in the town of Colonie, New York (Figures 1.1 and 1.2). The proposed FY 84 actions include cleanup of nine vicinity properties and interim storage of the contaminated materials inside the building at the NL Industries site, which was recently acquired by DOE (February 1984). The vicinity properties will be decontaminated under DOE's Formerly Utilized Sites Remedial Action Program (FUSRAP). The major proposed actions include:

- Removal of about 200 m^3 (260 yd^3) of radioactively contaminated soils from two residential properties on Central Avenue in the town of Colonie.

- Removal of about 50 m^3 (60 yd^3) of contaminated soils from seven residential properties on Yardboro/Palmer Avenue in the city of Albany.

- Construction of a vehicle decontamination area and other support facilities on the NL Industries site.

- Placement of the 250 m^3 (320 yd^3) of decontaminated soil materials inside the NL Industries building in bulk.

Details of the various activities are given in Section 4 (Proposed Action and Alternatives).

The proposed FY 84 actions involving cleanup of the nine vicinity properties (Figure 1.2) are the first phase of remedial actions to be implemented at the NL Industries site. Congress has appropriated funds for FY 84 to initiate cleanup activities. As additional funding becomes available, there will be separate future decisions on cleanup of additional properties. Because a licensed permanent disposal site is not readily available in the state of New York, current decontamination plans call for interim storage of offsite waste in the onsite building in bulk. A future decision will have to be made relative to permanent disposition of the contaminated materials. The contaminated materials will be removed from the vicinity properties according to the residual contamination and waste-control guideline for uranium-238 of 35 pCi/g. Following removal of contaminated materials, the extent of residual contamination will be determined and DOE will make a decision regarding release of the properties for unrestricted use. Separate environmental analyses will be prepared to support future decisions on cleanup of other vicinity properties, decontamination of the NL Industries site, permanent disposition of the contaminated materials, and release of the sites for unrestricted use after cleanup.

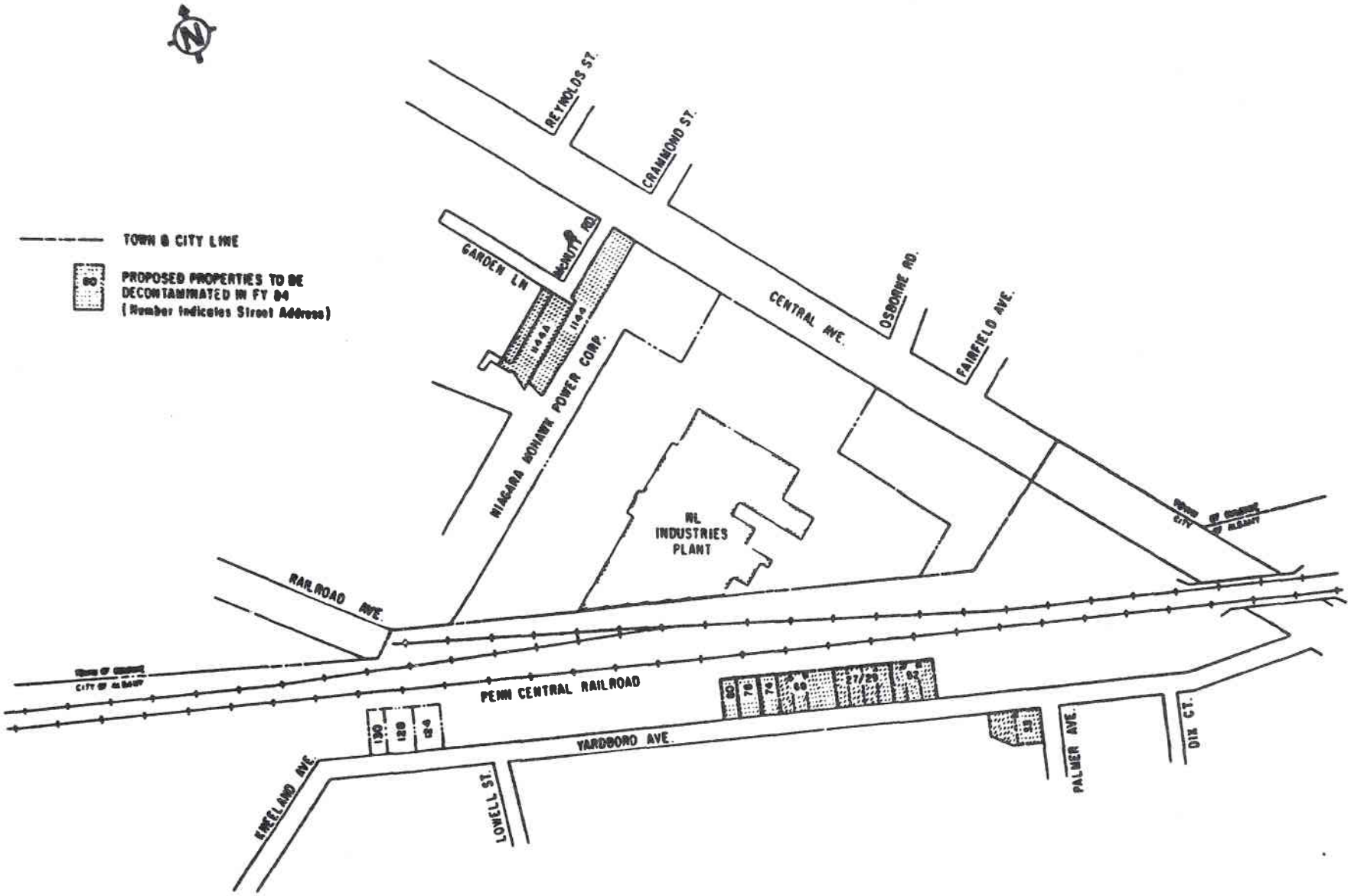

Figure 1.2. Location of Contaminated Properties near the NL Industries Site.

2. HISTORY AND NEED FOR ACTION

2.1 GENERAL SETTING

The former NL Industries site (now owned by DOE) is located in the town of Colonie, New York (Figure 1.1). The border between the town of Colonie and the city of Albany, New York is just south of the site. The site is about 6 km (4 mi) northwest of downtown Albany, and located in a urban area about 5 km (3 mi) southeast of the village of Colonie (Figure 1.1). The NL Industries site is approximately 4 ha (10 acres) in size, with the masonry office and manufacturing building occupying about 0.8 ha (2 acres) (Figure 1.2). The facility is enclosed by a chain-link fence.

The neighborhood surrounding the facility is mixed light industrial, commercial, and residential. The site is bordered on the northeast by State Route 5, which is also called Central Avenue or the Albany-Schenectady Road (Figures 1.1 and 1.2). Heavy traffic occurs on this route. To the northwest and west, the site is bordered by open land and a power substation owned by the Niagara Mohawk Power Corporation. The southeast and eastern boundaries of the site adjoin various commercial properties. To the southwest and south, the facility is abutted by the Penn Central Railroad tracks. Residential properties occur along Yardboro Avenue, which runs parallel to the tracks and intersects Central Avenue. A stream passes through the facility in a concrete conduit and empties into Patroon Creek south of the facility.

Several radiological surveys have been performed on the NL Industries site and in the surrounding area in an attempt to define the nature and extent of the contamination (Jeter and Eagleson 1980; Oak Ridge Natl. Lab. 1984a-1984i). A number of residential properties in the area have been identified as being potentially radioactively contaminated. The proposed actions are to decontaminate nine of these properties during FY 84; these properties (Figure 1.2) and the corresponding radiological surveys are:

- Two residential properties on Central Avenue (Oak Ridge Natl. Lab. 1984a, 1984b).
- Six residential properties on Yardboro Avenue (Oak Ridge Natl. Lab. 1984c-1984h).
- One residential property on Palmer Avenue (Oak Ridge Natl. Lab. 1984i).

The street addresses of these vicinity properties are listed in Table 2.1.

Figure 5.1) are the principal contaminants in the area and that the contamination is greatest to the northwest and southeast of the site. Very little contamination was found beyond a distance of 400 m (1300 ft).

Radiological surveys were performed at vicinity properties by the Radiological Survey Activities Group, Oak Ridge National Laboratory (ORNL), during October 20-27, 1983 (Oak Ridge Natl. Lab. 1984a-1984i). A summary of the survey results is presented in the following section.

2.3 RADIOLOGICAL CONTAMINATION AND NEED FOR ACTION

The results of the surveys performed by Jeter and Eagleson (1980) and Oak Ridge National Laboratory (1984a-1984i) indicate that portions of properties in the vicinity of the NL Industries site have soils that are contaminated to levels exceeding the proposed New York State residual contamination guideline for uranium-238 of 35 pCi/g. In addition to uranium-238, the other two uranium isotopes associated with naturally occurring uranium (i.e., uranium-234 and uranium-235) as well as thorium-234 and protactinium-234 (decay products of uranium-238) are also present at elevated concentrations.* However, the concentrations of uranium-234 and uranium-235 are significantly lower than that of uranium-238. The concentrations of thorium-234 and protactinium-234 are assumed to be equal to that of uranium-238 because these two radionuclides have short half-lives. Hence, current efforts are directed toward cleaning up uranium-238. It is anticipated that cleaning up the residual contamination level to 35 pCi/g for uranium-238 will also result in reducing the concentration of uranium-234 and uranium-235 to acceptable levels.

Recent ORNL radiological surveys indicated that the uranium contamination in the area is depleted uranium (Oak Ridge Natl. Lab. 1984a-1984i). Based on these surveys, two properties located on Central Avenue were identified as requiring decontamination. These properties are located at 1144 and 1144A Central Avenue. Additional areas of contamination were also identified on seven properties located on Yardboro and Palmer Avenues. These additional areas will also be cleaned up during remedial actions in FY 84.

2.3.1 Central Avenue Properties

The two properties at 1144 and 1144A Central Avenue are located on adjoining land immediately northwest of the NL Industries plant. The contamination generally occurs within the top 5 cm (2 in.) of soil. The highest concentration of uranium-238 measured at 1144 Central Avenue was 740 pCi/g, and the average uranium-238 concentration in the top 5 cm at this site was about 70 pCi/g (Oak Ridge Natl. Lab. 1984a). The average uranium-238 concentration below 5 cm was not significantly above background except in localized areas.

The highest uranium-238 concentration measured at 1144A Central Avenue and an adjacent small area was 850 pCi/g (Oak Ridge Natl. Lab. 1984b). This concentration was measured along the drip line of the house roof within the

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*Because the NL Industries plant utilized processed uranium, there will be negligible concentrations of thorium-230 and all subsequent decay products (see the uranium-238 radioactive decay chain in Section 5, Figure 5.1).

3. THE EXISTING ENVIRONMENT

3.1 METEOROLOGY

The climate of the NL Industries site is typical of upstate New York. The mean annual temperature in the city of Albany is 8.9°C (48°F). January is the coldest month, with a mean temperature of -4.4°C (24°F); and July is the warmest month, with a mean temperature of 22°C (72°F). The average last date of killing frost is April 24, and the average first date for freezing in fall is October 16. The mean annual precipitation in the site area is 94 cm (37 in.). It is fairly evenly distributed throughout the year, with maximum monthly means in June, July, and August. The growing season averages about 175 days. Average annual snowfall is 127 cm (50 in.); a high of 279 cm (110 in.) occurred in 1887-1888 and a low of 35 cm (13.8 in.) occurred in 1912-1913 (Arnow 1949). The prevailing winds are from the west in October and April, from the west-northwest during the winter months, and from the southwest during the summer months (U.S. Geol. Surv. 1970).

3.2 GEOLOGY AND HYDROLOGY

The NL Industries site is located in the Pine Bush area within the Mohawk-Hudson lowland, which is bounded on the north by the Adirondack Mountains and on the east by the Rensselaer Plateau (Halberg et al. 1964). The site is underlain by Ordovician shale of the Normanskill Formation at a depth of about 45 to 60 m (150 to 200 ft) (Bechtel Natl. Inc. 1984). [This depth was reported by the New York State Department of Environmental Conservation to be about 15 m (50 ft) (Carcich 1984--Map, Bedrock Contours, Albany Quadrangle).] This Ordovician shale consists primarily of dark-gray to black argillaceous shales but also contains red and green shales and heavy beds of chert and grit. The Normanskill Formation is a relatively impervious rock and yields only about 1.4 L/min (5 gpm) from joint and bedding planes (Heath 1964). The bedrock is overlain by thin layers of glacial till and stratified drift. These glacial deposits are overlain by a layer of clay and silt, 30-46 m (100-150 ft) thick (Dineen 1975). Soil logs for the area surrounding the NL Industries site indicate that the surficial material is a fine brown sand about 1.5-m (5-ft) thick, and layers of grey sand, silt, and clay exist within 9.2 m (30 ft) of the ground surface (Jeter et al. 1981). The unconsolidated surficial material was deposited by glacial rivers that built a large delta into glacial Lake Albany. The NL Industries site is located about 1.6 km (1 mi) west of the buried Colonie channel, which is filled with Pleistocene glacial till, stratified drift, lake clay, and silt. These outwash-sorted deposits are capable of yielding more than 7,600 m^3/day (2 mgd) of water to supply the town of Colonie (Simpson 1949).

The site is located within the Patroon Creek drainage basin about 2.6 km (1.6 mi) east of Rensselaer Lake (Figure 3.1). At the Albany gauging station on Central Avenue, Patroon Creek has a drainage area of about 19 km^2 (7.4 mi^2) and flows east to the south of the NL Industries plant. Discharges measured

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Table 3.1. Water Quality of Patroon Creek at Central Avenue

Constituent	Concentration (mg/L)		
	04/12/79	08/28/79	04/02/80
Calcium	--	--	62
Chloride	120	110	120
Hardness, total	--	--	200
Magnesium	--	--	11
Nitrogen NH_3 as NH_4	0.10	0.04	0.18
Organic Nitrogen as N	0.15	0.28	0.15
Nitrogen as N	0.66	0.74	0.76
Nitrogen KJD	0.23	0.31	0.29
Nitrogen NH_4 as N	0.08	0.03	0.14
Nitrite + nitrate as N	0.43	0.43	0.47
Phosphorus as P	--	0.01	0.00
Potassium	--	--	2.5
Sodium	--	--	73

Source: Snavely (1983).

quality of water from the glacial deposits has, on the average, a lower mineral content than that from the bedrock (Arnow 1949). Groundwater samples taken from the four wells in the surficial aquifer around the plant site indicate that the gross alpha activity is less than 3 pCi/L, the gross beta activity ranges from less than 2 to 5.1 pCi/L, and uranium concentration ranges from 1.1 to 5 pCi/L (Weddendorf 1982). The primary source of groundwater in the area comes from the infiltration of rain and melting snow, and about 38% of precipitation recharges the Pine Bush aquifer (Snavely 1983). The groundwater table around the plant ranged from about 0.6 to 4.9 m (2 to 16 ft) below ground during borehole drilling in March 1981 (Jeter et al. 1981). Water depths measured in the four wells on November 1, 1982, ranged from 1.2 to 3 m (4 to 10 ft) below the ground surface (Weddendorf 1982). The groundwater flows to the southeast or east in the vicinity of the site (Weddendorf 1982; Snavely 1983).

3.3 ECOLOGY

The NL Industries site is located within the northern hardwood forest section of the Laurentian mixed forest (Bailey 1978). Aspen, fire cherry, ash, and hawthorne are common trees in old fields and disturbed areas; oaks (chestnut, white, and red) are also common in the New York area (Galvin 1979). However, because the site is located within an urban setting and is on industrial property, little to no actual forest habitat is present.

Table 3.3. The city of Albany has the lowest percentage of owner-occupied housing, the highest vacancy rates, and the lowest median value. The generally poor characteristics of the housing market in Albany could be expected based on the 12.5% decline in population from 1970 to 1980. Oversupply of housing and low demand could have created a situation where owners were unable to sell property and had to rent their property instead. This would account for the relatively low (34.7%) percentage of owner-occupied housing in the area.

Because of the housing characteristics in Albany and the highway- and rail-bounded location of the Yardboro/Palmer Avenue residences, marketability of these affected properties would likely have been low prior to any radiological surveys of area properties.

The town of Colonie has experienced population growth and a healthier housing situation. A greater percentage of the housing units are owner-occupied and the vacancy rate for owner-occupied units is lower than for any other political entity considered herein. The town of Colonie has a low percentage of substandard housing units. Rent and median value of housing units in the town of Colonie are generally high when compared to the city of Albany, Albany County, or the state of New York.

3.5.3 Community Issues and Concerns

The general public and state officials have been concerned about potential health effects associated with the NL Industries operation for the last few years. In 1980, the state obtained a temporary restraining order against "any operation at its facility at Colonie, New York, which will emit air contaminants, except for those operations similar to and consistent with the operations engaged in by the defendant at said facility from March 31, 1980 to April 30, 1980, including the addition of casting operations" (State of New York 1980). Although the plant has ceased operation and the property has been acquired by DOE, there are public concerns regarding the following points:

- Sensitivity of techniques used to measure residual radioactivity
- Adequacy of cleanup guidelines used to determine acceptable residual contamination levels
- Adequacy of the interim-storage method for protection of public health and safety
- Hazards to children playing in an area where materials may have been dumped or buried
- Responsibility of NL Industries for damages in the area

Local perceptions of the situation will vary depending on how the above concerns are dealt with by the parties involved. The effects of DOE's proposed remedial actions relative to community concerns are discussed in Section 5.4.3.

4. PROPOSED REMEDIAL ACTIONS AND ALTERNATIVES

4.1 PROPOSED FY 1984 ACTIONS

4.1.1 Property Cleanup

The proposed remedial actions for FY 84 involve cleanup of two properties adjacent to the NL Industries site on Central Avenue, an area adjacent to 1144A Central Avenue, and seven residential properties along Yardboro/Palmer Avenues. The addresses of these properties are given in Table 2.1; the locations relative to the site are shown in Figure 1.2. The vicinity properties will be decontaminated using the radiological cleanup guideline for uranium-238 of 35 pCi/g averaged over a depth of 5 cm (2.5 in.) and an area of 100 m^2 (1,080 ft^2). This guideline was recommended by the New York Department of Health (Condon 1984). Based on this cleanup guideline, the estimated volumes of contaminated materials to be removed are given in Table 4.1. The volumes

Table 4.1. Decontamination Volumes for Nine Vicinity Properties Near NL Industries Site

Property Address	Approximate Decontamination Volumes†1	
	m^3	yd^3
1144 Central Avenue	98	128
1144A Central Avenue and adjacent property	99	129
27/29 Yardboro Avenue	5	7
52 Yardboro Avenue	11	14
68 Yardboro Avenue	25	33
74 Yardboro Avenue	0.8	1
78 Yardboro Avenue	0.8	1
80 Yardboro Avenue	6	8
33 Palmer Avenue	0.8	1
TOTAL†2	250	320

†1 Based on cleanup guideline for uranium-238 of 35 pCi/g recommended by the New York Department of Health (Condon 1984).

†2 Totals given to two significant figures.

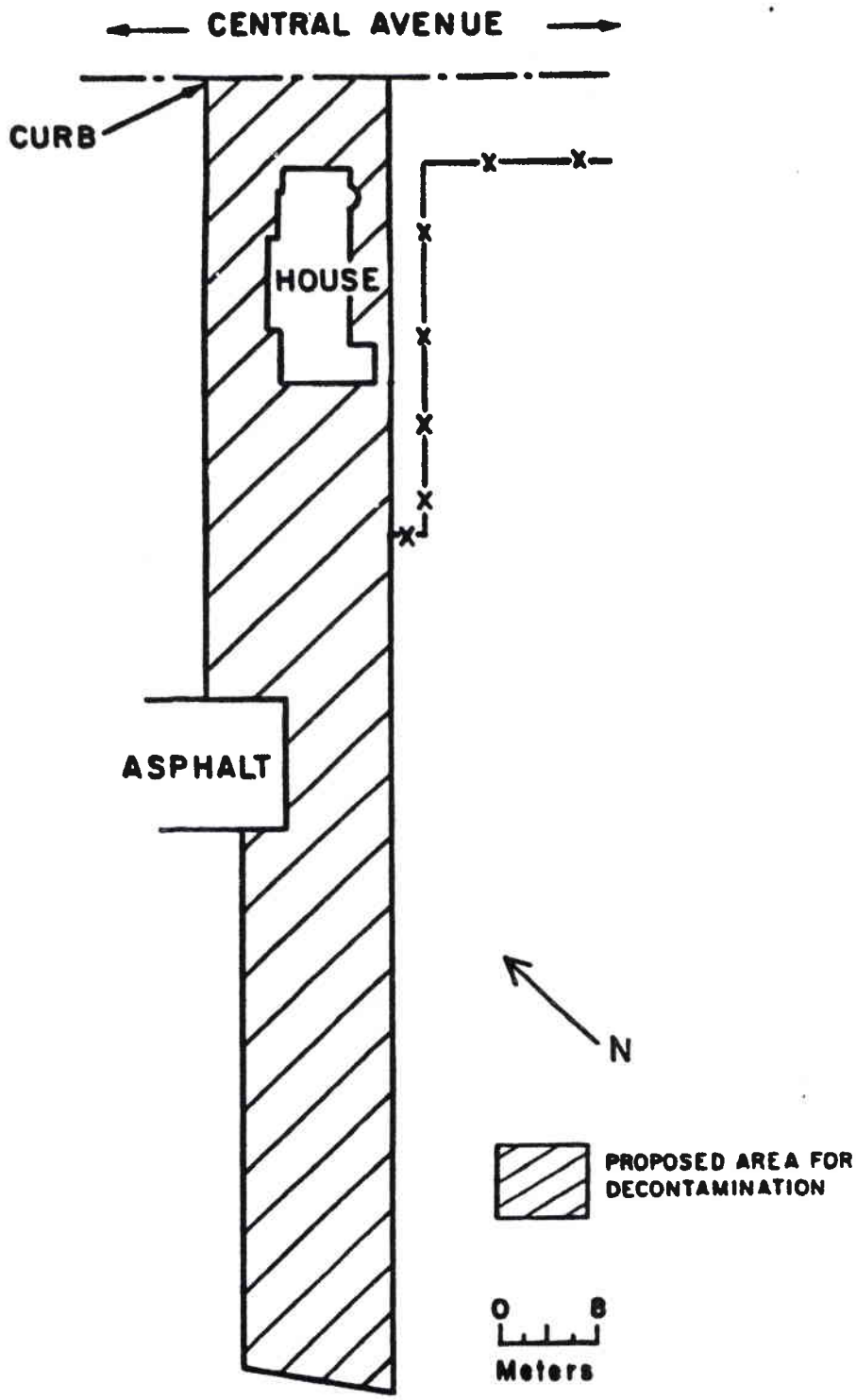

Figure 4.1. Location of Proposed Areas for Decontamination on Property at 1144 Central Avenue, Colonie, New York.

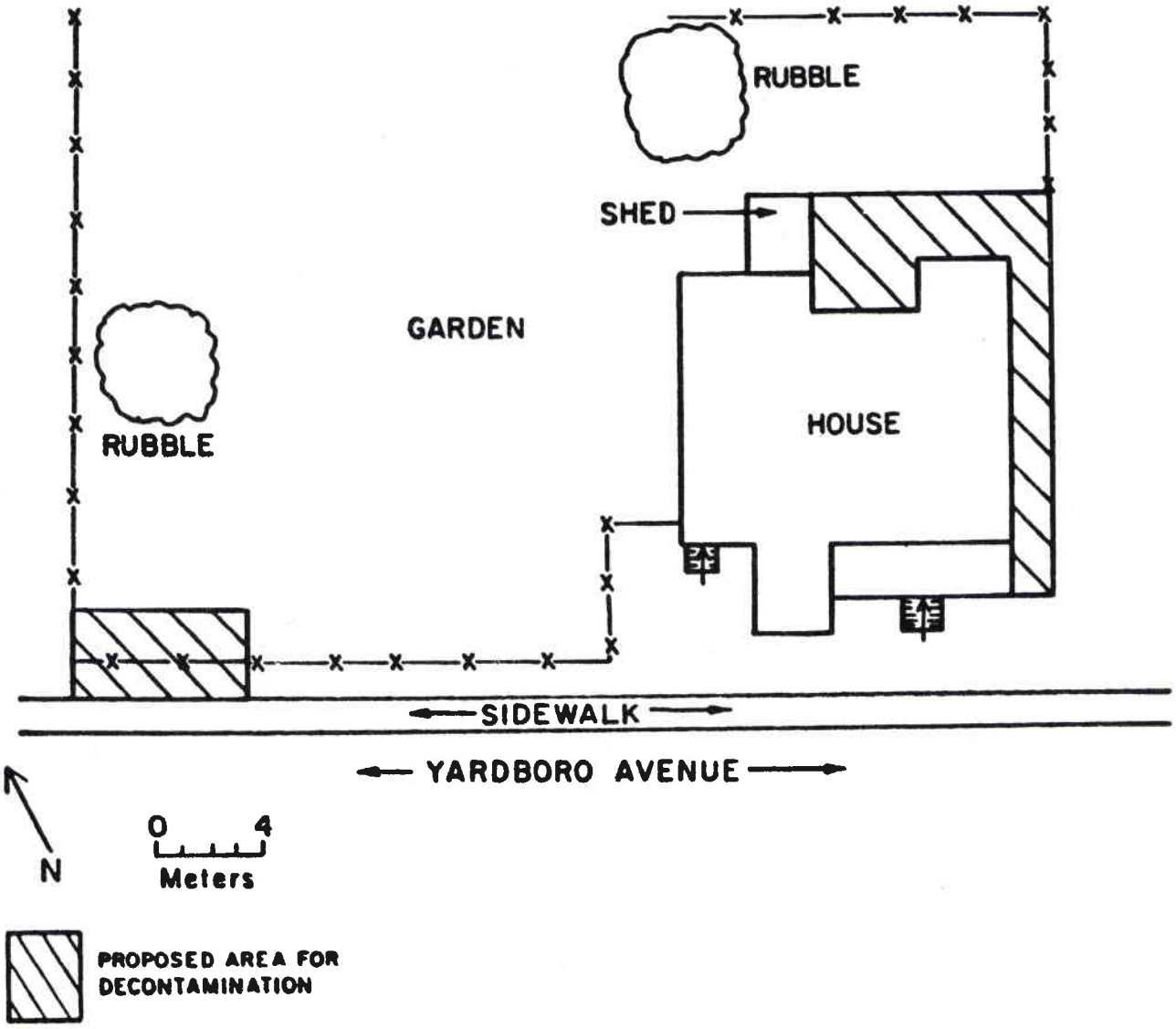

Figure 4.3. Location of Proposed Areas for Decontamination on Property at 27/29 Yardboro Avenue, Albany, New York.

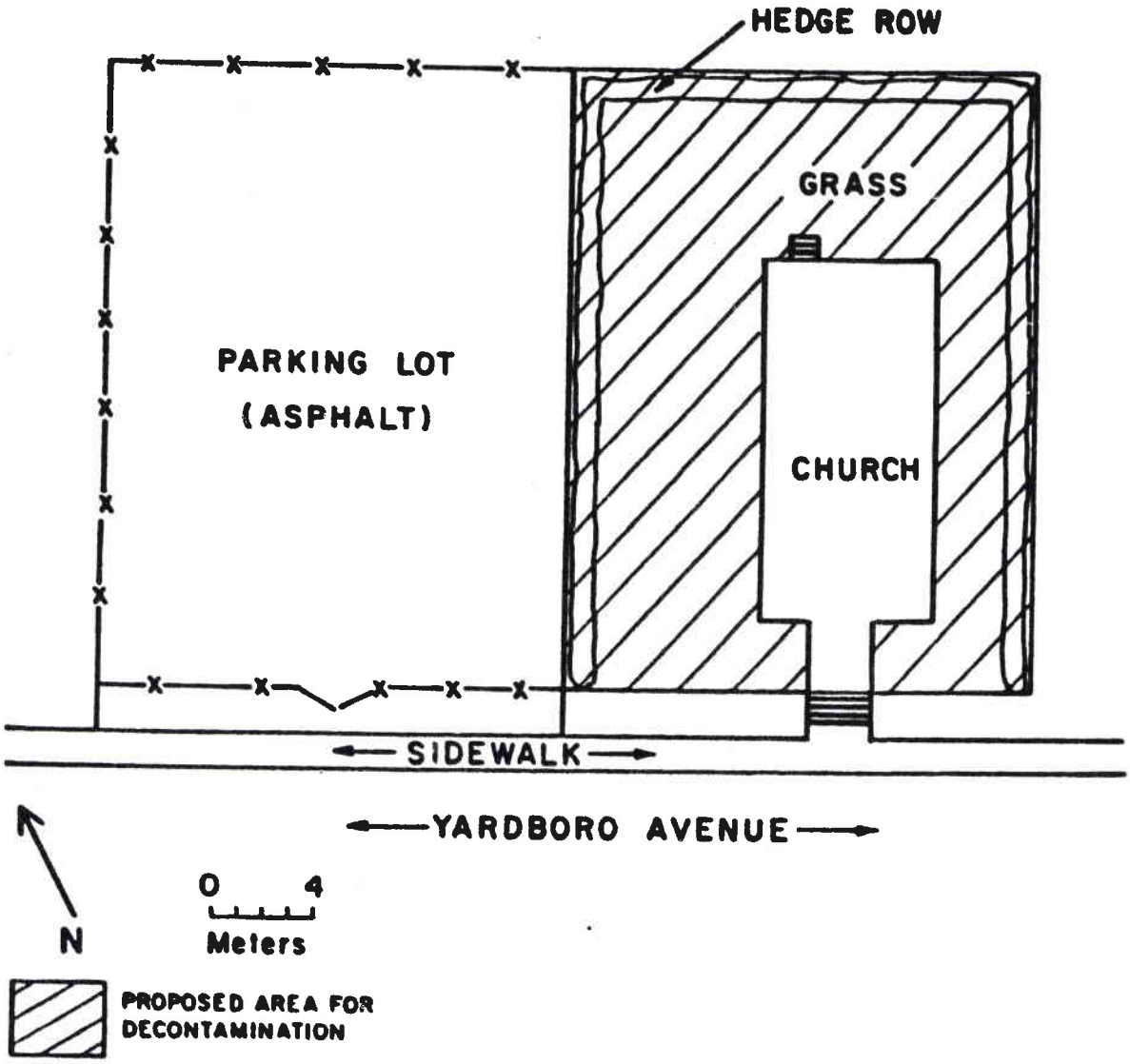

Figure 4.5. Location of Proposed Areas for Decontamination on Property at 68 Yardboro Avenue, Albany, New York.

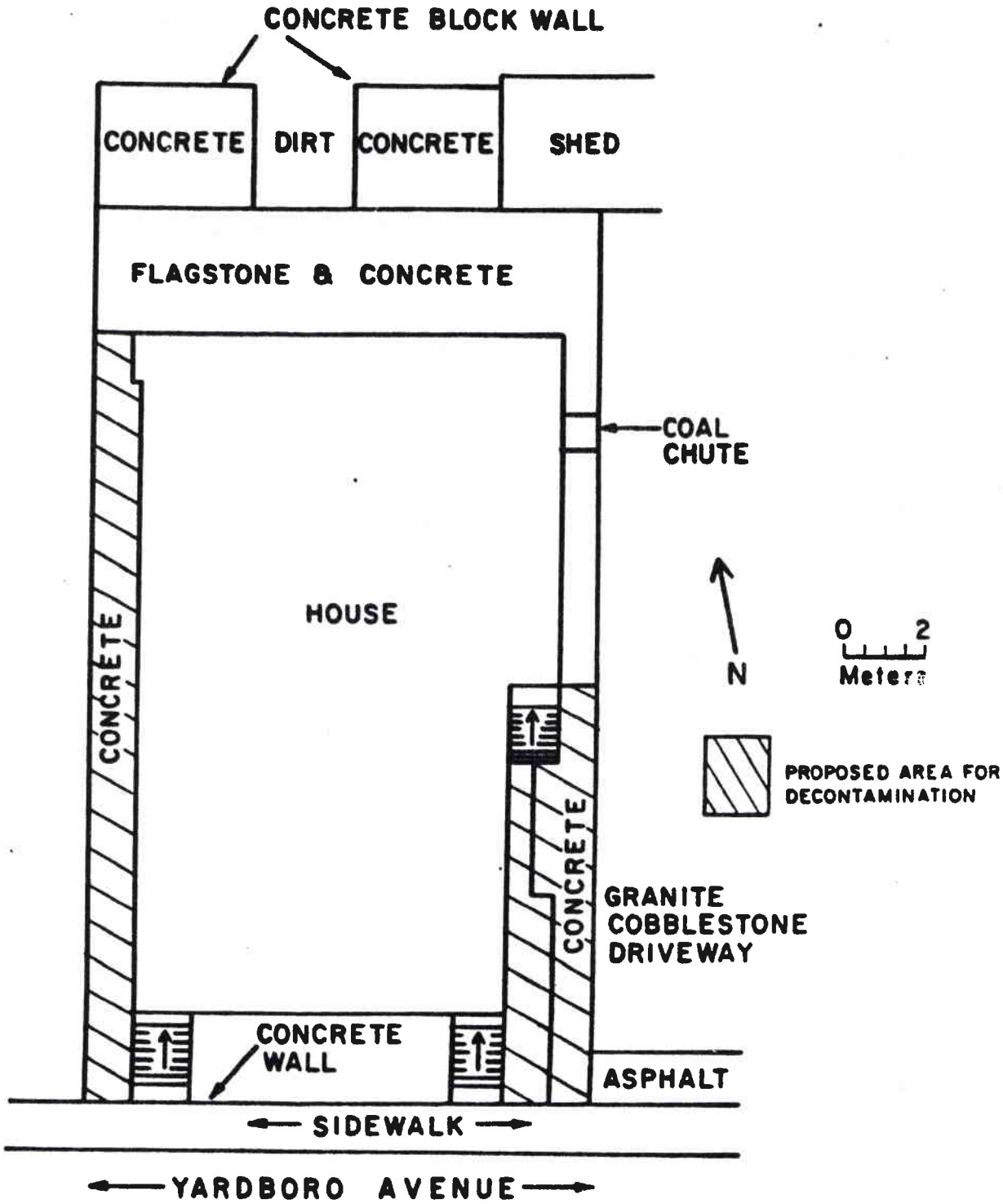

Figure 4.7. Location of Proposed Areas for Decontamination on Property at 78 Yardboro Avenue, Albany, New York.

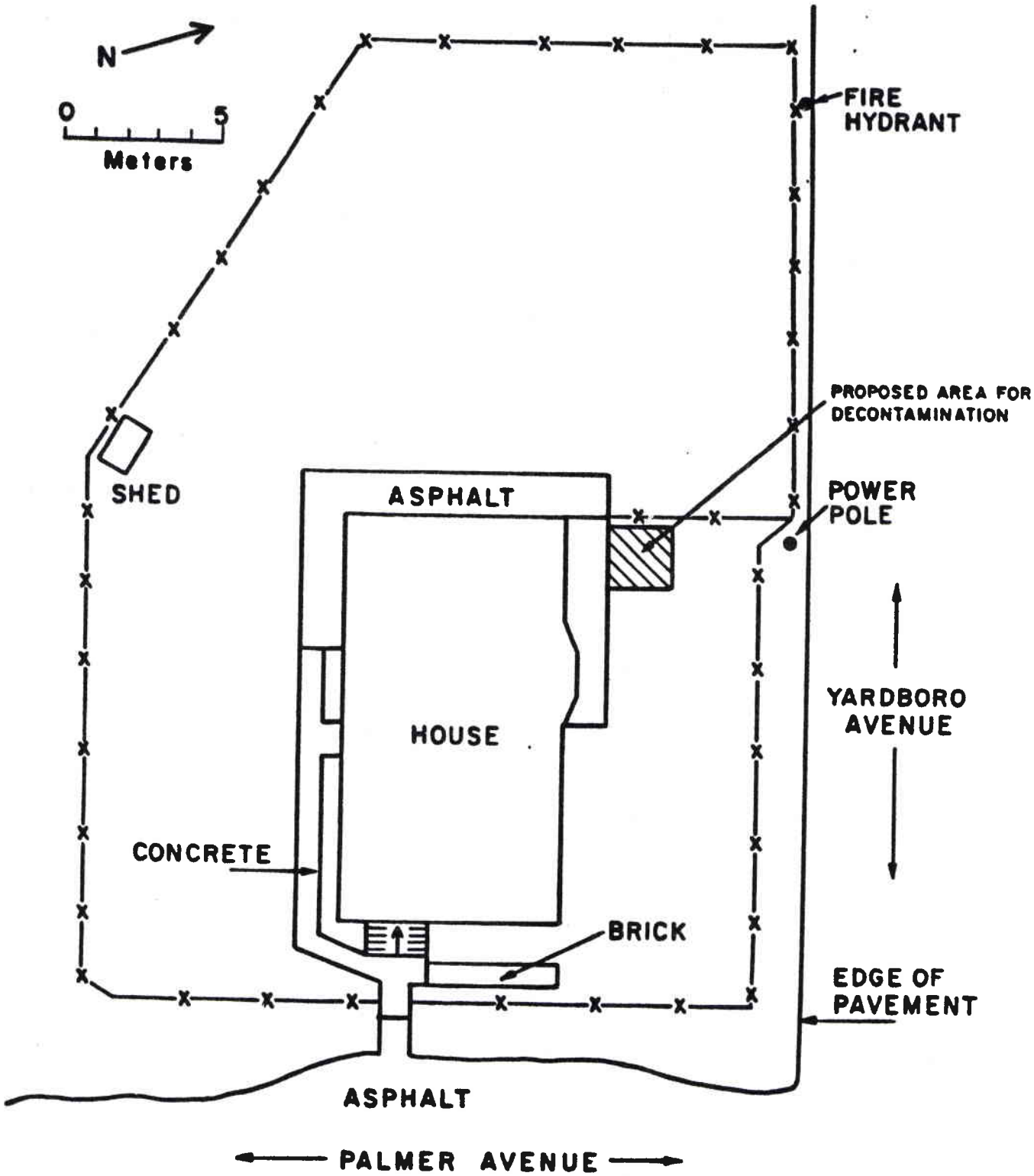

Figure 4.9. Location of Proposed Areas for Decontamination on Property at 33 Palmer Avenue, Albany, New York.

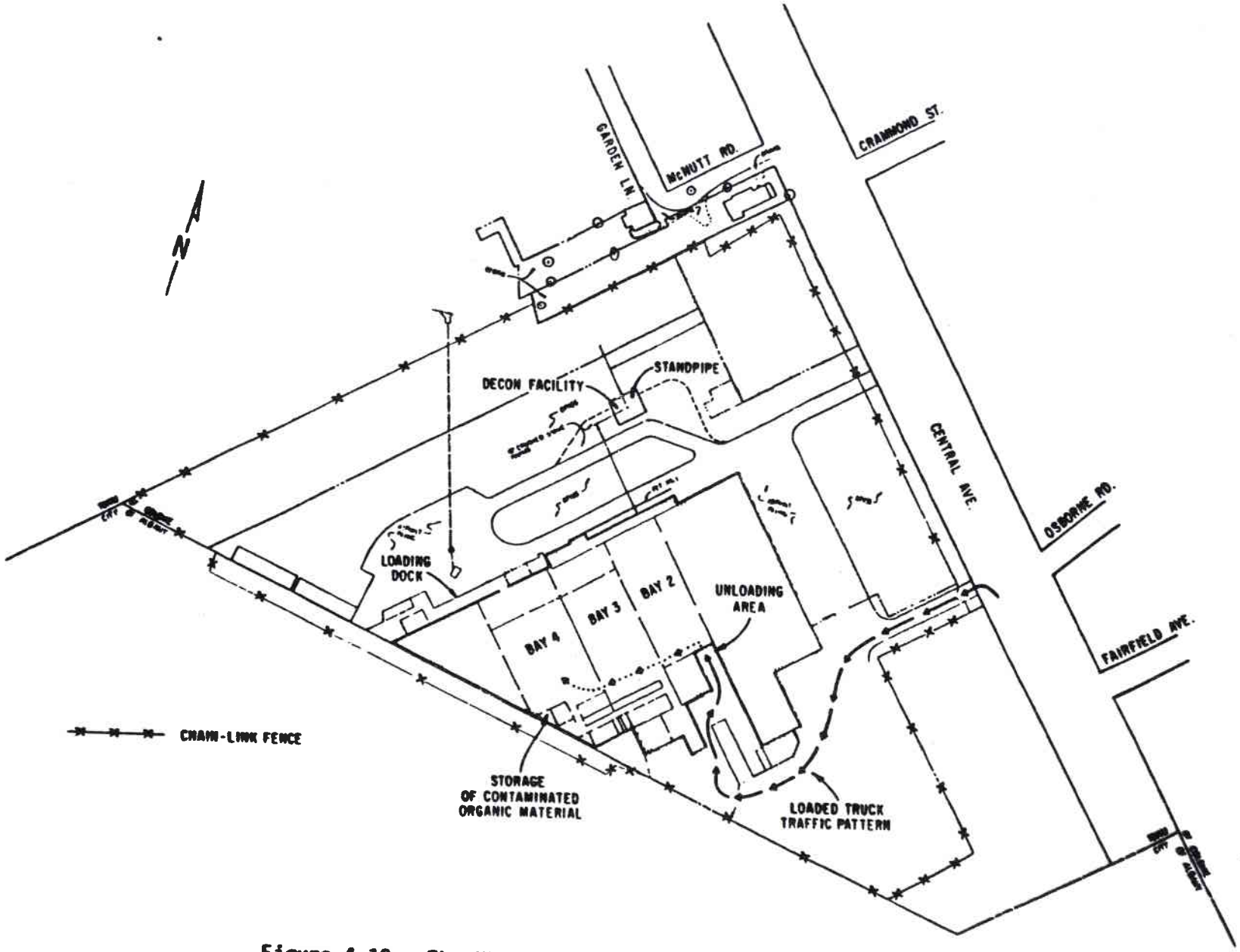

Figure 4.10. The NL Industries Site Showing Interim-Storage Area (Bay 4) and Support Facilities.

within or outside of the state of New York, and Congress has directed DOE to give priority to cleaning up the residential properties and has made funds available for this purpose. Any delay in cleaning up properties until a permanent storage site is available would result in continued concerns about health effects and property values.

Table 4.2. Summary of Measures to Mitigate and Monitor Potential Adverse Impacts of the Proposed FY 84 Actions

- Controls over possible spread of contamination, including: worker and environmental monitoring; decontamination of vehicles; and erosion- and dust-control measures.
- Erosion and dust controls, including: staged, prompt restoration/revegetation of disturbed areas and completion of work before end of growing season; covering truckloads of contaminated materials.
- Air monitoring for radioactive gases and contaminated dust release through the ventilation system.
- Noise mitigation, including: periodic checks of mufflers, compressors, etc.; work between 8:00 a.m. and 8:00 p.m. to minimize nuisance to nearby residents.
- Use of temporary snow fences around excavation areas; prompt restoration of fences, driveways, landscaping, etc.
- Scheduling of truck movements and provision of traffic directors, as necessary, to minimize traffic congestion.
- Spreading of contaminated water over several days during dry season and on a periodic basis as pit fills up.
- Consultation, cooperation, and coordination with local authorities and concerned citizens throughout the entire period of the action, including: regular information/coordination/planning meetings during both the cleanup and storage phases and designation of an onsite public liaison person for the cleanup phase.
- Periodic monitoring and surveillance of the interim-storage pile to ensure the integrity of the pile and minimize potential offsite movement of contaminants.

5. ENVIRONMENTAL CONSEQUENCES AND MITIGATION

5.1 RADIOLOGICAL

A major potential issue is the radiological impacts associated with the proposed remedial actions. The predominant pathways by which radionuclides could reach nearby workers and members of the general public during the proposed actions and result in radiation doses are: (1) inhalation of contaminated dust particles resulting in an internal dose, (2) submersion in a cloud of contaminated dust resulting in an external dose, and (3) exposure from radioactive particles deposited on the ground resulting in an external dose. Based on analysis of similar activities (Argonne Natl. Lab. 1982), it is expected that ingestion of contaminated food or water will result in a relatively insignificant internal dose.

The analysis of potential doses to nearby individuals and to the general public within an 80-km (50-mi) radius of the NL Industries site is based on the following assumptions:

- Radionuclides in the uranium-238 decay chain (Figure 5.1) between uranium-238 and uranium-234 are assumed to be present in secular equilibrium. In actuality, the concentration of uranium-234 is significantly less than uranium-238; thus, this assumption will result in a slight overprediction of actual impacts.

- The radiological impacts associated with uranium-235 decay series radionuclide will be negligible and are not included.

- The contamination from radionuclides in the uranium-238 decay chain below uranium-234 are assumed to be negligible because the NL Industries plant utilized processed uranium. This assumption is supported by field measurements indicating low concentrations of radium-226.

- The average concentration of uranium-238 in the contaminated materials to be excavated and stored is 100 pCi/g.

- The duration of the activities involving cleanup will be about three months.

- There will be particulate releases while the material is being excavated and transported to the building for interim storage and while the materials are being unloaded at the interim-storage site. There will be negligible particulate releases during the interim-storage period because the contaminated materials will be covered with low-permeability membrane sheets.

- Particulate releases from excavation activities are assumed to be 0.27 $kg/m^2/mo$ (1.2 tons/acre/mo) (U.S. Environ. Prot. Agency 1977), and releases from the pile of contaminated soil in the building are conservatively assumed to be 50% of releases from the excavation activities

during the three months of cleanup. Because the total surface area of excavation is about 3,200 m^2 (34,000 ft^2), estimated particulate releases during cleanup are 3.9×10^{-4} Ci of uranium-238 and all decay products in this decay chain down to and including uranium-234.

- The population distribution for the 1.3 million people living within 80 km (50 mi) of the NL Industries site is estimated based on 1980 county census data.

- Meteorological conditions at the NL Industries site are assumed to be similar to those at Albany County airport (Figure 1.1) where meteorological data are available.

- Doses are evaluated in terms of the 100-year environmental dose commitment (EDC). The 100-year EDC is the integrated dose over 100 years resulting from continued exposure to radionuclides released either during the three months of remedial actions.

Remedial actions will be conducted in a manner to minimize radiation doses to the general public and to workers in accordance with DOE's as-low-as-reasonably-achievable (ALARA) philosophy. Assuming that the mitigative measures discussed in Table 4.2 are implemented, potential doses to nearby individuals are estimated to be very small (Table 5.1). The estimated whole-body doses and specific organ doses (i.e., bone and lung) to the maximally exposed individual are much lower than doses received from natural sources (Table 5.2).

The estimated doses to the whole body, bone, and lung for the general public during the action period are presented in Table 5.3. The general public is considered to be the population of about 1.3 million people (1980 census) residing within 80 km (50 mi) of the site. These doses will all be negligible compared to doses the same population will receive from natural background sources of radiation.

Table 5.1. Estimated Radiological Doses to Nearby Individuals As a Result of Releases During the Proposed 1984 Remedial Actions†[1]

Individual/Location	Distance and Direction from Center of Storage Pile	Dose (mrem)		
		Whole Body	Bone	Average Lung
Resident at 1126 Central Avenue	0.15 km NE	0.060	0.97	4.7
Resident at 1144 Central Avenue	0.15 km NW	0.042	0.69	3.3
Resident at 52 Yardboro Avenue	0.17 km SE	0.0097	0.16	0.76
Resident at 110 Yardboro Avenue	0.18 km SW	0.014	0.13	0.65

†[1] Bases for radiological analysis are given in the text.

Doses to workers will be controlled and limited to less than those specified by DOE regulations for occupational doses (e.g., whole-body doses of 3000 mrem/quarter or 5000 mrem/year). Workers will be trained with regard to radiation risks and proper health-physics procedures.

Another radiological issue may be whether the decontamination criteria for the contaminated areas are considered sufficient. The New York Department of Health (Condon 1984) has suggested that the cleanup guideline for decontamination of residential properties near the NL Industries site should be 35 pCi/g for uranium-238. This value is lower than that proposed by DOE but has been adopted by DOE for this action. Release of the decontaminated areas for unrestricted use is not part of the proposed remedial actions. Such release will be subject to a separate DOE decision in the future.

5.2 PHYSICAL AND BIOLOGICAL

The proposed actions will result in some short-term impacts on surface water and groundwater. These impacts will be limited to the period of construction. Disturbed areas will be subject to wind and water erosion, with subsequent increases in turbidity, sedimentation, and dissolved solids of nearby waterways (e.g., Patroon Creek). The greatest potential for such temporary impacts will be during the thunderstorm season in June, July, and August; and the magnitude of these impacts will depend primarily on the timing of construction and the amount of materials exposed. However, because Patroon Creek is located in an urbanized area and thus receives a number of point and nonpoint discharges, no noticeable change in the water quality of the creek resulting from the proposed actions is expected. Mitigative measures--such as limiting the operation of construction vehicles and other equipment during unfavorable weather conditions, minimizing the time that the contaminated areas are exposed, and using straw bales downslope from the excavation areas (Table 4.2)--should minimize this impact.

Because most of contaminated materials will be removed from the top 5 cm (2 in.) of soil and stored inside the building at the NL Industries site, the proposed actions are not expected to markedly affect the quality of groundwater in the vicinity of the site. However, during construction, improper handling or refueling of construction equipment and storage of construction materials in an area with a high water table could result in contamination of groundwater. Proper management to contain any spills or release of oils, fuels, greases, and other potentially contaminating materials will minimize this impact.

Water from a local public supply system will be used for equipment decontamination at the site during the remedial action period. A steam/high-pressure water system will be used to minimize water use. The amount of water to be used is small relative to the available resources and local demands in the town of Colonie. Bechtel National, Inc. (1984), estimates that the maximum amount of contaminated water will be about 19,000 liters (5,000 gal). This estimated volume might be larger than the actual volume resulting from washing the trucks needed for the remedial action--about 32 truckloads. Contaminated water will be spread periodically over the contaminated grass area northwest of the plant. The spreading of 19,000 liters of water uniformly over an estimated area of about 3,300 m^2 (0.8 acre) would amount to an equivalent of about 0.6 cm (0.2 in.) of rainfall. Much of this would evaporate when the

expected to follow the commuting trends that are well established for this area. Impacts, such as demands on local goods and services or effects on the local economy, are expected to be minimal for a project of this size (Argonne Natl. Lab. 1982).

5.4.2 Affected Residential Environment

There will be adverse impacts on the residential areas immediately surrounding the NL Industries site. These adverse impacts will be related to cleanup activities involving movement and storage of the contaminated materials. Affected properties will be disrupted for short periods of time while excavation takes place. In some instances, this may result in the temporary removal of grass, shrubs, fences, etc.

Excavation and construction activities, as well as increased traffic, are expected to increase local noise levels. However, because the truck traveling distance is short and the amount of materials to be transported is small (Section 4.1.1), the impacts due to increased truck traffic will be minimal and for short duration only.

The longer the cleanup of all vicinity properties takes, the longer the contamination will be in the public forefront. This undoubtedly will affect property values, although the effect will be temporary and will concern only those interested in or actively trying to sell their property. The cleanup is expected to take about one month for properties on Yardboro/Palmer Avenues and about two months for properties on Central Avenue. This schedule should minimize potential negative perceptions in relation to the contamination. Planned cleanup activities, when completed, should alleviate concerns regarding property values. The interim-storage plan could cause a reduction in property values in the area adjacent to NL Industries. However, this would probably be the result of a perceived risk, not a real risk.

5.4.3 Community Issues and Concerns

There are currently two citizens groups that are concerned about DOE actions with reference to the NL Industries site: Citizens Concerned About NL (CCNL) and East New York Council of Occupational Safety and Health (ENYCOSH). The CCNL is primarily made up of area residents and ENYCOSH involves former NL Industries employees. Both groups work together with reference to the NL Industries issue. The following issues and concerns were indicated by representatives of these groups (Eccles 1984; Rabe 1984):

- Security of the NL site and building now and during the interim-storage period
- Desire of local citizens to find out what is going on with reference to radiological surveys and cleanup
- Cost of cleanup rather than public welfare as the major criterion for specifying action
- Schedule of the cleanup of area properties and the NL Industries site
- Performance of additional surveys at nearby residential properties to determine if any radioactivity is present

6. REFERENCES

Argonne National Laboratory. 1982. Methods for Assessing Environmental Impacts of a FUSRAP Property-Cleanup/Interim-Storage Remedial Action. ANL/EIS-16. Prepared for Formerly Utilized Sites Remedial Action Program, U.S. Department of Energy, by Division of Environmental Impact Studies, Argonne National Laboratory.

Arnow, T.A. 1949. The Ground-Water Resources of Albany County, New York. N.Y. State Water Power Control Comm. Bull. GW-20. 56 pp.

Bailey, R.G. 1978. Descriptions of the Ecoregions of the United States. U.S. Forest Service, Intermountain Region, Ogden UT. 77 pp.

Bechtel National, Inc. 1984. Work Plan for the Colonie Interim Storage Site. Prepared for the U.S. Department of Energy, Oak Ridge Operations, Oak Ridge, TN. April 1984.

Carcich, I.G. 1984. Letter (Director, Bureau of Water Research, New York State Department of Environmental Conservation, Albany, NY) to J.Y. Yang (Argonne National Laboratory, Argonne, IL), dated February 3, 1984, with enclosure (3 maps).

Condon, W.J. 1984. Letter (Bureau of Environmental Radiation Protection, New York Department of Health, Albany, NY) to L. Campbell (U.S. Department of Energy, Oak Ridge, TN), dated February 9, 1984.

Dineen, R.J. 1975. Geology and Land Uses in the Pine Bush, Albany County, New York. N.Y. State Museum Sci. Serv. Circ. 47. 27 pp.

Eccles, M. 1984. Personal communication (Citizens Concerned About NL) to R.G. Williams (Argonne National Laboratory), May 2, 1984.

Galvin, M. 1979. Management of Transmission Line Rights-of-Way for Fish and Wildlife. Volume 2, Eastern United States. FWS/OBS-79/22. U.S. Fish and Wildlife Service.

Halberg, N.H., et al. 1964. Water Resources of the Albany-Schenectady-Troy Area. N.Y. Geol. Surv. Water-Supply Pap. 1499-D.

Heath, R.C. 1964. Ground Water in New York. Bulletin GW-51. Prepared by the U.S. Geological Survey in cooperation with the New York Water Resources Commission, Albany, NY.

Jeter, H.W., and D.M. Eagleson. 1980. A Survey of Uranium in Soils Surrounding the NL Bearings Plant. INL-9488-61. Prepared for NL Bearings/NL Industries, Inc., Albany, NY, by Teledyne Isotopes, Westwood, NJ. October 1980.

Rudolph, R.L. 1984. Letter (Bechtel National, Inc.) to E.L. Keller (U.S. Department of Energy, Oak Ridge Operations), dated March 22, 1984.

Simpson, E.S. 1949. Buried Preglacial Ground Water Channels, the Albany - Schenectady Area in New York. N.Y. State Water Power Control Comm. Bull. GW-20 A.

Snavely, D.S. 1983. Ground-Water Appraisal of the Pine Bush Area, Albany County, New York. U.S. Geol. Surv. Water Resour. Invest. Rep. 82-4000.

Snavely, D.S. 1984a. Personal communication (U.S. Geological Survey, Albany, NY) to J. Yang (Argonne National Laboratory, Argonne, IL), May 3, 1984.

Snavely, D.S. 1984b. Personal communication (U.S. Geological Survey, Albany, NY) to J. Yang (Argonne National Laboratory, Argonne, IL), April 12, 1984.

State of New York, Supreme Court of the County of Albany. 1980. Robert F. Flacke, Commissioner of Environmental Conservation of the State of New York against N.L. Industries, Inc., Order Index No. 1842-80, April 30, 1980.

U.S. Bureau of the Census. 1984. Data obtained by telephone from the Chicago Information Center.

U.S. Congress. 1983. FY 1984 Energy and Water Appropriations Act. Congressional Record--House. June 28, 1983.

U.S. Environmental Protection Agency. 1977. Compilation of Air Pollution Emission Factors. AP-42. Research Triangle Park, NC.

U.S. Geological Survey. 1970. The National Atlas of the United States of America. Washington, DC.

U.S. Senate. 1980. The Socioeconomic Effects of a Nuclear Waste Storage Site on Rural Areas and Small Communities. Hearing before the Subcommittee on Rural Development of the Committee on Agriculture, Nutrition, and Forestry, United States Senate, Ninety-Sixth Congress, Second Session, August 26, 1980. U.S. Government Printing Office, Washington, DC.

Weddendorf, W.K. 1982. Groundwater Assessment Program at NL Industries Colonie Facility. November 1982.

7. LIST OF CONTRIBUTORS

This Action Description Memorandum has been prepared by the U.S. Department of Energy (DOE) with contractual assistance from Argonne National Laboratory (ANL). Staff members of the DOE Oak Ridge Operations Office and Bechtel National, Inc., have reviewed the document. The following staff members of the ANL Environmental Research Division contributed to the preparation of this report.

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ACTION DESCRIPTION MEMORANDUM

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Prepared by

Environmental Research Division
Argonne National Laboratory
Argonne, Illinois

June 5, 1984

Prepared for

U.S. Department of Energy
Oak Ridge Operations
Technical Services Division
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1. SUMMARY OF PROPOSED ACTIONS

As part of the research and development project authorized by Congress pursuant to the FY 1984 Energy and Water Appropriations Act (U.S. Congress 1983), the U.S. Department of Energy (DOE) proposes to carry out some remedial actions during 1984 at vicinity properties near the NL Industries, Inc., facility in the town of Colonie, New York (Figures 1.1 and 1.2). The proposed FY 84 actions include cleanup of nine vicinity properties and interim storage of the contaminated materials inside the building at the NL Industries site, which was recently acquired by DOE (February 1984). The vicinity properties will be decontaminated under DOE's Formerly Utilized Sites Remedial Action Program (FUSRAP). The major proposed actions include:

- Removal of about 200 m^3 (260 yd^3) of radioactively contaminated soils from two residential properties on Central Avenue in the town of Colonie.

- Removal of about 40 m^3 (50 yd^3) of contaminated soils from seven residential properties on Yardboro/Palmer Avenue in the city of Albany.

- Construction of a vehicle decontamination area and other support facilities on the NL Industries site.

- Placement of the 240 m^3 (310 yd^3) of decontaminated soil materials inside the NL Industries building in bulk.

Details of the various activities are given in Section 4 (Proposed Action and Alternatives).

The proposed FY 84 actions involving cleanup of the nine vicinity properties (Figure 1.2) are the first phase of remedial actions to be implemented at the NL Industries site. There will be separate future decisions on cleanup of additional properties. Because a licensed permanent disposal site is not readily available in the state of New York, current decontamination plans call for interim storage of offsite waste in the onsite building in bulk. A future decision will have to be made relative to permanent disposition of the contaminated materials. The contaminated materials will be removed from the vicinity properties according to the residual contamination and waste-control guideline for uranium-238 of 35 pCi/g averaged over a depth of 5 cm (2 in.) and an area of 10 m × 10 m (33 ft × 33 ft). This guideline is consistent with DOE's As Low As Reasonably Achievable (ALARA) policy. Following removal of contaminated materials, DOE will certify the properties for future use, as appropriate. Separate environmental analyses will be prepared to support future decisions on cleanup of other vicinity properties, decontamination and release of the NL Industries site, and permanent disposition of the contaminated materials.

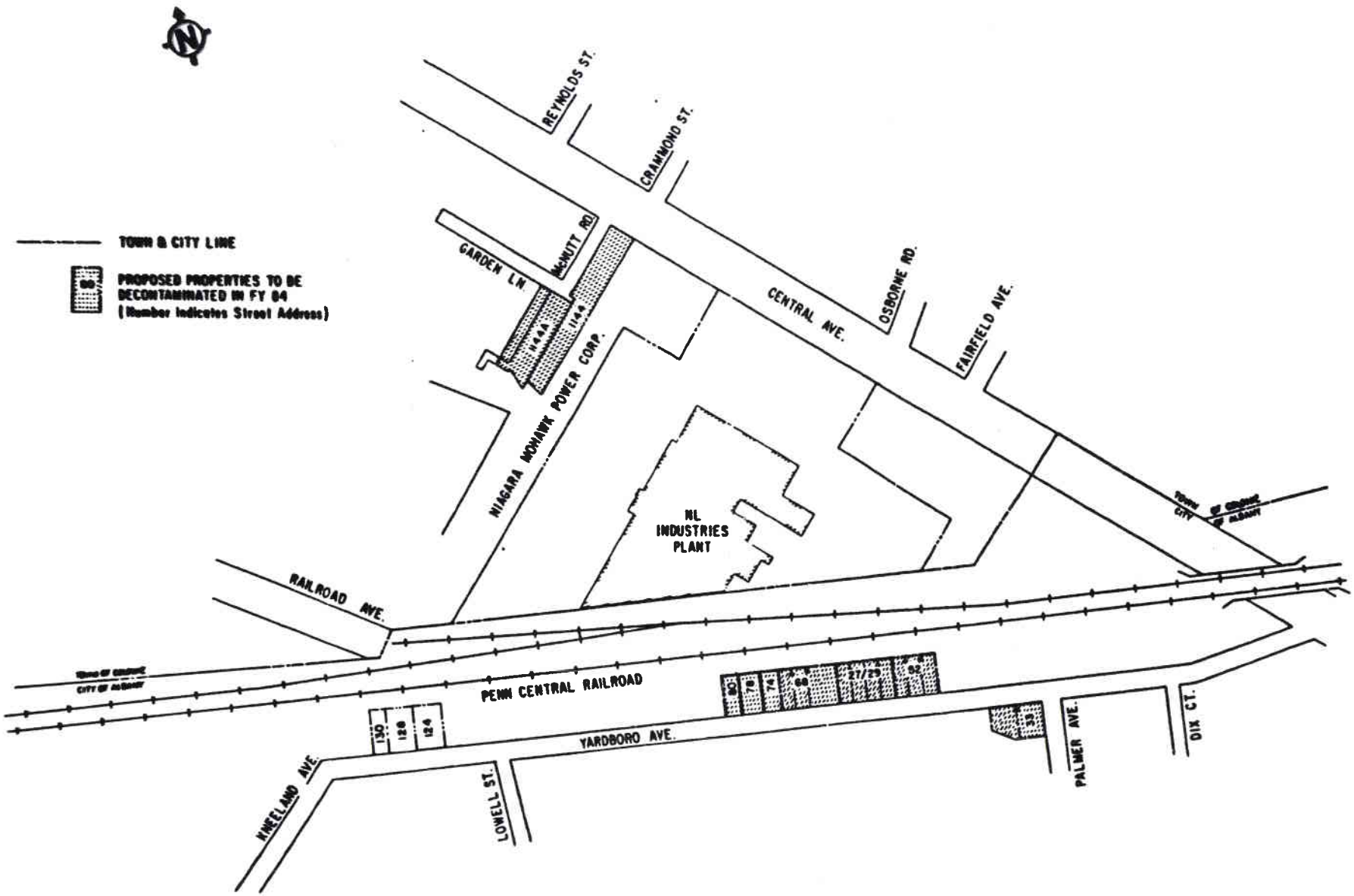

Figure 1.2. Location of Contaminated Properties near the NL Industries Site.

2. HISTORY AND NEED FOR ACTION

2.1 GENERAL SETTING

The former NL Industries site (now owned by DOE) is located in the town of Colonie, New York (Figure 1.1). The border between the town of Colonie and the city of Albany, New York is just south of the site. The site is about 6 km (4 mi) northwest of downtown Albany, and located in a urban area about 5 km (3 mi) southeast of the village of Colonie (Figure 1.1). The NL Industries site is approximately 4 ha (10 acres) in size, with the masonry office and manufacturing building occupying about 0.8 ha (2 acres) (Figure 1.2). The facility is enclosed by a chain-link fence.

The neighborhood surrounding the facility is mixed light industrial, commercial, and residential. The site is bordered on the northeast by State Route 5, which is also called Central Avenue or the Albany-Schenectady Road (Figures 1.1 and 1.2). Heavy traffic occurs on this route. To the northwest and west, the site is bordered by open land and a power substation owned by the Niagara Mohawk Power Corporation. The southeast and eastern boundaries of the site adjoin various commercial properties. To the southwest and south, the facility is abutted by the Penn Central Railroad tracks. Residential properties occur along Yardboro Avenue, which runs parallel to the tracks and intersects Central Avenue. A stream passes through the facility in a concrete conduit and empties into Patroon Creek south of the facility.

Several radiological surveys have been performed on the NL Industries site and in the surrounding area in an attempt to define the nature and extent of the contamination (Jeter and Eagleson 1980; Oak Ridge Natl. Lab. 1984a-1984i). A number of residential properties in the area have been identified as being potentially radioactively contaminated. The proposed actions are to decontaminate nine of these properties during FY 84; these properties (Figure 1.2) and the corresponding radiological surveys are:

- Two residential properties on Central Avenue (Oak Ridge Natl. Lab. 1984a, 1984b).
- Six residential properties on Yardboro Avenue (Oak Ridge Natl. Lab. 1984c-1984h).
- One residential property on Palmer Avenue (Oak Ridge Natl. Lab. 1984i).

The street addresses of these vicinity properties are listed in Table 2.1.

Figure 5.1) are the principal contaminants in the area and that the contamination is greatest to the northwest and southeast of the site. Very little contamination was found beyond a distance of 400 m (1300 ft).

Radiological surveys were performed at vicinity properties by the Radiological Survey Activities Group, Oak Ridge National Laboratory (ORNL), during October 20-27, 1983 (Oak Ridge Natl. Lab. 1984a-1984i). A summary of the survey results is presented in the following section.

2.3 RADIOLOGICAL CONTAMINATION AND NEED FOR ACTION

The results of the surveys performed by Jeter and Eagleson (1980) and Oak Ridge National Laboratory (1984a-1984i) indicate that portions of properties in the vicinity of the NL Industries site have soils that are contaminated to levels exceeding the proposed New York State residual contamination guideline for uranium-238 of 35 pCi/g. In addition to uranium-238, the other two uranium isotopes associated with naturally occurring uranium (i.e., uranium-234 and uranium-235) as well as thorium-234 and protactinium-234 (decay products of uranium-238) are also present at elevated concentrations.* However, the concentrations of uranium-234 and uranium-235 are significantly lower than that of uranium-238. The concentrations of thorium-234 and protactinium-234 are assumed to be equal to that of uranium-238 because these two radionuclides have short half-lives. Hence, current efforts are directed toward cleaning up uranium-238. It is anticipated that cleaning up the residual contamination level to 35 pCi/g for uranium-238 will also result in reducing the concentration of uranium-234 and uranium-235 to acceptable levels.

Recent ORNL radiological surveys indicated that the uranium contamination in the area is depleted uranium (Oak Ridge Natl. Lab. 1984a-1984i). Based on these surveys, two properties located on Central Avenue were identified as requiring decontamination. These properties are located at 1144 and 1144A Central Avenue. Additional areas of contamination were also identified on seven properties located on Yardboro and Palmer Avenues. These additional areas will also be cleaned up during remedial actions in FY 84.

2.3.1 Central Avenue Properties

The two properties at 1144 and 1144A Central Avenue are located on adjoining land immediately northwest of the NL Industries plant. The contamination generally occurs within the top 5 cm (2 in.) of soil. The highest concentration of uranium-238 measured at 1144 Central Avenue was 740 pCi/g, and the average uranium-238 concentration in the top 5 cm at this site was about 70 pCi/g (Oak Ridge Natl. Lab. 1984a). The average uranium-238 concentration below 5 cm was not significantly above background except in localized areas.

The highest uranium-238 concentration measured at 1144A Central Avenue and an adjacent small area was 850 pCi/g (Oak Ridge Natl. Lab. 1984b). This concentration was measured along the drip line of the house roof within the

---

*Because the NL Industries plant utilized processed uranium, there will be negligible concentrations of thorium-230 and all subsequent decay products (see the uranium-238 radioactive decay chain in Section 5, Figure 5.1).

Table 3.1. Water Quality of Patroon Creek at Central Avenue

Constituent	Concentration (mg/L)		
	04/12/79	08/28/79	04/02/80
Calcium	--	--	62
Chloride	120	110	120
Hardness, total	--	--	200
Magnesium	--	--	11
Nitrogen NH_3 as NH_4	0.10	0.04	0.18
Organic Nitrogen as N	0.15	0.28	0.15
Nitrogen as N	0.66	0.74	0.76
Nitrogen KJD	0.23	0.31	0.29
Nitrogen NH_4 as N	0.08	0.03	0.14
Nitrite + nitrate as N	0.43	0.43	0.47
Phosphorus as P	--	0.01	0.00
Potassium	--	--	2.5
Sodium	--	--	73

Source: Snavely (1983).

quality of water from the glacial deposits has, on the average, a lower mineral content than that from the bedrock (Arnow 1949). Groundwater samples taken from the four wells in the surficial aquifer around the plant site indicate that the gross alpha activity is less than 3 pCi/L, the gross beta activity ranges from less than 2 to 5.1 pCi/L, and uranium concentration ranges from 1.1 to 5 pCi/L (Weddendorf 1982). The primary source of groundwater in the area comes from the infiltration of rain and melting snow, and about 38% of precipitation recharges the Pine Bush aquifer (Snavely 1983). The groundwater table around the plant ranged from about 0.6 to 4.9 m (2 to 16 ft) below ground during borehole drilling in March 1981 (Jeter et al. 1981). Water depths measured in the four wells on November 1, 1982, ranged from 1.2 to 3 m (4 to 10 ft) below the ground surface (Weddendorf 1982). The groundwater flows to the southeast or east in the vicinity of the site (Weddendorf 1982; Snavely 1983).

3.3 ECOLOGY

The NL Industries site is located within the northern hardwood forest section of the Laurentian mixed forest (Bailey 1978). Aspen, fire cherry, ash, and hawthorne are common trees in old fields and disturbed areas; oaks (chestnut, white, and red) are also common in the New York area (Galvin 1979). However, because the site is located within an urban setting and is on industrial property, little to no actual forest habitat is present.

from 1970 to 1980, which was greater than the decline of either the county or state. The town of Colonie grew 7.9% from 1970 to 1980. The median household income (1980 dollars) of the town of Colonie is about $21,191, which is higher than that of the city of Albany ($12,511), Albany County ($17,006), and the state of New York ($16,647) (U.S. Bur. Census 1984).

3.5.2 Affected Residential Environment

Seven of the residential properties selected for remedial action in FY 84 are located to the south of the NL Industries site in the city of Albany. Only two residential sites are located in the town of Colonie. The residential properties are listed in Table 2.1.

The 1980 housing characteristics of the town of Colonie, city of Albany, Albany County, and state of New York vary considerably. The important characteristics of the housing markets in these political entities are given in Table 3.3. The city of Albany has the lowest percentage of owner-occupied

Table 3.3. Housing Characteristics for the NL Industries Site Area, 1980

Political Entity	Total Number of Units†[1]	% Owner-Occupied	Vacancy Rate: Owner-Occupied†[2]	Vacancy Rate: Rental
Town of Colonie	26,646	69.7	1.0	4.5
City of Albany	46,187	34.7	1.9	7.3
Albany County	114,938	52.1	1.3	6.0
New York State	6,699,084	46.0	1.2	4.1

Political Entity	% Sub-standard†[3]	Median Rent/Month	Median†[4] Value
Town of Colonie	0.6	$242	$42,500
City of Albany	2.1	$175	$37,700
Albany County	1.6	$187	$41,900
New York State	2.5	$210	$45,600

†[1] Total number of year-round housing units.

†[2] Units for sale.

†[3] Percent substandard is technically defined as units lacking complete plumbing for exclusive use.

†[4] Median value is for owner-occupied units. Excludes residences on 4 ha (10 acres) or more, mobile homes, condos, and homes with medical or commercial offices.

Source: U.S. Bureau of the Census (1984).

4. PROPOSED REMEDIAL ACTIONS AND ALTERNATIVES

4.1 PROPOSED FY 1984 ACTIONS

4.1.1 Property Cleanup

The proposed remedial actions for FY 84 involve cleanup of two properties adjacent to the NL Industries site on Central Avenue, an area adjacent to 1144A Central Avenue, and seven residential properties along Yardboro/Palmer Avenues. The addresses of these properties are given in Table 2.1; the locations relative to the site are shown in Figure 1.2. The vicinity properties will be decontaminated using the radiological cleanup guideline for uranium-238 of 35 pCi/g averaged over a depth of 5 cm (2.5 in.) and an area of 100 m × 10 m (33 ft × 33 ft). This guideline was recommended by the New York Department of Health (Condon 1984) and is consistent with DOE's ALARA principle. Based on this cleanup guideline, the estimated volumes of contaminated materials to be removed are given in Table 4.1. The volumes shown in Table 4.1 indicate that

Table 4.1. Decontamination Volumes for Nine Vicinity Properties Near NL Industries Site

Property Address	Approximate Decontamination Volumes†1	
	m^3	yd^3
1144 Central Avenue	98	128
1144A Central Avenue and adjacent property	99	130
27/29 Yardboro Avenue	4	5
52 Yardboro Avenue	4	5
68 Yardboro Avenue	22	29
74 Yardboro Avenue	0.8	1
78 Yardboro Avenue	0.8	1
80 Yardboro Avenue	8	11
33 Palmer Avenue	0.8	1
TOTAL†2	240	310

†1 Based on cleanup guideline for uranium-238 of 35 pCi/g.

†2 Totals given to two significant figures.

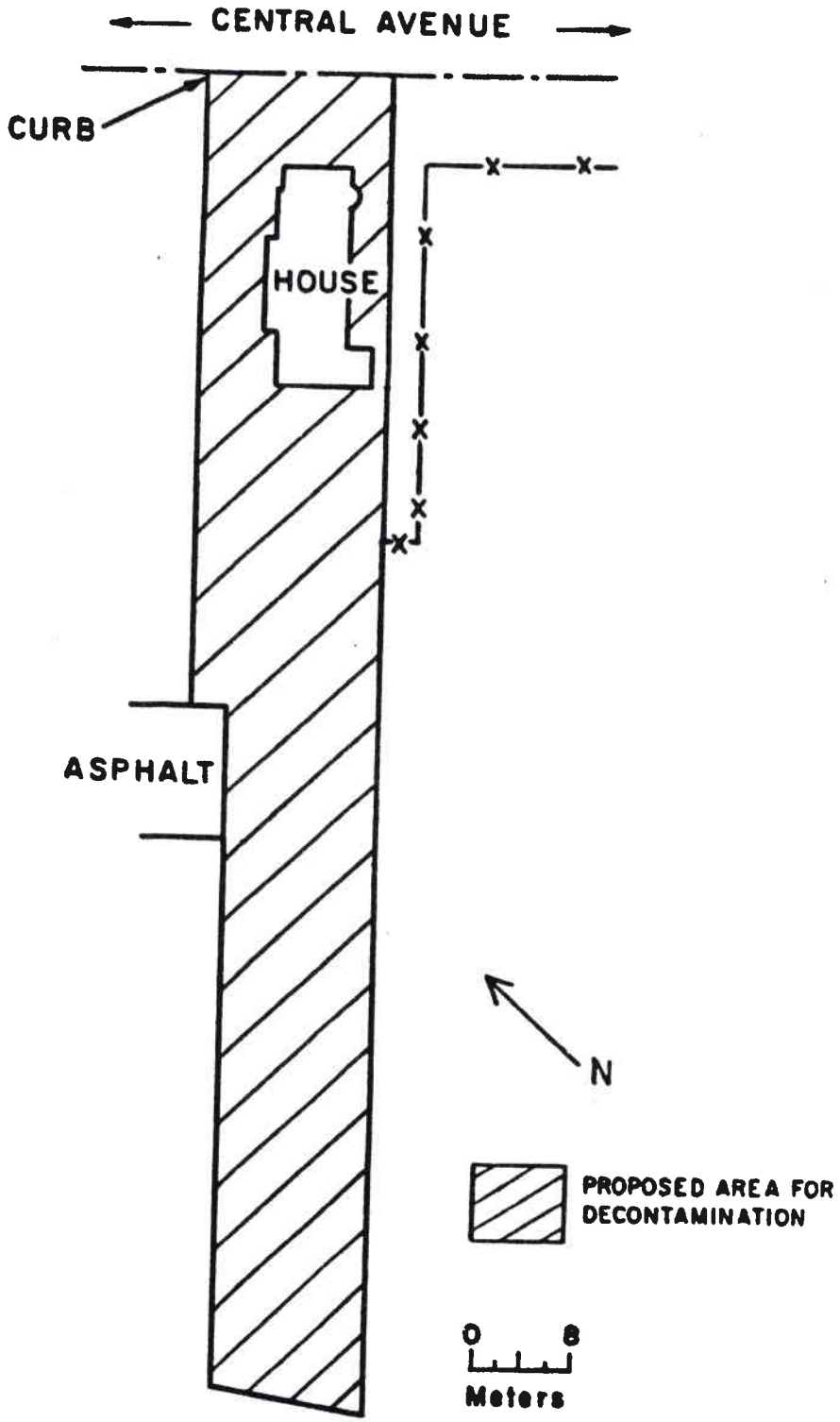

Figure 4.1. Location of Proposed Areas for Decontamination on Property at 1144 Central Avenue, Colonie, New York.

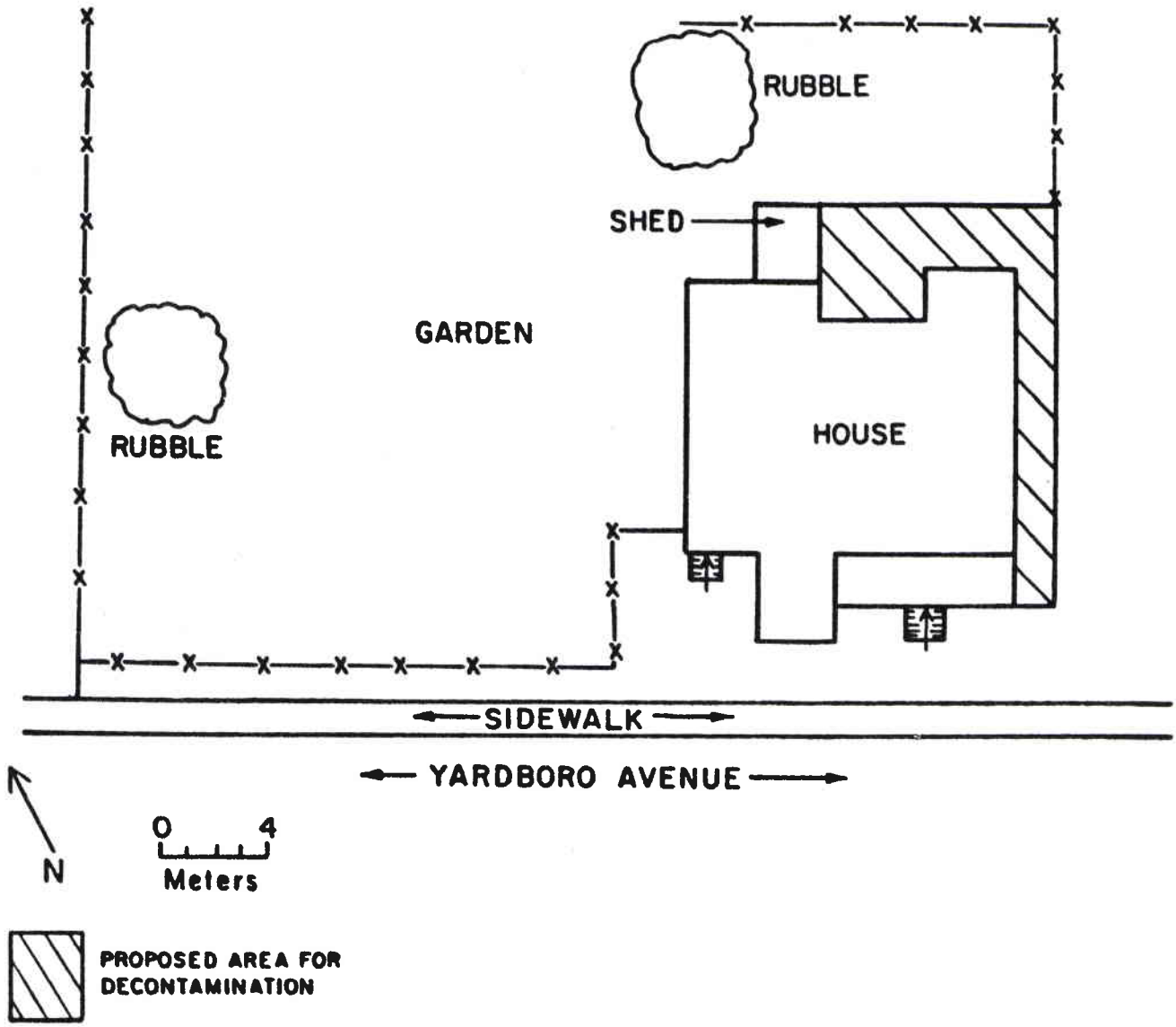

Figure 4.3. Location of Proposed Areas for Decontamination on Property at 27/29 Yardboro Avenue, Albany, New York.

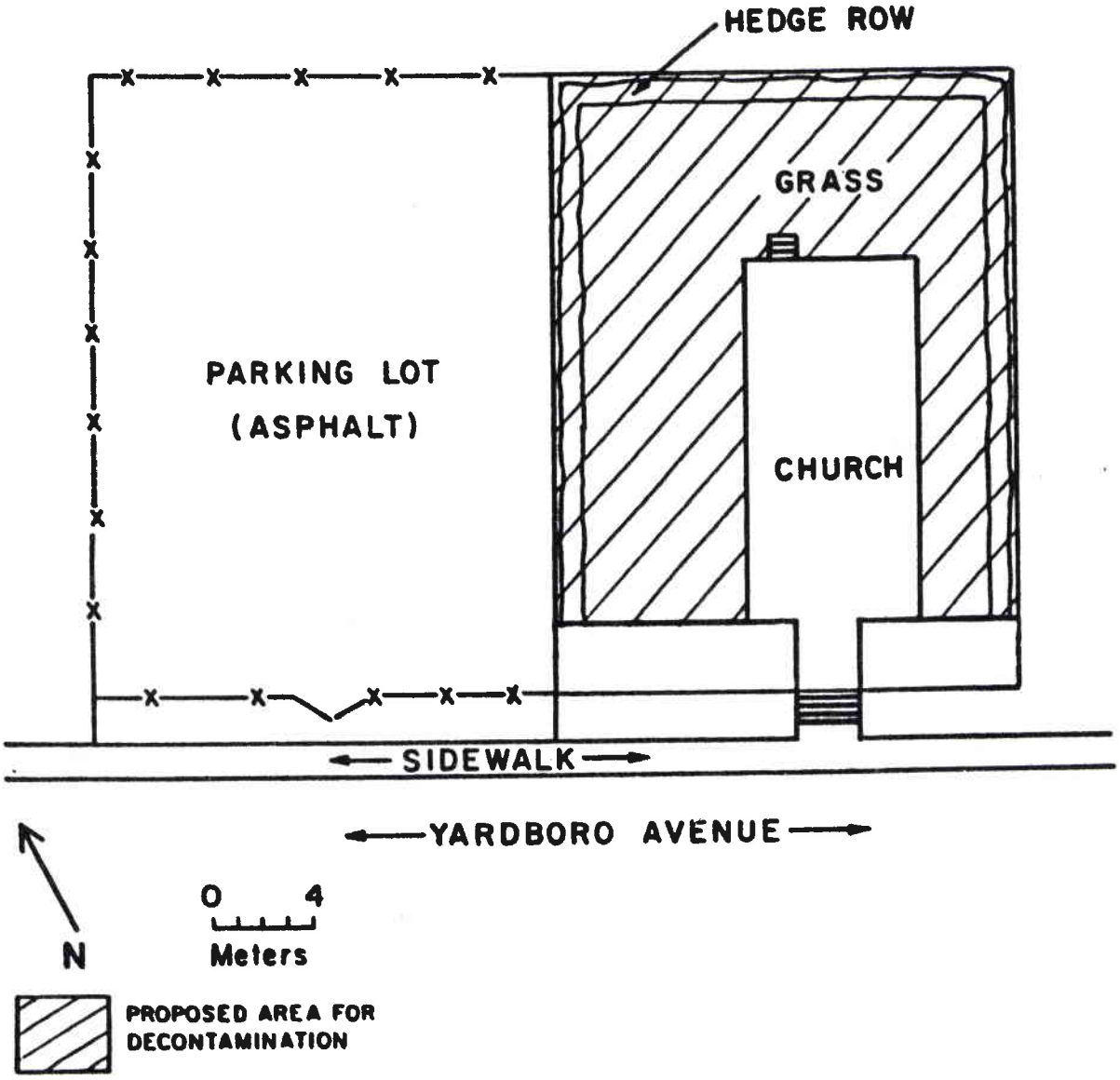

Figure 4.5. Location of Proposed Areas for Decontamination on Property at 68 Yardboro Avenue, Albany, New York.

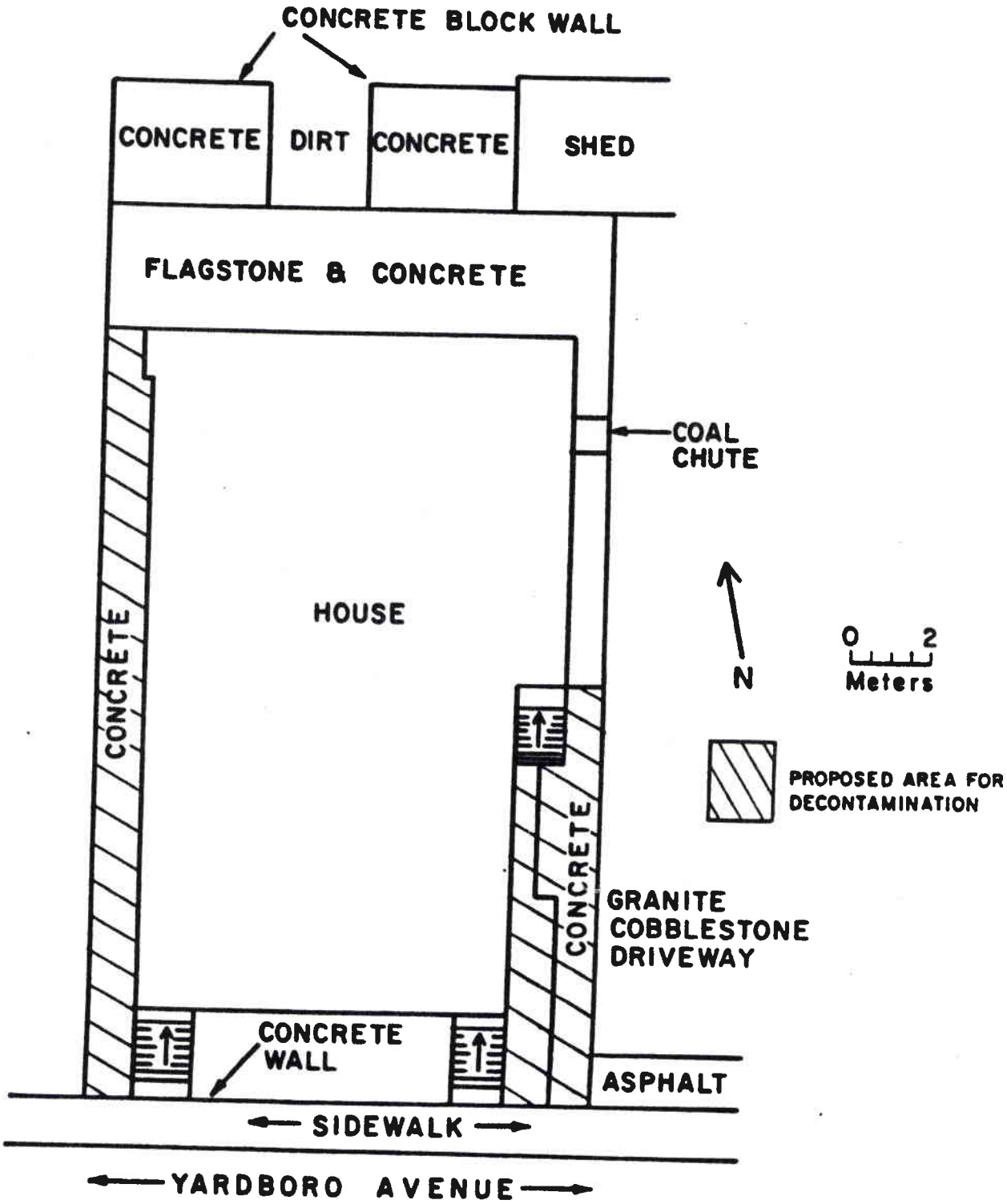

Figure 4.7. Location of Proposed Areas for Decontamination on Property at 78 Yardboro Avenue, Albany, New York.

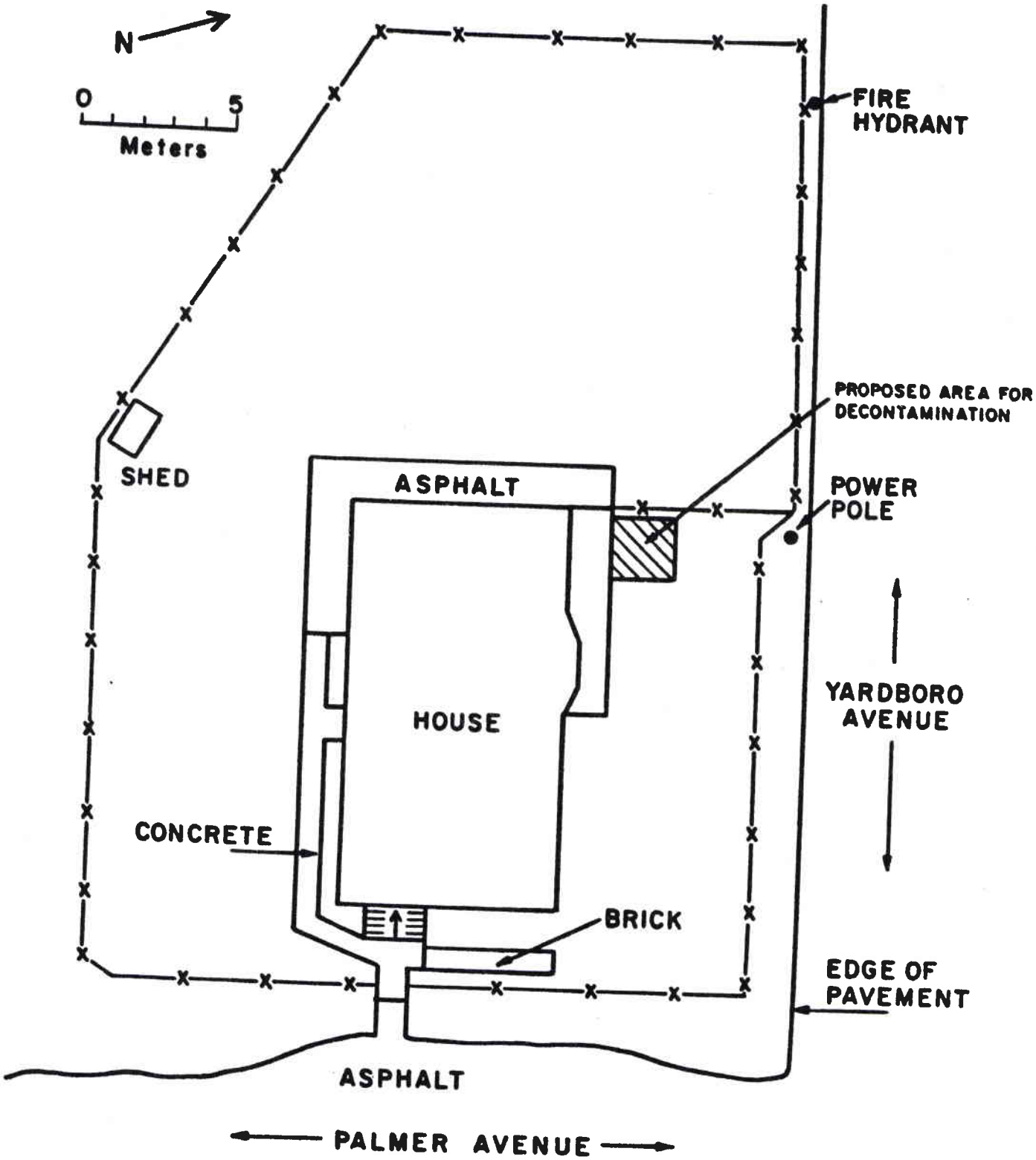

Figure 4.9. Location of Proposed Areas for Decontamination on Property at 33 Palmer Avenue, Albany, New York.

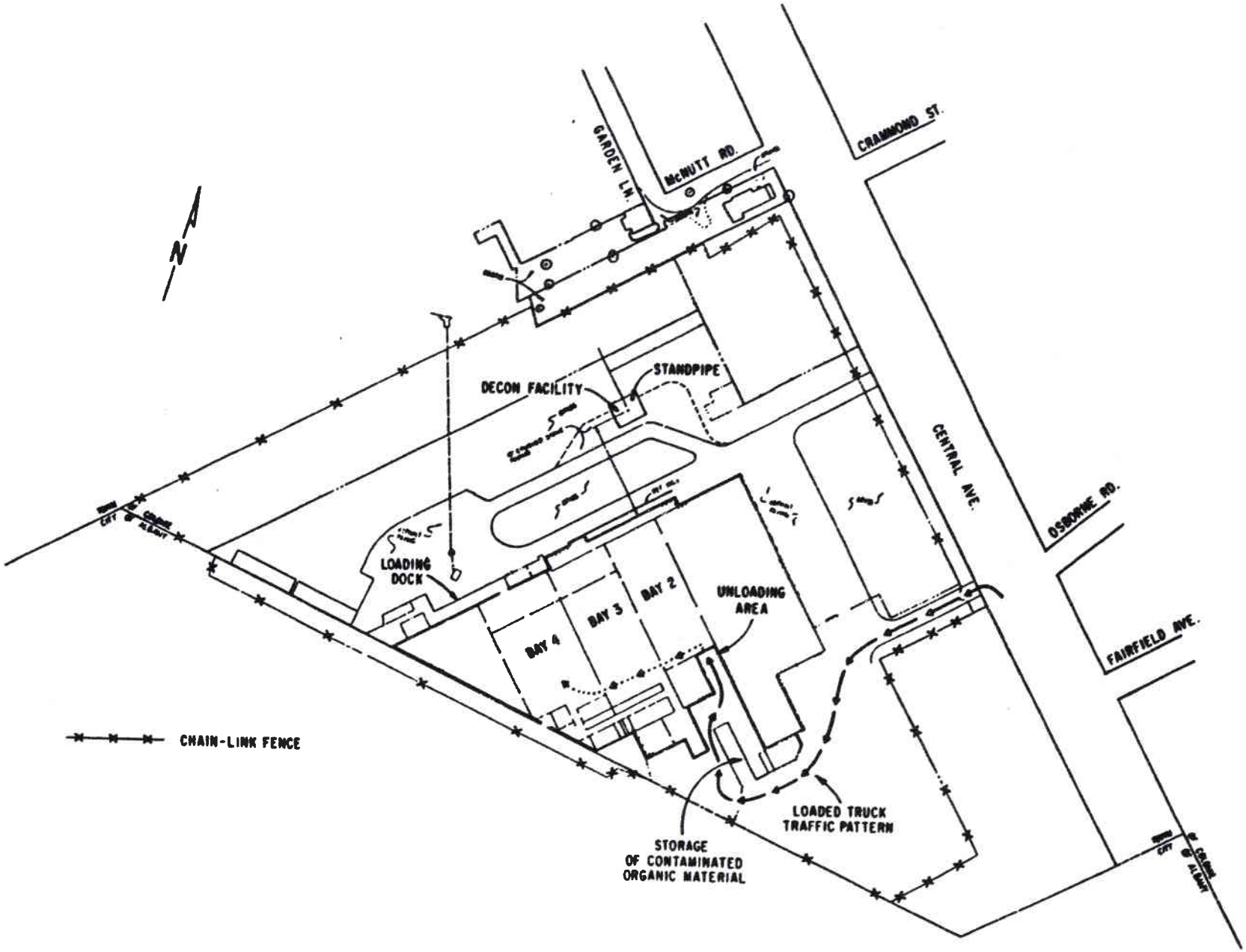

Figure 4.10. The NL Industries Site Showing Interim-Storage Area (Bay 4) and Support Facilities.

Table 4.2. Summary of Measures to Mitigate and Monitor Potential Adverse Impacts of the Proposed FY 84 Actions

- Controls over possible spread of contamination, including: worker and environmental monitoring; decontamination of vehicles; and erosion- and dust-control measures.
- Erosion and dust controls, including: staged, prompt restoration/revegetation of disturbed areas and completion of work before end of growing season; covering truckloads of contaminated materials.
- Air monitoring for radioactive gases and contaminated dust release through the ventilation system.
- Noise mitigation, including: periodic checks of mufflers, compressors, etc.; work between 8:00 a.m. and 8:00 p.m. to minimize nuisance to nearby residents.
- Use of temporary snow fences around excavation areas; prompt restoration of fences, driveways, landscaping, etc.
- Scheduling of truck movements and provision of traffic directors, as necessary, to minimize traffic congestion.
- Spreading of contaminated water over several days during dry season and on a periodic basis as pit fills up.
- Consultation, cooperation, and coordination with local authorities and concerned citizens throughout the entire period of the action, including: regular information/coordination/planning meetings during both the cleanup and storage phases and designation of an onsite public liaison person for the cleanup phase.
- Periodic monitoring and surveillance of the interim-storage pile to ensure the integrity of the pile and minimize potential offsite movement of contaminants.

Another alternative might be to move the contaminated materials from all properties directly to another site for permanent disposition. This alternative offers the advantage of having to move the contaminated materials only once. However, a permanent storage site has not yet been identified, either within or outside of the state of New York, and Congress has directed DOE to give priority to cleaning up the residential properties and has made funds available for this purpose. Any delay in cleaning up properties until a permanent storage site is available would result in continued concerns about health effects and property values.

5. ENVIRONMENTAL CONSEQUENCES AND MITIGATION

5.1 RADIOLOGICAL

A major potential issue is the radiological impacts associated with the proposed remedial actions. The predominant pathways by which radionuclides could reach nearby workers and members of the general public during the proposed actions and result in radiation doses are: (1) inhalation of contaminated dust particles resulting in an internal dose, (2) submersion in a cloud of contaminated dust resulting in an external dose, and (3) exposure from radioactive particles deposited on the ground resulting in an external dose. Based on analysis of similar activities (Argonne Natl. Lab. 1982), it is expected that ingestion of contaminated food or water will result in a relatively insignificant internal dose.

The analysis of potential doses to nearby individuals and to the general public within an 80-km (50-mi) radius of the NL Industries site is based on the following assumptions:

- Radionuclides in the uranium-238 decay chain (Figure 5.1) between uranium-238 and uranium-234 are assumed to be present in secular equilibrium. In actuality, the concentration of uranium-234 is significantly less than uranium-238; thus, this assumption will result in a slight overprediction of actual impacts.

- The radiological impacts associated with uranium-235 decay series radionuclide will be negligible and are not included.

- The contamination from radionuclides in the uranium-238 decay chain below uranium-234 are assumed to be negligible because the NL Industries plant utilized processed uranium. This assumption is supported by field measurements indicating low concentrations of radium-226.

- The average concentration of uranium-238 in the contaminated materials to be excavated and stored is 100 pCi/g.

- The duration of the activities involving cleanup will be about three months.

- There will be particulate releases while the material is being excavated and transported to the building for interim storage and while the materials are being unloaded at the interim-storage site. There will be negligible particulate releases during the interim-storage period because the contaminated materials will be covered with low-permeability membrane sheets.

- Particulate releases from excavation activities are assumed to be 0.27 kg/m^2/mo (1.2 tons/acre/mo) (U.S. Environ. Prot. Agency 1977), and releases from the pile of contaminated soil in the building are conservatively assumed to be 50% of releases from the excavation activities

during the three months of cleanup. Because the total surface area of excavation is about 3,100 m^2 (33,000 ft^2), estimated particulate releases during cleanup are 3.9×10^{-4} Ci of uranium-238 and all decay products in this decay chain down to and including uranium-234.

- The population distribution for the 1.3 million people living within 80 km (50 mi) of the NL Industries site is estimated based on 1980 county census data.

- Meteorological conditions at the NL Industries site are assumed to be similar to those at Albany County airport (Figure 1.1) where meteorological data are available.

- Doses are evaluated in terms of the 100-year environmental dose commitment (EDC). The 100-year EDC is the integrated dose over 100 years resulting from continued exposure to radionuclides released either during the three months of remedial actions.

Remedial actions will be conducted in a manner to minimize radiation doses to the general public and to workers in accordance with DOE's ALARA policy. Assuming that the mitigative measures discussed in Table 4.2 are implemented, potential doses to nearby individuals are estimated to be very small (Table 5.1). The estimated whole-body doses and specific organ doses (i.e., bone and lung) to the maximally exposed individual are much lower than doses received from natural sources (Table 5.2).

The estimated doses to the whole body, bone, and lung for the general public during the action period are presented in Table 5.3. The general public is considered to be the population of about 1.3 million people (1980 census) residing within 80 km (50 mi) of the site. These doses will all be negligible compared to doses the same population will receive from natural background sources of radiation.

Table 5.1. Estimated Radiological Doses to Nearby Individuals As a Result of Releases During the Proposed 1984 Remedial Actions†[1]

Individual/Location	Distance and Direction from Center of Storage Pile	Dose (mrem)		
		Whole Body	Bone	Average Lung
Resident at 1126 Central Avenue	0.15 km NE	0.060	0.97	4.7
Resident at 1144 Central Avenue	0.15 km NW	0.042	0.69	3.3
Resident at 52 Yardboro Avenue	0.17 km SE	0.0097	0.16	0.76
Resident at 110 Yardboro Avenue	0.18 km SW	0.014	0.13	0.65

†[1] Bases for radiological analysis are given in the text.

Doses to workers will be controlled and limited to less than those specified by DOE regulations for occupational doses (e.g., whole-body doses of 3000 mrem/quarter or 5000 mrem/year). Workers will be trained with regard to radiation risks and proper health-physics procedures.

Another radiological issue may be whether the decontamination criteria for the contaminated areas are considered sufficient. The New York Department of Health (Condon 1984) has suggested that the cleanup guideline for decontamination of residential properties near the NL Industries site should be 35 pCi/g for uranium-238. This value is lower than that proposed by DOE but has been used by DOE for this action based the ALARA policy. Following removal of the contaminated materials, DOE will certify the properties for future use, as appropriate.

5.2 PHYSICAL AND BIOLOGICAL

The proposed actions will result in some short-term impacts on surface water and groundwater. These impacts will be limited to the period of construction. Disturbed areas will be subject to wind and water erosion, with subsequent increases in turbidity, sedimentation, and dissolved solids of nearby waterways (e.g., Patroon Creek). The greatest potential for such temporary impacts will be during the thunderstorm season in June, July, and August; and the magnitude of these impacts will depend primarily on the timing of construction and the amount of materials exposed. However, because Patroon Creek is located in an urbanized area and thus receives a number of point and nonpoint discharges, no noticeable change in the water quality of the creek resulting from the proposed actions is expected. Mitigative measures--such as limiting the operation of construction vehicles and other equipment during unfavorable weather conditions, minimizing the time that the contaminated areas are exposed, and using straw bales downslope from the excavation areas (Table 4.2)--should minimize this impact.

Because most of contaminated materials will be removed from the top 5 cm (2 in.) of soil and stored inside the building at the NL Industries site, the proposed actions are not expected to markedly affect the quality of groundwater in the vicinity of the site. However, during construction, improper handling or refueling of construction equipment and storage of construction materials in an area with a high water table could result in contamination of groundwater. Proper management to contain any spills or release of oils, fuels, greases, and other potentially contaminating materials will minimize this impact.

Water from a local public supply system will be used for equipment decontamination at the site during the remedial action period. A steam/high-pressure water system will be used to minimize water use. The amount of water to be used is small relative to the available resources and local demands in the town of Colonie. Bechtel National, Inc. (1984), estimates that the maximum amount of contaminated water will be about 19,000 liters (5,000 gal). This estimated volume might be larger than the actual volume resulting from washing the trucks needed for the remedial action--about 32 truckloads. As discussed in Section 4.1, spreading periodically over the existing contaminated grass area northwest of the plant appears to be the most viable option for disposal of contaminated water. The spreading of 19,000 liters of water uniformly over

5.4 SOCIOECONOMICS

5.4.1 Population

Demographic changes from the influx of workers or outmigration of local residents are expected to be insignificant. Local subcontractors will be hired, and the personnel associated with the small, short-term work force are expected to follow the commuting trends that are well established for this area. Impacts, such as demands on local goods and services or effects on the local economy, are expected to be minimal for a project of this size (Argonne Natl. Lab. 1982).

5.4.2 Affected Residential Environment

There will be adverse impacts on the residential areas immediately surrounding the NL Industries site. These adverse impacts will be related to cleanup activities involving movement and storage of the contaminated materials. Affected properties will be disrupted for short periods of time while excavation takes place. In some instances, this may result in the temporary removal of grass, shrubs, fences, etc.

Excavation and construction activities, as well as increased traffic, are expected to increase local noise levels. However, because the truck traveling distance is short and the amount of materials to be transported is small (Section 4.1.1), the impacts due to increased truck traffic will be minimal and for short duration only.

The longer the cleanup of all vicinity properties takes, the longer the contamination will be in the public forefront. This undoubtedly will affect property values, although the effect will be temporary and will concern only those interested in or actively trying to sell their property. The cleanup is expected to take about one month for properties on Yardboro/Palmer Avenues and about two months for properties on Central Avenue. This schedule should minimize potential negative perceptions in relation to the contamination. Planned cleanup activities, when completed, should alleviate concerns regarding property values. The interim-storage plan could cause a reduction in property values in the area adjacent to NL Industries. However, this would probably be the result of a perceived risk, not a real risk.

5.4.3 Community Issues and Concerns

There are currently two citizens groups that are concerned about DOE actions with reference to the NL Industries site: Citizens Concerned About NL (CCNL) and East New York Council of Occupational Safety and Health (ENYCOSH). The CCNL is primarily made up of area residents and ENYCOSH involves former NL Industries employees. Both groups work together with reference to the NL Industries issue. The following issues and concerns were indicated by representatives of these groups (Eccles 1984; Rabe 1984):

- Security of the NL site and building now and during the interim-storage period

- Desire of local citizens to find out what is going on with reference to radiological surveys and cleanup

6. REFERENCES

Argonne National Laboratory. 1982. Methods for Assessing Environmental Impacts of a FUSRAP Property-Cleanup/Interim-Storage Remedial Action. ANL/EIS-16. Prepared for Formerly Utilized Sites Remedial Action Program, U.S. Department of Energy, by Division of Environmental Impact Studies, Argonne National Laboratory.

Arnow, T.A. 1949. The Ground-Water Resources of Albany County, New York. N.Y. State Water Power Control Comm. Bull. GW-20. 56 pp.

Bailey, R.G. 1978. Descriptions of the Ecoregions of the United States. U.S. Forest Service, Intermountain Region, Ogden UT. 77 pp.

Bechtel National, Inc. 1984. Work Plan for the Colonie Interim Storage Site. Prepared for the U.S. Department of Energy, Oak Ridge Operations, Oak Ridge, TN. April 1984.

Carcich, I.G. 1984. Letter (Director, Bureau of Water Research, New York State Department of Environmental Conservation, Albany, NY) to J.Y. Yang (Argonne National Laboratory, Argonne, IL), dated February 3, 1984, with enclosure (3 maps).

Condon, W.J. 1984. Letter (Bureau of Environmental Radiation Protection, New York Department of Health, Albany, NY) to L. Campbell (U.S. Department of Energy, Oak Ridge, TN), dated February 9, 1984.

Dineen, R.J. 1975. Geology and Land Uses in the Pine Bush, Albany County, New York. N.Y. State Museum Sci. Serv. Circ. 47. 27 pp.

Eccles, M. 1984. Personal communication (Citizens Concerned About NL) to R.G. Williams (Argonne National Laboratory), May 2, 1984.

Galvin, M. 1979. Management of Transmission Line Rights-of-Way for Fish and Wildlife. Volume 2, Eastern United States. FWS/OBS-79/22. U.S. Fish and Wildlife Service.

Halberg, N.H., et al. 1964. Water Resources of the Albany-Schenectady-Troy Area. N.Y. Geol. Surv. Water-Supply Pap. 1499-D.

Heath, R.C. 1964. Ground Water in New York. Bulletin GW-51. Prepared by the U.S. Geological Survey in cooperation with the New York Water Resources Commission, Albany, NY.

Jeter, H.W., and D.M. Eagleson. 1980. A Survey of Uranium in Soils Surrounding the NL Bearings Plant. INL-9488-61. Prepared for NL Bearings/NL Industries, Inc., Albany, NY, by Teledyne Isotopes, Westwood, NJ. October 1980.

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FILE
COLONIE

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Remedial Action
Projects

U.S. Department
of Energy

VERIFICATION OF 1984 REMEDIAL ACTION VICINITY PROPERTIES COLONIE INTERIM STORAGE SITE COLONIE, NEW YORK

J. D. BERGER

Radiological Site Assessment Program
Manpower Education, Research, and Training Division

FINAL REPORT
APRIL 1986

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VERIFICATION OF 1984 REMEDIAL ACTION VICINITY PROPERTIES COLONIE INTERIM STORAGE SITE COLONIE, NEW YORK

INTRODUCTION

Between 1958 and 1984, the National Lead Industries plant in Colonie, New York, performed various casting, machining, and milling operations on uranium. The plant processed primarily depleted uranium; however, small amounts of natural and slightly enriched uranium were handled at the site. Operations resulted in small quantities of uranium dust being released through exhaust ventilation stacks. This dust was dispersed and residential and commercial properties in the vicinity of the plant became contaminated with low levels of uranium.

Teledyne Isotopes surveyed neighboring properties in 1980 and reported the extent of uranium contamination.[1] In October 1983, more detailed surveys of individual properties were initiated by Oak Ridge National Laboratory (ORNL) at the direction of the U.S. Department of Energy's (DOE) Division of Remedial Action Projects. The purpose of the ORNL surveys was to identify those properties with uranium contamination levels exceeding guidelines established by DOE, EPA, and New York State officials (Appendix A).

The House and Senate Conference Report accompanying the Energy and Water Development Appropriations Act of 1984 directed the Department to give priority to the undertaking of a decontamination research and development project involving the National Lead Industries site and vicinity properties. This work is being conducted under the Formerly Utilized Sites Remedial Action Program (FUSRAP). During August and September 1984 Bechtel National, Inc. (BNI), the Project Management Contractor for FUSRAP, conducted additional characterization surveys, where necessary, to more accurately define the boundaries of the uranium contamination on ten properties identified by ORNL. These properties are:

1114 Central Avenue
1144/1144A Central Avenue
1159 Central Avenue

33 Palmer Avenue
27/29 Yardboro Avenue
52 Yardboro Avenue
68 Yardboro Avenue
74 Yardboro Avenue
78 Yardboro Avenue
80 Yardboro Avenue

The locations of these properties, relative to the former NL Industries Plant, are shown on Figure 1. Information on the radiological characterization survey findings is presented in ORNL and BNI documents.[2-14]

During late 1984 BNI performed remedial action on the ten properties identified above. This remedial action was in accordance with BNI's June 1984 work plan for the Colonie Site.[15] Cleanup consisted primarily of excavation of contaminated surface soil; however, in several cases additional actions, such as removal of roofing, scabbling of asphalt and concrete surfaces, removal of a stone driveway, and replacement of a wooden coal chute door, were required. Following completion of the remedial actions, a followup survey was performed by BNI to demonstrate compliance with the cleanup guidelines. Remedial actions at each of the properties and results of the followup surveys are presented in a post-remedial action report prepared by BNI.[16] Activities to identify and remove contamination on additional vicinity properties is continuing.

It is the policy of DOE to perform independent (third party) verifications of the effectiveness of remedial actions conducted within FUSRAP. The Radiological Site Assessment Program of Oak Ridge Associated Universities (ORAU) has been designated by DOE as the organization responsible for this task at the Colonie site. During November 1985 - January 1986, ORAU performed verification activities for the ten Colonie properties at which remedial action was performed in 1984. This report describes the procedures and findings of that verification.

PROCEDURES

Objectives

The objectives of the verification were to confirm that remedial actions have been effective in meeting established guidelines and that documentation accurately describes the post-remedial action radiological conditions of the properties.

Procedures

1. Radiological characterization reports (references 2-14), the work plan (reference 15), and the post-remedial action report (reference 16) were reviewed. Data were evaluated to assure that areas exceeding guidelines were identified and had undergone remedial action. Post-remedial action uranium soil concentration and surface dose rate data were compared to guidelines and the post-remedial action report was reviewed for general thoroughness and accuracy.

2. Thirty soil samples (from 2 to 5 from each property), collected by BNI during the post-remedial action survey, were selected by ORAU from data tables in the post-remedial action report. These samples were obtained from BNI and independently analyzed for U-238 by ORAU laboratories to confirm the accuracy of BNI analyses.

3. A survey team from ORAU visited the Colonie area and performed visual inspections and limited independent gamma scans, beta gamma measurements, and soil sampling on three of the ten properties, which had undergone remedial action. The properties selected for independent ORAU evaluation were:

   a. 1114 Central Avenue (originally surveyed as part of the 1118 Central Avenue property) - an auto service business.

   b. 52 Yardboro Avenue - a residence

   c. 68 Yardboro Avenue - a church and adjoining parking lot.

Findings of the inspections and radiological surveys were compared with the post-remedial action report and the established Colonie guidelines. Measurement and analytical equipment and procedures are described in further detail in Appendices B and C.

FINDINGS AND RESULTS

Document Reviews

Review of the ORNL survey reports indicated appropriate decisions in designating the ten properties as exceeding the U-238 soil contamination guidelines. There was one roof area (74 Yardboro Avenue) which had an average beta-gamma dose rate of 0.29 mrad/h - slightly higher than the guideline level of 0.20 mrad/h - which was not designated for remedial action. The reason was that the roof was in poor condition at the time of the survey, and before remedial action was initiated, the property owner had repaired and recovered the roof. This recovering was sufficient to reduce the dose rate to below the guideline level and also to eliminate the potential for spread of contamination by run off.

Characterization data collected by BNI identified additional small areas of contamination on five of the properties and these areas were appropriately included for remedial action as described in the post-remedial action report. The BNI additional characterization primarily utilized in situ measurements with a FIDLER detector, calibrated specifically for the Colonie site contaminant.

The post-remedial action report accurately portrayed the areas of remedial action, as identified by ORNL and BNI. No deficiencies in the data in this report were noted. All reported U-238 sample concentrations were well below the average guideline level of 35 pCi/g.

Confirmatory Analyses

Table 1 presents the results of analyses performed by ORAU and BNI on thirty soil samples from the remediated Colonie properties. Analysis of variance on the paired data yielded a correlation factor of 0.955. Paired results were in agreement within their respective 2σ confidence limits for 26 of

the 30 samples analyzed and within the 3σ confidence limits for all 30 of the samples. The three samples having the greatest difference between BNI and ORAU analyses were those containing the highest concentrations of U-238. In each of these three samples the ORAU analyses indicated slightly higher U-238 concentrations than were reported by BNI. However, considering the associated analytical uncertainties and the fact that none of the samples from the BNI post-remedial action survey exceeded 50% of the established guideline level, these differences are considered acceptable. The accuracy of the BNI data is therefore confirmed.

Independent Surveys

1114 Central Avenue

Visual inspection identified the areas of remedial action were as described in the post-remedial action reports. No areas of elevated gamma radiation were identified by surface scans. Soil samples from 4 locations and gamma-beta surface measurements at 4 locations were well below the guideline levels (refer to Figure 2). The maximum U-238 concentration measured in soil was 10.6 pCi/g (Table 2). This sample was from a small grassy area near the front of the property, which had not undergone remedial action. The beta-gamma dose rates ranged from 0.01 to 0.03 mrad/h (Table 3).

52 Yardboro Avenue

The areas of remedial action were confirmed by visual inspection. Surface gamma scans identified one small area (about 0.5 m x 0.5 m) at the rear of the house, with a level approximately twice ambient background (Figure 3). This small area had not received remedial action but was immediately adjacent to an area that had been cleaned. The U-238 soil concentrations presented in Table 2, indicate that the surface sample (2a) from that location contained 83.3 pCi/g and that the soil (2b) beneath the 5 cm surface layer contained 24.2 pCi/g. Although the concentration in the surface sample exceeds the average guideline of 35 pCi/g, direct monitoring showed that the contamination is limited to a small area. It therefore satisfies the additional

criteria of 100 pCi/g for areas of 1 m^2 or less, and also, averaging over the surrounding 100 m^2 of soil (much of which had received remedial action) reduces the average concentration to below the 35 pCi/g level. None of the other soil samples collected during the independent survey contained in excess of 35 pCi/g. All beta-gamma measurements (presented in Table 3) for this property were below the 0.20 mrad/h guideline level.

68 Yardboro Avenue

As with the other two properties visual inspection confirmed that remedial action areas were accurately described in the BNI report. Gamma surface scans did not identify areas with radiation levels significantly above the ambient background. The soil sample results in Table 2 indicate that sample 1 contains a U-238 concentration of 66.5 pCi/g. This sample was obtained from behind a wooden barrier at the edge of the parking lot (Figure 4). A shallow surface deposit of soil in a narrow strip, about 0.1 m x 14 m, had accumulated in this area as a result of run off from the properties to the north and west of the parking lot. Averaging the concentration at this location over the adjacent 100 m^2 will result in an average concentration of less than 35 pCi/g; other samples from the property contained less than 35 pCi/g of U-238. Dose-rate measurements at 7 locations were less than 0.20 mrad/h (Table 3).

Additional Analysis

Levels of radionuclides, other than uranium, in samples from the Colonie properties were typical of concentrations normally occuring in soils from this area of New York[17]. Four samples were selected at random for determination of isotopic uranium concentrations. These analyses show the weight ratio of U-235 to U-238 ranges from 0.22 to 0.32% as compared to the natural ratio of 0.726%. This confirms that the uranium contaminant is depleted in U-235.

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CONCLUSIONS

Based on the results and findings of this independent verification study, it is the opinion of the verification contractor, Oak Ridge Associated Universities' Radiological Site Assessment Program, that remedial action has been effective in meeting the guidelines for the ten Colonie site vicinity properties described in this report. It is also the opinion of ORAU that the documentation adequately and accurately describes the activities related to these properties and the current radiological conditions of the properties. A letter summarizing these conclusions has been submitted to the Department of Energy's Division of Remedial Action Projects.

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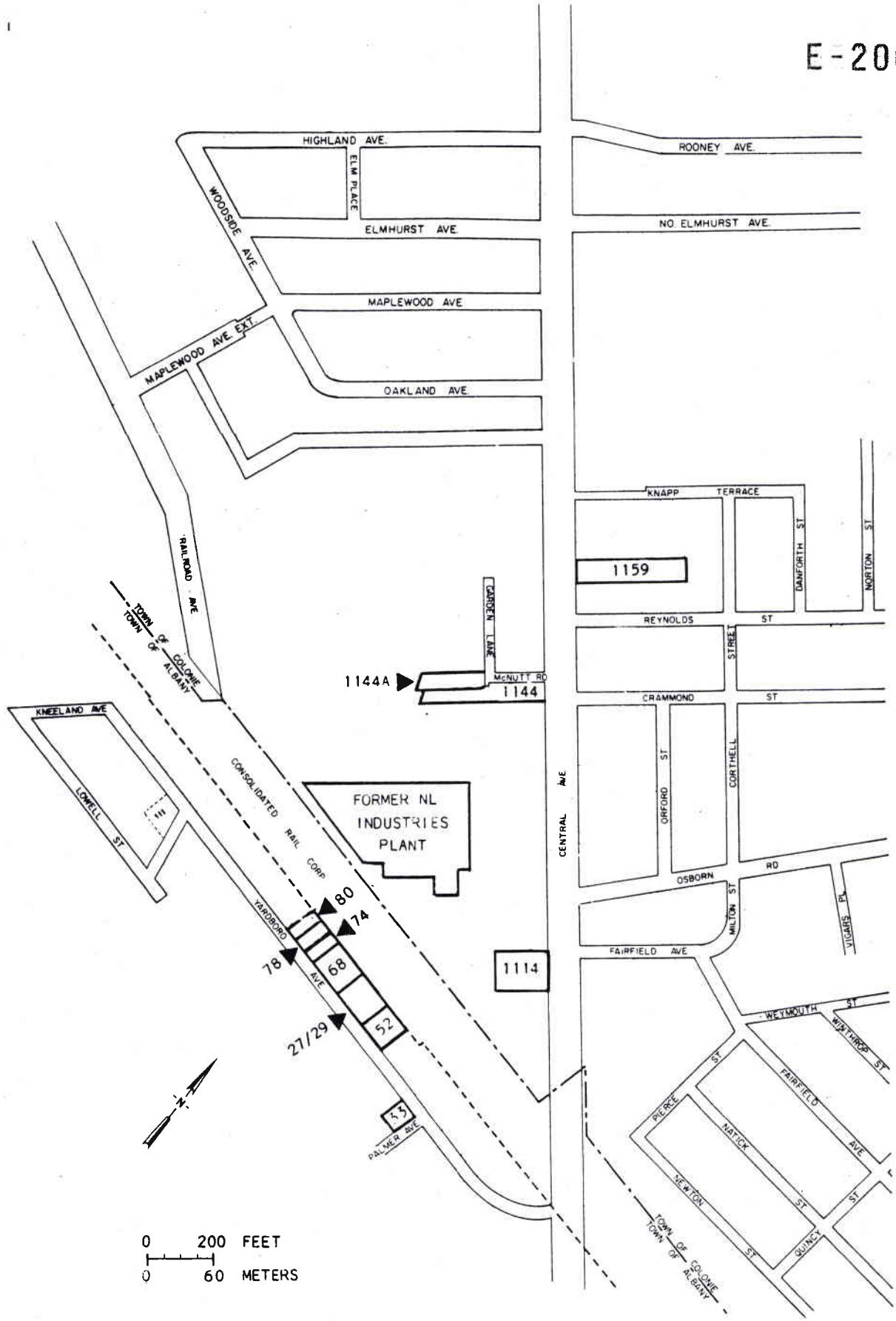

FIGURE 1: Section of Colonie, NY, Indicating Locations of Vicinity Properties Relative to the Former National Lead Industries Plant

COL2

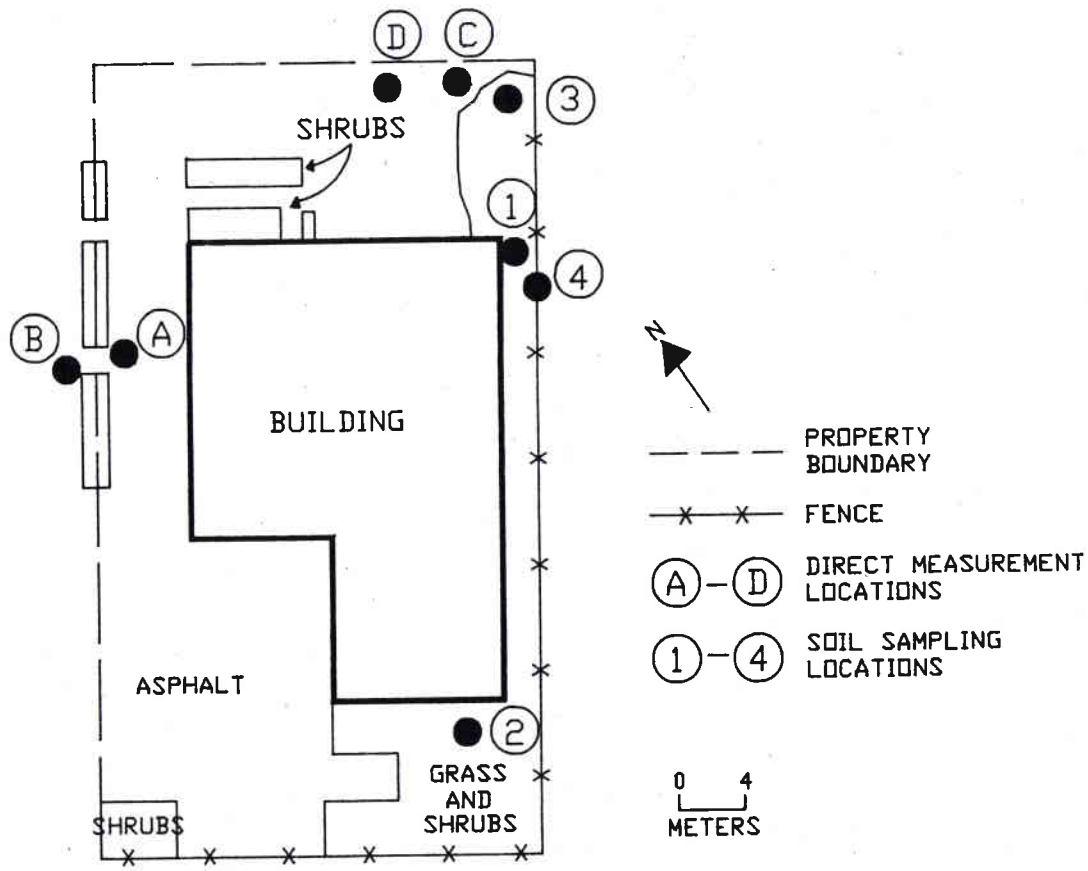

FIGURE 2: Plot Plan of Property at 1114 Central Avenue, Indicating Locations of Independent Measurements and Sampling

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COL3

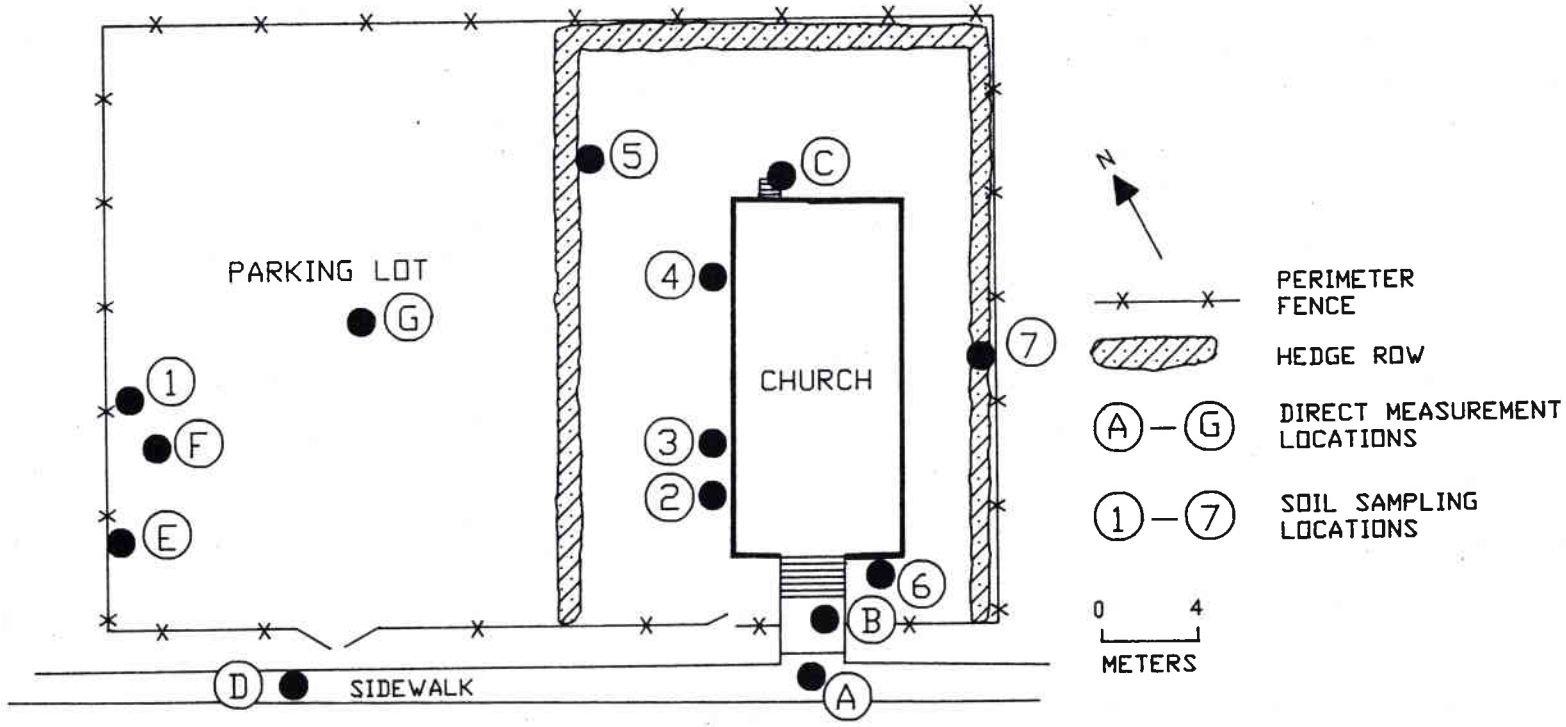

FIGURE 3: Plot Plan of Property at 52 Yardboro Avenue, Indicating Locations of Independent Measurements and Sampling

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COL1

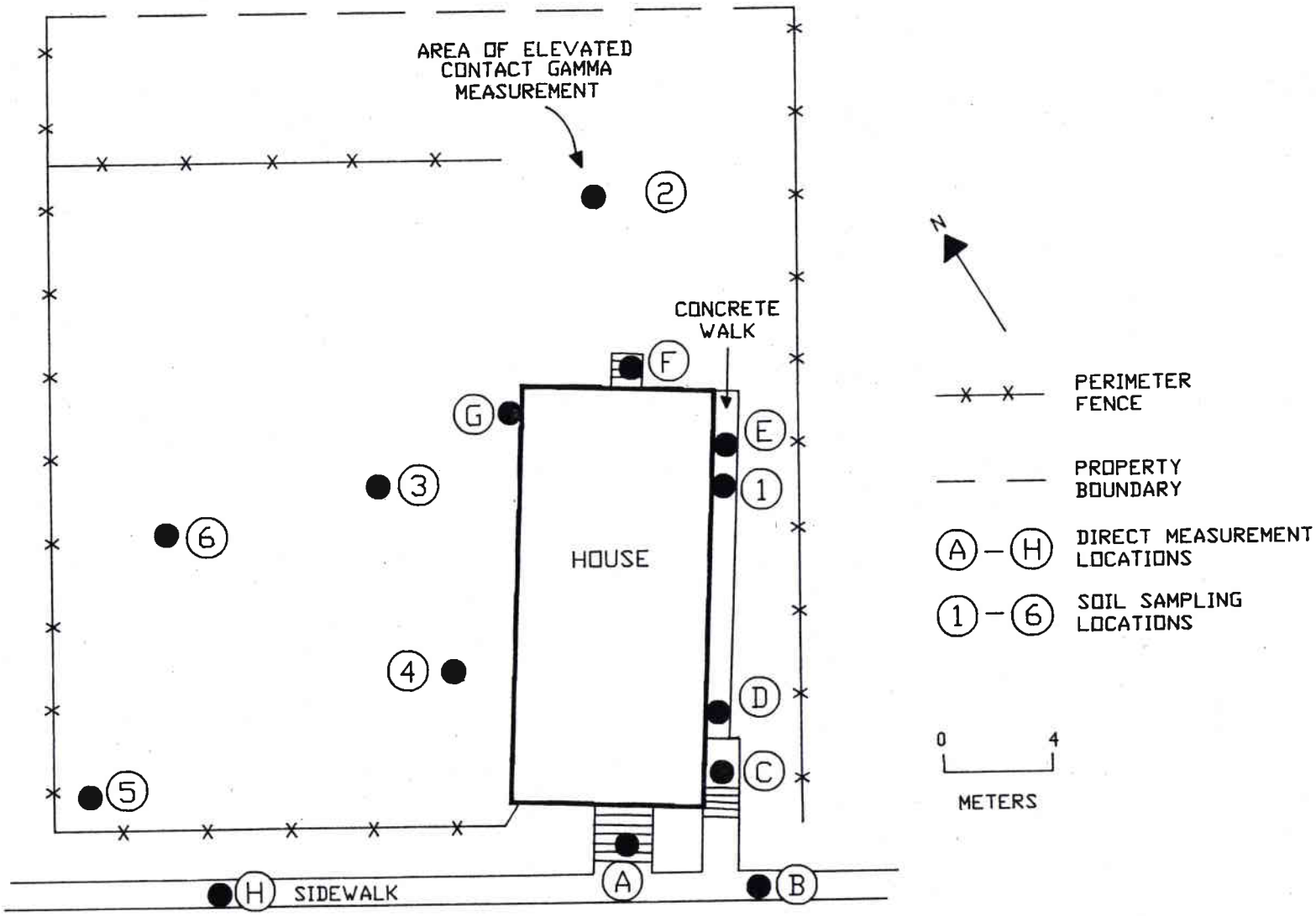

FIGURE 4: Plot Plan of Property at 68 Yardboro Avenue, Indicating Locations of Independent Measurements and Sampling

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TABLE 1

RESULTS OF CONFIRMATORY U-238 ANALYSES ON SOIL SAMPLES FROM 1984 COLONIE REMEDIAL ACTION PROPERTIES

Property and Sample[a]	U-238 Concentration (pCi/g)	
	BNI analysis	ORAU analysis
1114 Central Avenue		
1	2.0 ± 0.4[b]	2.08 ± 0.51
4	5.0 ± 0.8	7.34 ± 2.04
1144/1144A Central Avenue		
14	13.3 ± 2.0	17.5 ± 1.6
24	<1.4[c]	1.93 ± 1.19
46	13.0 ± 2.0	18.1 ± 2.4
81	2.2 ± 2.0	4.67 ± 1.85
100	9.0 ± 1.3	10.3 ± 3.2
1159 Central Avenue		
6	6.3 ± 1.2	6.37 ± 1.70
16	5.1 ± 1.8	6.32 ± 2.72
25	<5.0	1.03 ± 1.57
33 Palmer Avenue		
3	5.3 ± 1.8	7.10 ± 2.03
5	5.0 ± 1.8	6.98 ± 0.80
27/29 Yardboro Avenue		
2	5.0 ± 2.0	3.67 ± 0.61
6	4.0 ± 1.8	4.96 ± 0.64
10	13.2 ± 2.4	20.2 ± 2.7
52 Yardboro Avenue		
4	1.7 ± 0.4	2.23 ± 1.60
11	8.7 ± 2.0	9.55 ± 2.33
18	4.0 ± 1.4	6.42 ± 0.70
22	5.2 ± 1.4	4.41 ± 0.96
68 Yardboro Avenue		
3	4.3 ± 1.0	3.09 ± 0.81
12	<1.5	1.23 ± 1.31
15	2.5 ± 1.6	0.63 ± 0.52
74 Yardboro Avenue		
1	0.7 ± 0.6	2.01 ± 1.33
7	7.5 ± 1.4	6.05 ± 1.99
11	6.0 ± 0.8	6.84 ± 1.13

TABLE 1 (Continued)

RESULTS OF CONFIRMATORY U-238 ANALYSES ON SOIL SAMPLES FROM 1984 COLONIE REMEDIAL ACTION PROPERTIES

Property and Sample	U-238 Concentration (pCi/g)	
	BNI analysis	ORAU analysis
78 Yardboro Avenue		
2	1.4 ± 0.8	1.04 ± 0.59
6	3.0 ± 0.6	3.61 ± 0.52
8	0.7 ± 0.4	0.77 ± 0.71
80 Yardboro Avenue		
3	2.2 ± 0.6	2.64 ± 1.30
8	1.0 ± 0.4	1.33 ± 0.61

[a]Sample identification as presented in the BNI post-remedial action report.[16]
[b]Errors are 2σ based only on counting statistics.
[c](<) Indicates concentration less than measurement capability of analytical procedure.

TABLE 2

U-238 CONCENTRATIONS IN SOIL SAMPLES
FROM SELECTED COLONIE VICINITY PROPERTIES

Property and Location[a]	Sample Depth (cm)	U-238 Concentration (pCi/g)
1114 Central Avenue		
1a	0- 5	<0.49
1b	5-15	0.88 ± 1.02[b]
2a	0- 5	<0.45
2b	5-15	1.28 ± 1.74
3a	0- 5	10.6 ± 1.4
3b	5-15	2.62 ± 1.21
4	0- 5	1.32 ± 1.72
52 Yardboro Avenue		
1	0- 5	32.4 ± 2.5
2a	0- 5	83.3 ± 5.9
2b	5-15	24.2 ± 5.2
3a	0- 5	25.4 ± 3.1
3b	5-15	15.7 ± 1.9
4a	0-15	6.15 ± 2.25
4b	5-15	6.68 ± 1.51
5a	0- 5	10.9 ± 1.6
5b	5-15	5.99 ± 1.96
6a	0- 5	12.0 ± 2.9
6b	5-15	5.86 ± 1.52
68 Yardboro Avenue		
1	0- 5	66.5 ± 5.8
2a	0- 5	1.03 ± 1.06
2b	5-15	1.16 ± 1.20
3a	0- 5	28.4 ± 1.8
3b	5-15	25.3 ± 3.2
4a	0- 5	2.49 ± 1.36
4b	5-15	3.82 ± 1.78
5a	0- 5	3.70 ± 1.20
5b	5-15	2.89 ± 2.23
6a	0- 5	<4.46
6b	5-15	2.08 ± 1.29
7a	0- 5	1.39 ± 1.16
7b	5-15	1.98 ± 1.64

[a]Refer to Figures 1-3.
[b]Errors are 2σ based only on counting statistics.

TABLE 3

BETA-GAMMA MEASUREMENTS ON SELECTED COLONIE VICINITY PROPERTIES

Property and Location[a]	Beta-Gamma Levels	
	dpm/100 cm^2	mrad/h
1114 Central Avenue		
A	510	0.01
B	1260	0.03
C	930	0.02
D	630	0.02
52 Yardboro Avenue		
A	810	0.02
B	690	0.02
C	1320	0.03
D	1870	0.04
E	1110	0.03
F	450	0.01
G	4480	0.11
H	690	0.02
68 Yardboro Avenue		
A	1110	0.03
B	660	0.02
C	360	0.01
D	1110	0.03
E	600	0.01
F	990	0.02
G	990	0.02

[a]Refer to Figures 1-3.

REFERENCES

1. Teledyne Isotopes. A Survey of Uranium in Soil Surrounding the NL Bearings Plant, IWL-9488-461, October 31, 1980.

2. Oak Ridge National Laboratory. Results of the Radiological Survey at 1118 Central Avenue, Colonie, New York (AL 022), Oak Ridge, TN, June 1985.

3. Oak Ridge National Laboratory. Results of the Radiological Survey at 1144 Central Avenue, Colonie, New York (AL 010), Oak Ridge, TN, March 1984.

4. Oak Ridge National Laboratory. Results of the Radiological Survey at 1144A Central Avenue, Colonie, New York (AL 011), Oak Ridge, TN, March 1984.

5. Oak Ridge National Laboratory. Results of the Radiological Survey at 1159 Central Avenue, Colonie, New York (AL 028), Oak Ridge, TN, June 1985.

6. Oak Ridge National Laboratory. Results of the Radiological Survey at 33 Palmer Avenue, Albany, New York (AL 006), Oak Ridge, TN, March 1984.

7. Oak Ridge National Laboratory. Results of the Radiological Survey at 27/29 Yardboro Avenue, Albany, New York (AL 012), Oak Ridge, TN, March 1984.

8. Oak Ridge National Laboratory. Results of the Radiological Survey at 52 Yardboro Avenue, Albany, New York (AL 005), Oak Ridge, TN, March 1984.

9. Oak Ridge National Laboratory. Results of the Radiological Survey at 68 Yardboro Avenue, Albany, New York (AL 004), Oak Ridge, TN, March 1984.

10. Oak Ridge National Laboratory. Results of the Radiological Survey at 74 Yardboro Avenue, Albany, New York (AL 003), Oak Ridge, TN, March 1984.

11. Oak Ridge National Laboratory. Results of the Radiological Survey at 78 Yardboro Avenue, Albany, New York (AL 001), Oak Ridge, TN, March 1984.

12. Oak Ridge National Laboratory. Results of the Radiological Survey at 80 Yardboro Avenue, Albany, New York (AL 002), Oak Ridge, TN, March 1984.

13. Oak Ridge National Laboratory. Letter J.L. Marley (ORNL) to A.J. Whatman (DOE/NE), "Alpha and Beta-Gamma Data from Properties AL 001 - AL 012, Albany, New York", November 22, 1985.

14. Memorandum, R.C. Robertson to File. "BNI/EAC Characterization Data for Remedial Action on Colonie Vicinity Properties During FY 1984," September 27, 1985.

15. Department of Energy. Remedial Action Work Plan for the Colonie Site, ORO-847, Oak Ridge, TN, June 1984.

16. Bechtel National, Inc. Post-Remedial Action Report for the Colonie Interim Storage Site Vicinity Properties - 1984 (DOE/OR/20722-74), Oak Ridge, TN, November 1985.

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17. T.E. Myrick, B.A. Berven, and F.F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979 (ORNL/TM-7343), Oak Ridge, TN, November 1981.

APPENDIX A

GUIDELINES APPLICABLE TO THE COLONIE SITE

APPENDIX A

Guidelines Applicable to the Colonie Site

Site specific guidelines for Colonie properties were developed by DOE with input by New York state and EPA officials. These guidelines are:

1. Soil

   a. Thirty-five pCi/g depleted uranium (U-238) averaged over a 5 cm (2 in.) depth and a 100 m^2 (1,076 ft^2) area.

   b. One hundred pCi/g ("hot spot") averaged over a 5 cm (2 in.) depth and 1 m^2 (10 ft^2) will be removed.

2. Structures and surfaces other soil

   a. Surface contamination of 5,000 dpm/100 cm^2 averaged over up to 1 m^2, with a maximum of 15,000 dpm/100 cm^2 in areas not to exceed 100 cm^2.

   b. Removable contamination of 1,000 dpm/100 cm^2.

   c. 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.

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APPENDIX B

MAJOR SAMPLING AND ANALYTICAL EQUIPMENT

APPENDIX B

Major Sampling and Analytical Equipment

The display or description of a specific product is not to be construed as an endorsement of that product or its manufacturer by the authors or their employer.

A. Direct Radiation Measurements

Eberline RASCAL
Portable Scaler/Ratemeter
Model PRS-1
(Eberline, Sante Fe, NM)

Eberline PRM-6
Portable Ratemeter
(Eberline, Sante Fe, NM)

Eberline Beta-Gamma Pancake Probe
Model HP-260
(Eberline, Sante Fe, NM)

Victoreen NaI Gamma Scintillation Probe
Model 489-55
(Victoreen, Inc., Cleveland, OH)

B. Laboratory Analysis

Ge(Li) Detectors (2)
Model LGCC2220SD, 23% efficiency
(Princeton Gamma-Tech, Princeton, NJ)

Used in conjunction with:
Lead Shield, SPG-16
(Applied Physical Technology, Smyrna, GA)

High-Purity Germanium Detector
Model GMX-23195-S, 23% efficiency
(EG&G ORTEC, Oak Ridge, TN)

Used in conjunction with:
Lead Sheild, G-16
(Gamma Products Inc., Palos Hills, IL)

ND-66/ND-680 System
(Nuclear Data, Inc., Schaumburg, IL)

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Alpha Spectrometry System
Tennelec Electronics, EG&G ORTEC
Surface barrier detectors
(Tennelec, Inc., EG&G, Oak Ridge, TN)

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APPENDIX C

MEASUREMENT AND ANALYTICAL PROCEDURES

APPENDIX C

Measurement and Analytical Procedures

Gamma Surface Scans

Walkover surface scans were performed at 1 meter intervals, using Eberline Model PRM-6 portable ratemeters with Victoreen Model 489-55 gamma scintillation probes, containing 3.2 cm x 3.8 cm NaI(Tl) scintillation crystals. Relative count rates were monitored using earphones and increased rates above the ambient background levels were noted.

Beta-Gamma Dose Rate Measurements

Measurements of direct beta-gamma radiation levels were performed using Eberline Model PRS-1 portable scaler/ratemeters with Model HP-260 thin-window pancake G-M probes. Count rates (cpm) were converted to disintegration rates (dpm/100 cm^2) by dividing the net rate by the 4π efficiency and correcting for the active area of the detector. The effective window area is 15 cm^2 for the G-M detectors. The average background count rate was 40 cpm for the G-M probes. Dose rates were calculated by applying the conversion factor of 1,400 cpm/mrad/h to the net count rate.

Soil Sample Analysis

Gamma Spectrometry

Soil samples were dried, mixed, and a portion placed in a 0.5 l Marinelli beaker. The quantity placed in each beaker was chosen to reproduce the calibrated counting geometry and ranged from 600 to 800 g of soil. Net soil weights were determined and the samples counted using intrinsic germanium and Ge(Li) detectors coupled to a Nuclear Data Model ND-680 pulse height analyzer system. Background and Compton stripping, peak search, peak identification, and concentration calculations were performed using the computer capabilities inherent in the analyzer system. Energy peaks used for determination of radionuclides of concern were:

U-238 - 0.094 MeV from Th-234 or
1.001 MeV from Pa-234 (secular equilibrium assumed)

Alpha Spectrometry

Uranium isotopic analyses were performed by dissolving a sample aliquot by pyrosulfate fusion and precipitating with barium sulfate. The barium sulfate precipitate was redissolved and the uranium separated by liquid - liquid extraction. The uranium was then precipitated with a cerium fluoride carrier and counted using surface barrier detectors, alpha spectrometers, and an ND-66 Multichannel Analyzer.

Errors and Detection Limits

The uncertainties associated with the analytical data, presented in the tables of this report, represent the 95% (2σ) confidence levels based only on counting statistics. Other sources of error associated with the sampling and analyses introduce an additional uncertainty of $\pm$ 6 to 10% in the results.

Calibration and Quality Assurance

Laboratory and field survey procedures are documented in manuals developed specifically for the Oak Ridge Associated Universities' Radiological Site Assessment Program. Instruments were calibrated with NBS-traceable standards. Quality control procedures on all instruments included daily background and check-source measurments to confirm equipment operation within acceptable statistical fluctuations. The ORAU laboratory participates in the EPA and EML Quality Assurance Programs. All samples analyzed by ORAU as part of this verification have been permanently archived.

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Prepared by
Oak Ridge Associated
Universities

Prepared for
Division of
Remedial Action
Projects

U.S. Department
of Energy

VERIFICATION OF 1985 REMEDIAL ACTION VICINITY PROPERTIES COLONIE INTERIM STORAGE SITE COLONIE, NEW YORK

A. J. BOERNER AND J. D. BERGER

Radiological Site Assessment Program
Manpower Education, Research, and Training Division

FINAL REPORT
NOVEMBER 1986

NOTICES

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FINAL REPORT

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VERIFICATION
OF
1985 REMEDIAL ACTION
VICINITY PROPERTIES
COLONIE INTERIM STORAGE SITE
COLONIE, NEW YORK

INTRODUCTION

Between 1958 and 1984, the National Lead Industries plant in Colonie, New York, performed various casting, machining, and milling operations on uranium. The plant processed primarily depleted uranium; however, small amounts of natural and slightly enriched uranium were handled at the site. Operations resulted in small quantities of uranium dust being released through exhaust ventilation stacks. This dust was dispersed and residential and commercial properties in the vicinity of the plant became contaminated with low levels of uranium.

Teledyne Isotopes surveyed neighboring properties in 1980 and reported the extent of uranium contamination.[1] In October 1983, more detailed surveys of individual properties were initiated by Oak Ridge National Laboratory (ORNL) at the direction of the U.S. Department of Energy's (DOE) Division of Remedial Action Projects. The purpose of the ORNL surveys was to identify those properties with uranium contamination levels exceeding guidelines established by DOE, the Environmental Protection Agency (EPA), and New York State officials (Appendix A).

The House and Senate Conference Report accompanying the Energy and Water Development Appropriations Act of 1984 directed the Department to give priority to the undertaking of a decontamination research and development project involving the National Lead Industries site and vicinity properties. This work is being conducted under the Formerly Utilized Sites Remedial Action Program (FUSRAP). During 1985 Bechtel National, Inc. (BNI), the Project Management Contractor for FUSRAP, conducted additional characterization surveys, where necessary, to more accurately define the boundaries of the

uranium contamination on properties identified by ORNL and completed remedial actions on the following 22 properties:

1100 Central Avenue
1118 Central Avenue
1129 Central Avenue
1146 Central Avenue
1147 Central Avenue
1148 Central Avenue
1148 Central Avenue-Rear (10 Garden Lane)
1150 Central Avenue
1152 Central Avenue
1160 Central Avenue
1160/1162 Central Avenue
1163/1161 Central Avenue
1166 Central Avenue
1167 Central Avenue
1168 Central Avenue
1170 Central Avenue
1185 Central Avenue
1195 Central Avenue
7 Palmer Avenue
5 Yardboro Ave
24 Yardboro Avenue
25/27 Yardboro Avenue

The locations of these properties, relative to the former NL Industries Plant, are shown on Figure 1. Information on the radiological conditions prior to remedial action is presented in ORNL designation survey reports and on field data forms generated by BNI.[2 23]

Remedial action was in accordance with BNI's August 1985 work plan for the Colonie Site.[24] Cleanup consisted primarily of excavation of contaminated surface soil; however, in several cases additional actions, such as removal of contaminated stone, scabbling, surfacing and vacuuming of asphalt and concrete surfaces, and gutter cleaning, were required. Following completion of the remedial actions, a followup survey was performed by BNI to demonstrate compliance with the cleanup criteria. Remedial actions at each of the properties and results of the followup surveys are presented in a post-remedial action report prepared by BNI.[25] Activities to identify and remove contamination on additional vicinity properties is continuing.

It is the policy of DOE to perform independent (third party) verifications of the effectiveness of remedial actions conducted within FUSRAP. The Radiological Site Assessment Program of Oak Ridge Associated

Universities (ORAU) has been designated by DOE as the organization responsible for this task at the Colonie site. During March and April 1986, ORAU performed verification activities for the 22 Colonie properties remediated in 1985. This report describes the procedures and findings of that verification.

PROCEDURES

Objectives

The objectives of the verification were to confirm that remedial actions have been effective in meeting established criteria and that documentation accurately describes the post-remedial action radiological conditions of the properties.

Procedures

1. Radiological survey reports (references 2-23), BNI field characterization data, the work plan (reference 24), and the post-remedial action report (reference 25) were reviewed. Data were evaluated to assure that areas exceeding criteria were identified and had undergone remedial action. Post-remedial action uranium soil concentrations and surface dose rate data were compared to criteria and the post-remedial action report was reviewed for general thoroughness and accuracy.

2. Sixty-four soil samples, collected during the post-remedial action survey, were obtained from BNI. Thirty-one of these samples, representing 19 of the 22 properties, were selected at random and independently analyzed for U-238 by the ORAU laboratory to confirm the accuracy of BNI analyses.

3. A survey team from ORAU visited the Colonie area and performed visual inspections and limited independent gamma scans, gamma and beta-gamma direct measurements, and soil sampling on nine of the 22

properties which had undergone remedial action. The properties selected for independent ORAU evaluation were:

a. 1100 Central Avenue - a business
b. 1118 Central Avenue - a business
c. 1129 Central Avenue - a residence
d. 1146 Central Avenue - a business
e. 1147 Central Avenue - a business
f. 1167 Central Avenue - a business
g. 10 Garden Lane - a business
h. 7 Palmer Avenue - a residence
i. 24 Yardboro Avenue - a residence

Findings of the inspections and radiological surveys were compared with the post-remedial action report and the established Colonie criteria. Measurement and analytical equipment and procedures are described in further detail in Appendices B and C.

FINDINGS AND RESULTS

Document Review

Review of the ORNL survey reports indicated appropriate decisions in designating properties for remedial action. Each of the properties contained U-238 concentrations significantly above background levels for the Colonie/Albany area. Nine properties contained "hot spot" locations exceeding 100 pCi/g (three times criteria). The ORNL surveys also identified beta-gamma dose rates on a roof and paved surfaces at two properties, (1160/1162 Central Avenue and 10 Garden Lane) which either equaled or exceeded the 0.2 mrad/h average guideline beta-gamma level.

The BNI characterization primarily utilized in-situ measurements with a FIDLER* dectector, calibrated specifically for the Colonie site contaminant. Characterizations by BNI identified additional areas of contamination on eight

*Field Instrument for the Detection of Low Energy Radiation

of the properties, and these areas were appropriately included for remedial action as described in the post-remedial action report. Three other locations, identified by BNI field data as exceeding 35 pCi/g, were small in area and did not require remedial action because concentration averaging over 100 m^2 reduced the levels to below the cleanup criteria. Based on the in-situ measurements, four small soil areas, initially identified by ORNL on properties at 1100 Central Avenue, 1147 Central Avenue, 1185 Central Avenue, and 5 Yardboro Avenue, also did not require remedial action because of their limited size.

Visual inspection of the properties selected for verification measurements by ORAU confirmed the areas of remedial action indicated by BNI in the post-remedial action report. Uranium-238 concentrations reported in the BNI post remedial action report were below the criterion of 35 pCi/g, although three samples could, conceivably, slightly exceed the 35 pCi/g value, based on 2σ statistical uncertainties.

Confirmatory Analyses

The results of gamma spectrometry analyses, performed independently by ORAU and BNI on thirty-one soil samples collected from the remediated Colonie properties, are presented in Table 1. A Student T test, using Minitab[26] statistical software, indicated that no difference exists between the means of paired data at the 95% confidence level. In addition, comparison of the two data sets yielded a linear correlation coefficient (Pearson)[26] of 0.977. Paired results overlapped within their respective 2σ confidence limits for 25 of the 31 samples analyzed and within the 3σ confidence limits for all of the samples. These findings demonstrate that the ORAU and BNI data are statistically indistinguishable; it is therefore, ORAU's opinion that the BNI data are accurate and should be accepted as presented.

Verification Surveys

1100 Central Avenue

Visual inspection identified the area of remediation along the west side of the building. Slightly elevated contact exposure rates were noted during

the gamma scan of this area, relative to the rest of the property. Soil samples collected from this portion (Figure 2) contained U-238 concentrations of less than 35 pCi/g. Slightly elevated gamma levels were also noted near the curb (outside the property boundary) on Central Avenue along the front of the property. A sample of residue from this area contained only 1.34 pCi/g U-238. Elevated gamma levels are likely due to natural radioactive materials in the paving or paving base. Soil sampling results from other locations on the property are presented in Table 2. Beta-gamma dose rates measured at six locations ranged from 0.02 to 0.06 mrad/h (Table 3).

1118 Central Avenue

The gamma scan identified slightly elevated contact exposure rates adjacent to a set of steps (location 2) on the east side of the building (Figure 3), and underneath a tree (location 3) along the south fenceline. Levels of U-238, measured in surface soil samples (0-5 cm) collected from locations 2 and 3, were respectively 35.2 and 220 pCi/g (refer to Table 2). Slightly elevated contact exposure rates were also noted on the asphalt parking lot situated on the west side of this property. Samples of soil and gravel, collected from this location (location 6), contained well below 35 pCi/g of U-238. A review of gamma spectrometry analyses on samples of asphalt and asphalt base, obtained from this area during the BNI characterization, indicated concentrations of U-238, Ra-226, and the natural thorium series exceeding typical background levels. Such a combination of radionuclides would not be expected from the operations of the National Lead Industries plant. The elevated radionuclide and radiation levels at this location are similar to those occurring in fly ash, which has been used as a paving base in the Albany/Colonie area. Beta-gamma dose rates measured on paved surface ranged from 0.04 to 0.14 mrad/h (Table 3). The highest level was measured at point "B" (Figure 3) near the building where asphalt scraping had occurred during remediation.

As a result of the soil sampling, which identified a U-238 concentration exceeding 100 pCi/g along the west fenceline, BNI performed additional remedial action in that area on November 10, 1986 (Figure 4). After this

additional cleanup ORAU performed further verification sampling. The results, presented in Table 4, indicate that the cleanup was effective in reducing the U-238 concentrations to within the guideline of 35 pCi/g.

1129 Central Avenue

Visual inspection identified the remediated area situated between the house and the west property boundary. With one exception, no locations of elevated gamma activity were noted in this area or elsewhere on the property. Contact exposure rates around the garage were twice that found on the remainder of the property due to structural building materials. Soil samples collected from 5 locations, including adjacent to the area undergoing remedial action (Table 2 and Figure 5), were less than the 35 pCi/g criterion. Beta-gamma dose rates were well below the 0.2 mrad/h average and 1 mrad/h maximum guideline levels (Table 3).

1146 Central Avenue

A visual inspection of the property identified the remediated areas along the north and west portion of the property. Gamma scanning identified no areas of elevated activity. Three soil samples, collected from the planter area and front lawn, contained U-238 concentrations ranging from 3.80 to 30.8 pCi/g. The highest levels were found in the 0-5 cm sampling depth. Sampling results are presented in Table 2 and locations shown in Figure 6. Beta-gamma measurements, performed at 5 locations, ranged from 0.01 to 0.07 mrad/h (Table 3).

1147 Central Avenue

Soil was removed by BNI on all sides adjacent to this commercial property. ORAU collected soil samples at four locations adjacent to remediated areas (Table 2 and Figure 7). Three of the locations were situated on the east side of the property in areas on either side of a dormer where BNI had noted an increased FIDLER count-rate response. ORAU gamma scans of this

area also indicated slightly elevated exposure rates. These samples contained U-238 concentrations ranging from 1.89 to 13.7 pCi/g. A sample collected on the west side contained 7.90 pCi/g of U-238.

1167 Central Avenue

No locations of elevated gamma activity were found during a walkover scan of the property. Eight locations, adjacent to remediated areas, were selected for soil sampling (refer to Figure 8). The results, presented in Table 2, indicated U-238 concentrations less than the 35 pCi/g criterion. Beta-gamma dose rates ranged from 0.02 to 0.03 mrad/h (Table 3).

10 Garden Lane

The areas identified by BNI in its post-remedial action report were located by ORAU. Walkover gamma scans indicated slightly elevated levels in a remediated area at the rear property boundary. Samples collected from location 1 (Table 2 and Figure 9) contained 40.7 pCi/g of U-238 at the 0-5 cm sampling depth and 18.3 pCi/g at the 5-15 cm sampling depth. It should be noted that portions of the rear of the property have been disturbed through general brush and tree clearing and soil removal, although these areas were not, to ORAU's knowledge, designated for cleanup. Samples collected from location 2 in this area (Table 2) contained 4.94 pCi/g U-238 (0-5 cm) and 6.71 pCi/g U-238 (5-15 cm). One sample, collected adjacent to a remediated area at 10 Garden Lane, contained 40.7 pCi/g of U-238; however, this is an isolated spot and averaging over a 100 m^2 surface area would satisfy the established criterion. Beta-gamma levels, reported in Table 3, ranged from <0.01 to 0.05 mrad/h. The ORNL survey[19] identified average beta-gamma levels of 0.20 mrad/h on the roof. This level satisfies the DOE criteria for the Colonie vicinity properties.

7 Palmer Avenue

No locations of significantly elevated contact radiation levels were noted by the walkover scans. Soil samples were collected from 12 locations (Table 2 and Figure 10). Concentrations of U-238 ranged from 9.53 to 19.3 pCi/g at the 0-5 cm sampling depth and 2.34 to 14.6 pCi/g at the 5-15 cm

depth. Beta-gamma dose rates were well below the 0.2 mrad/h average and 1.0 mrad/h maximum guideline levels.

24 Yardboro Avenue

The walkover gamma scan identified slightly elevated exposure rates on the asphalt located on the east and west sides of the property. The ORNL survey[22] reported similar findings and suggested that elevated activity in the sealing coat could be responsible for the higher radiation levels. Beta-gamma readings were also elevated, though limited to the western portion. Levels ranged from 0.02 to 0.10 mrad/h (Table 3), satisfying the average and maximum dose rate criteria. Results of soil sampling at three locations (Figure 11) are listed in Table 2. Samples from location 3 were collected within the remediated area. Uranium-238 concentrations were less than the 35 pCi/g criterion in all cases.

Additional Analysis

Levels of radionuclides, other than uranium, in ORAU samples from the Colonie properties were typical of concentrations normally occurring in soils from this area of New York.[27] Isotopic analyses performed previously on samples collected from other vicinity properties[28] had confirmed that the uranium contaminant is depleted in U-235.

CONCLUSIONS

Based on the results and findings of this independent verification study, 21 of the 22 remediated properties were found to satisfy the established criteria. Additional remedial action was performed on a small area of residual contamination on the remaining property; verification sampling after this additional cleanup demonstrated that this property had also been adequately decontaminated. It is therefore the opinion of the verification contractor, Oak Ridge Associated Universities' Radiological Site Assessment Program, that remedial action on the 22 properties described herein has been effective in satisfying the established DOE criteria. It is also ORAU's opinion that the documentation supporting the remedial action process is adequate and accurate.

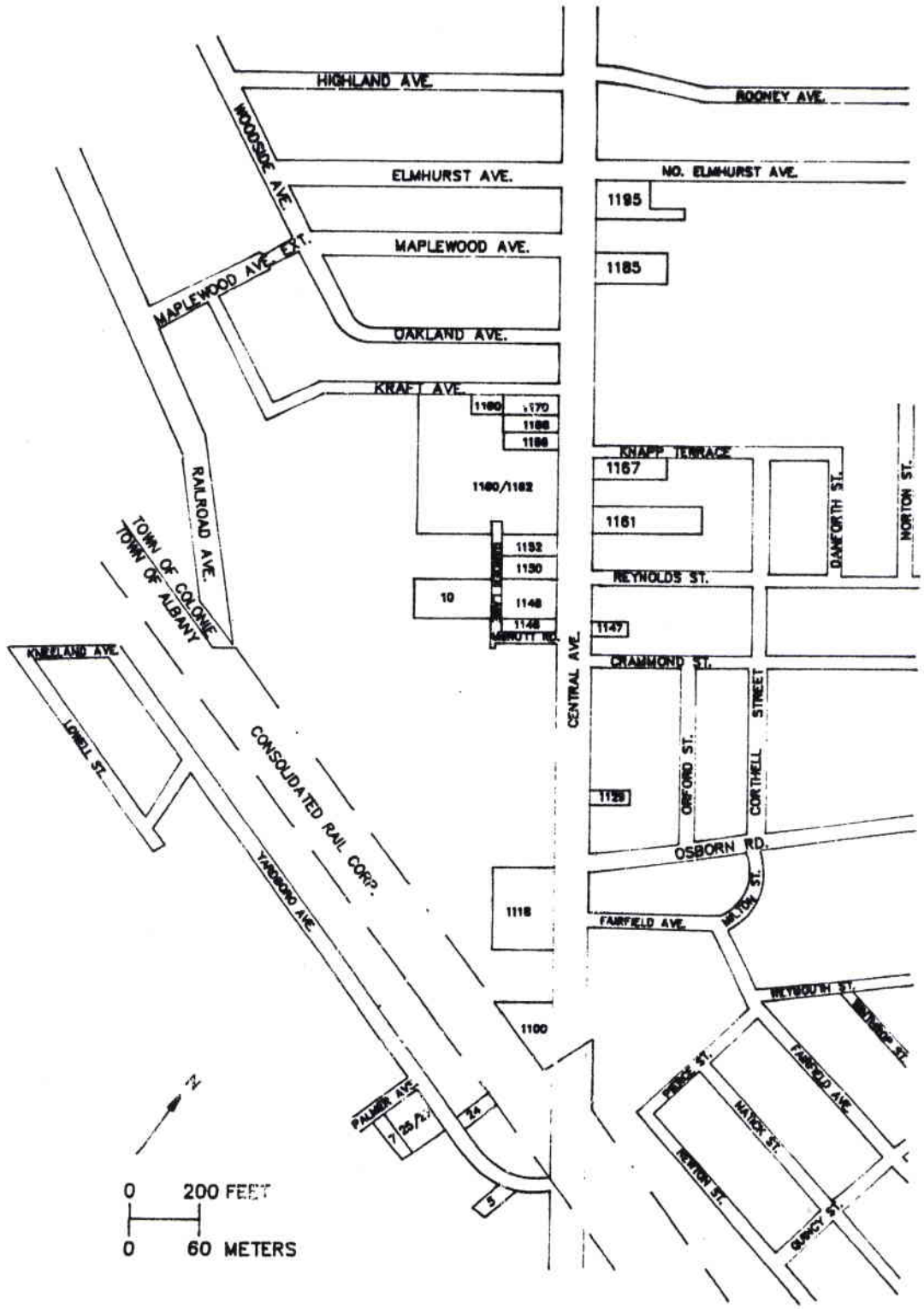

FIGURE 1: Section of Colonie, NY, Indicating Locations of Vicinity Properties Relative to the Former National Lead Industries Plant

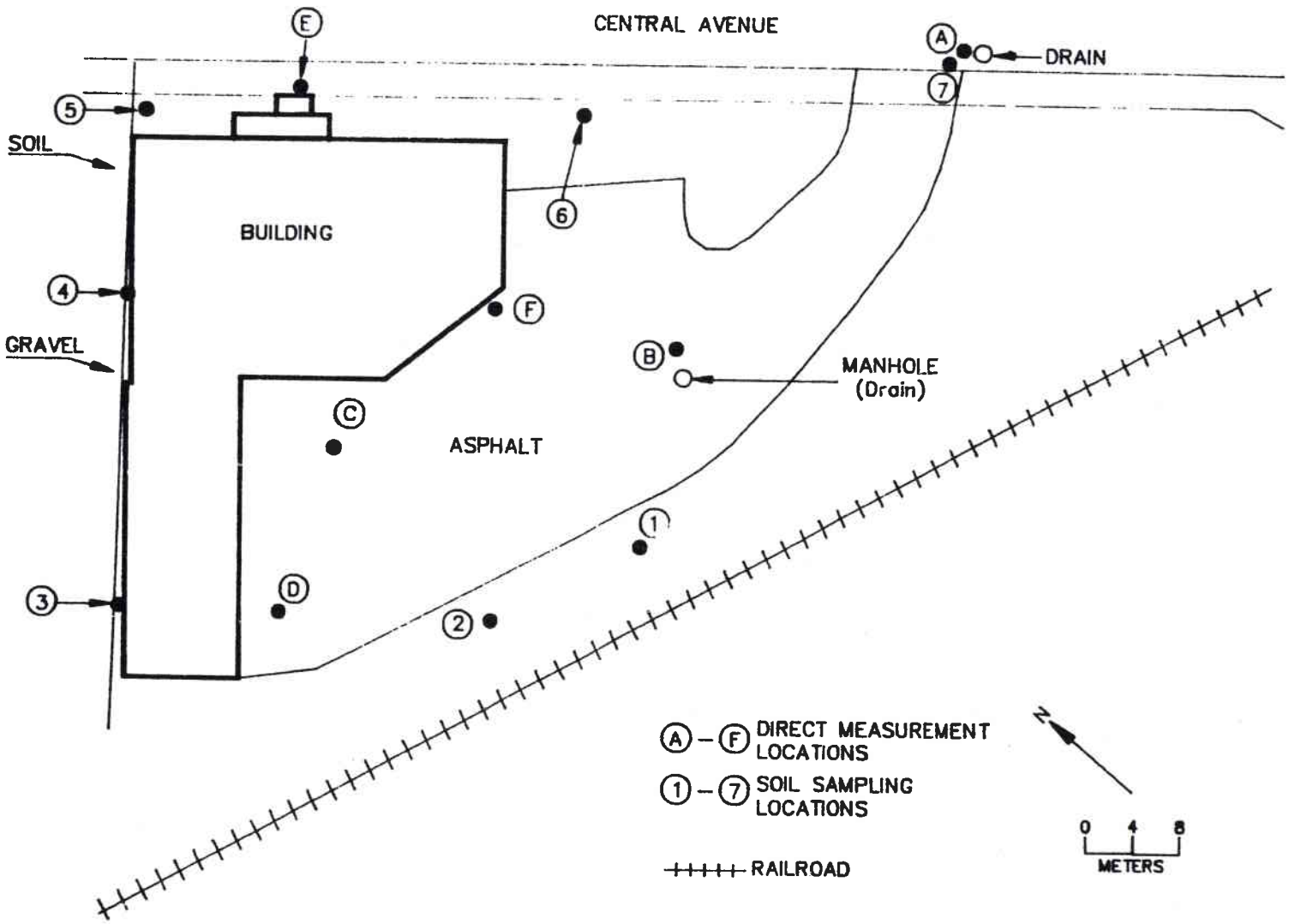

FIGURE 2: Plot Plan of Property at 1100 Central Avenue, Indicating Locations of Independent Measurements and Sampling

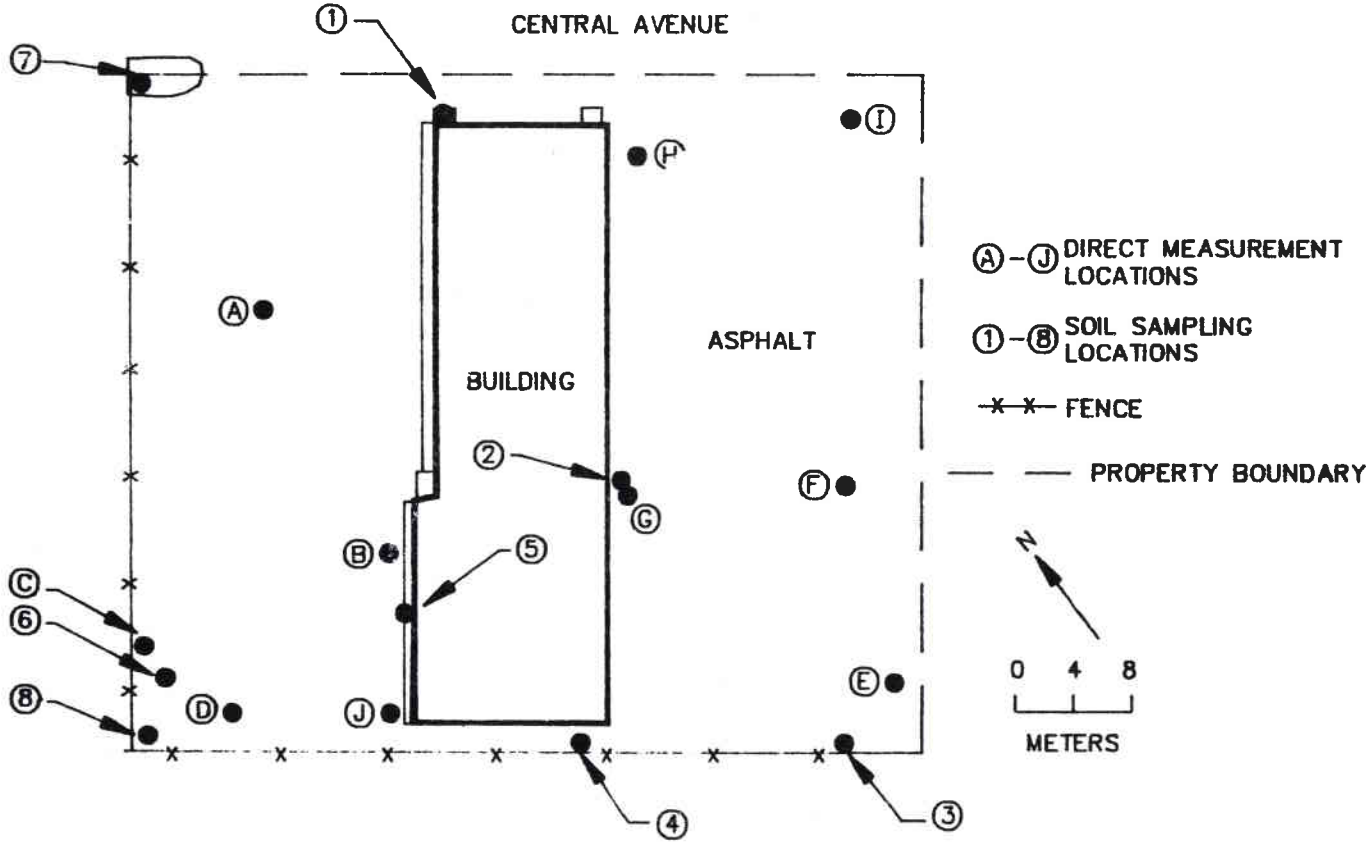

FIGURE 3: Plot Plan of Property at 1118 Central Avenue, Indicating Locations of Independent Measurements and Sampling

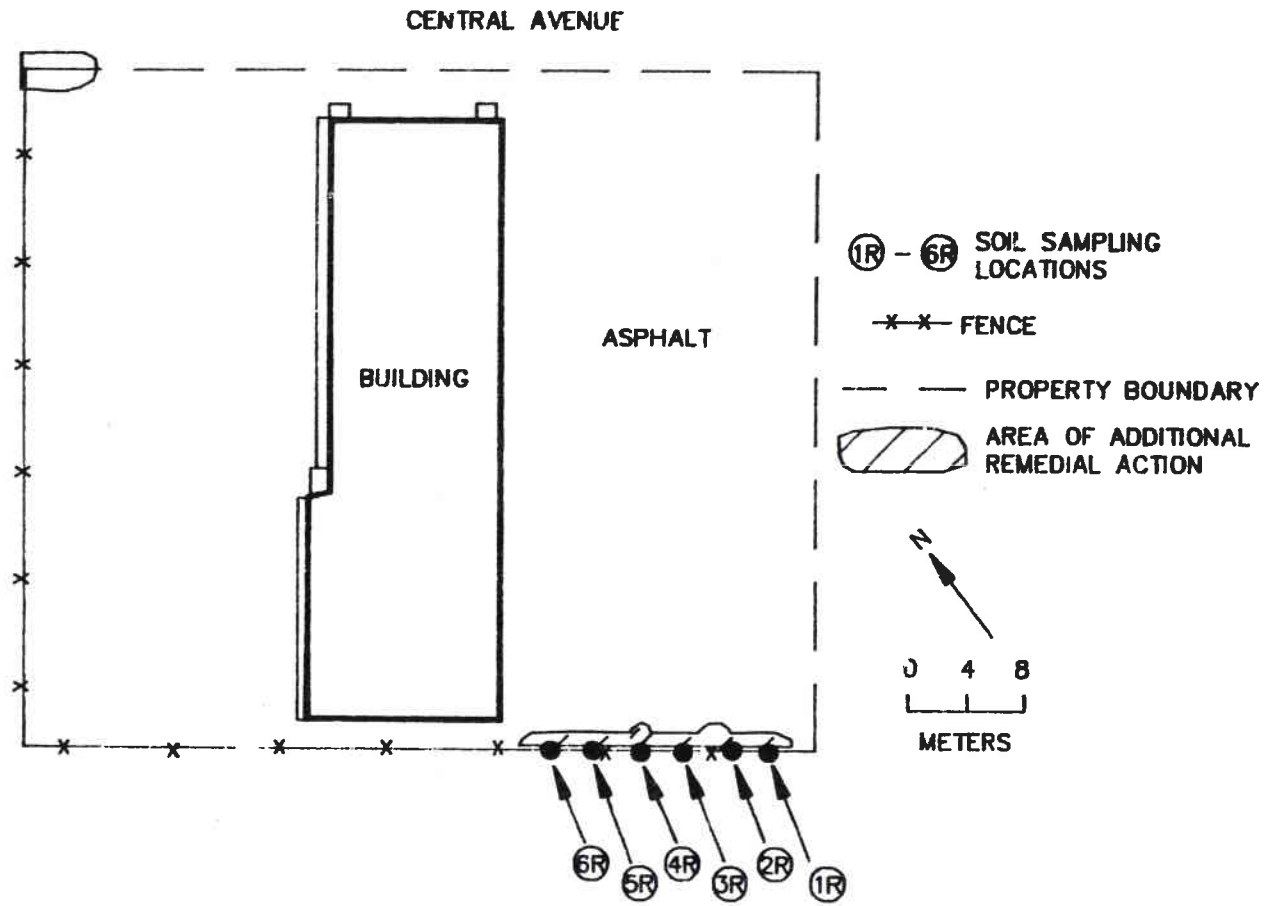

FIGURE 4: Plot Plan of Property at 1118 Central Avenue, Indicating Locations of Soil Sampling After Additional Cleanup

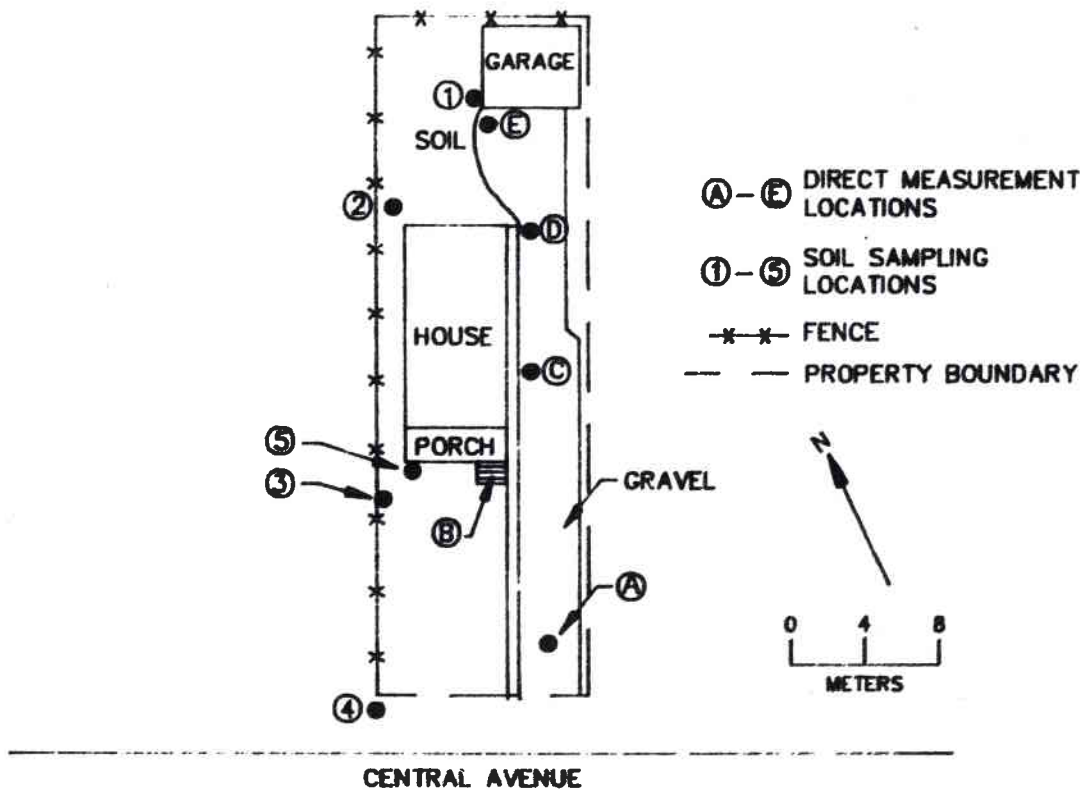

FIGURE 5: Plot Plan of Property at 1129 Central Avenue, Indicating Locations of Independent Measurements and Sampling

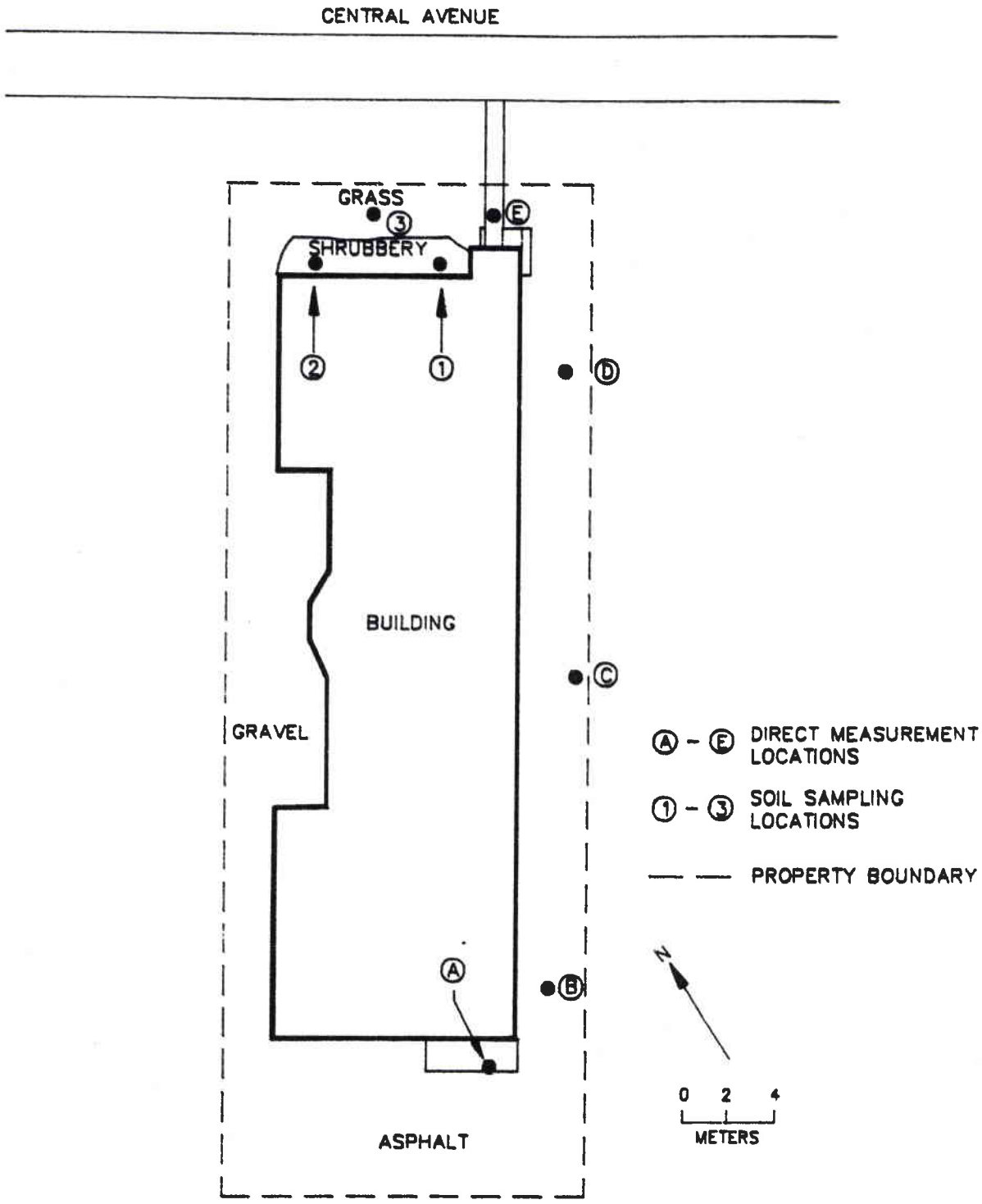

FIGURE 6: Plot Plan of Property at 1146 Central Avenue, Indicating Locations of Independent Measurements and Sampling

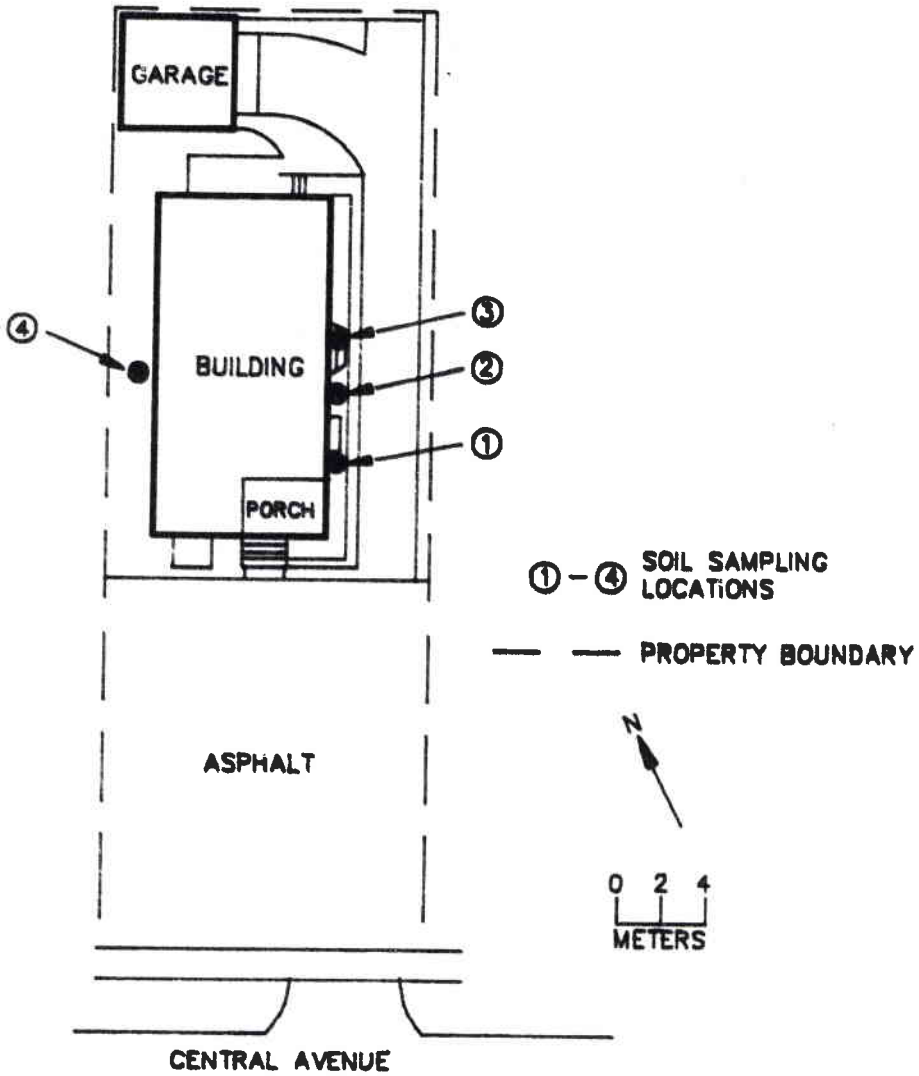

FIGURE 7: Plot Plan of Property at 1147 Central Avenue, Indicating Soil Sampling Locations

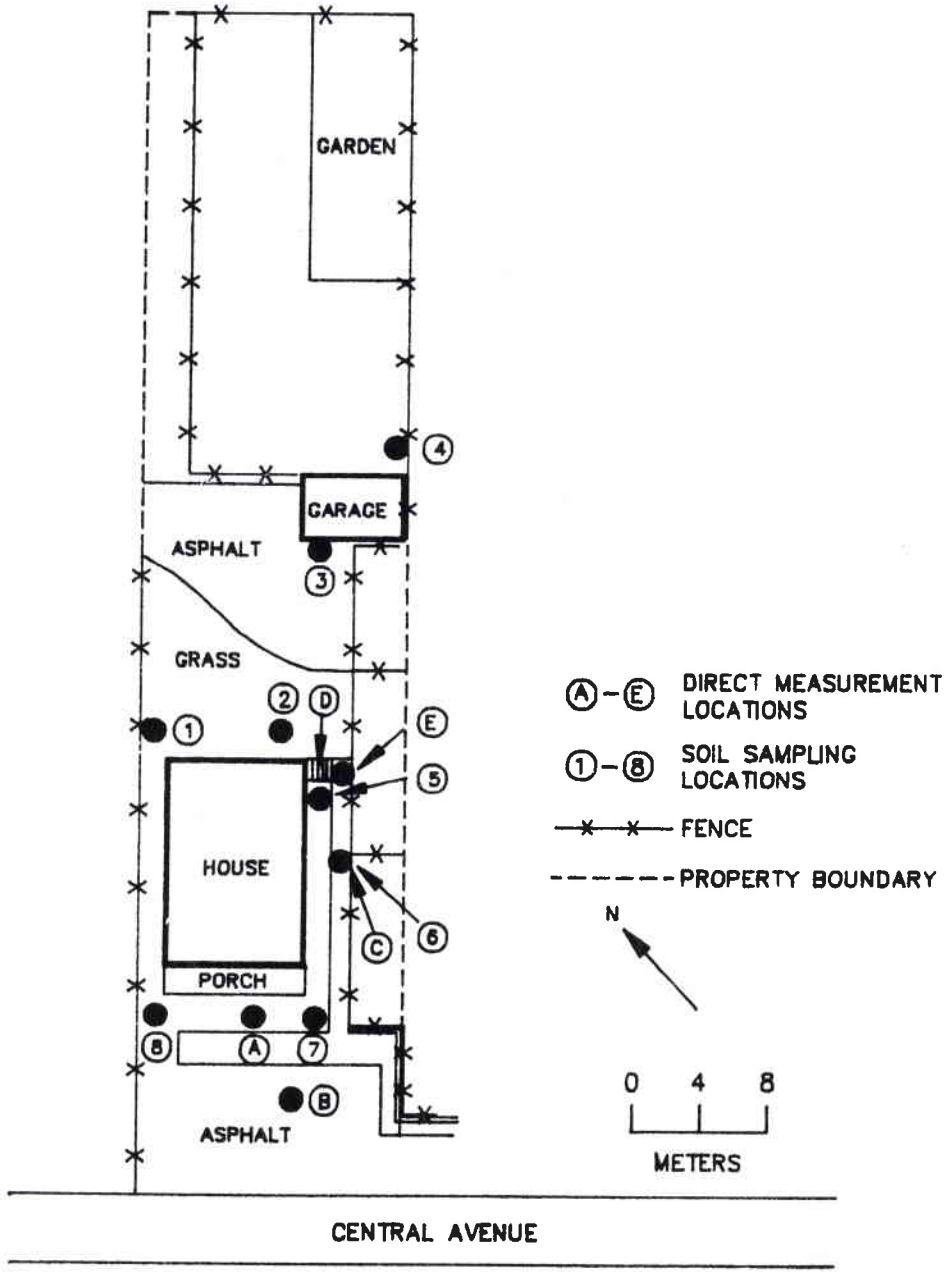

FIGURE 8: Plot Plan of Property at 1167 Central Avenue, Indicating Locations of Independent Measurements and Sampling

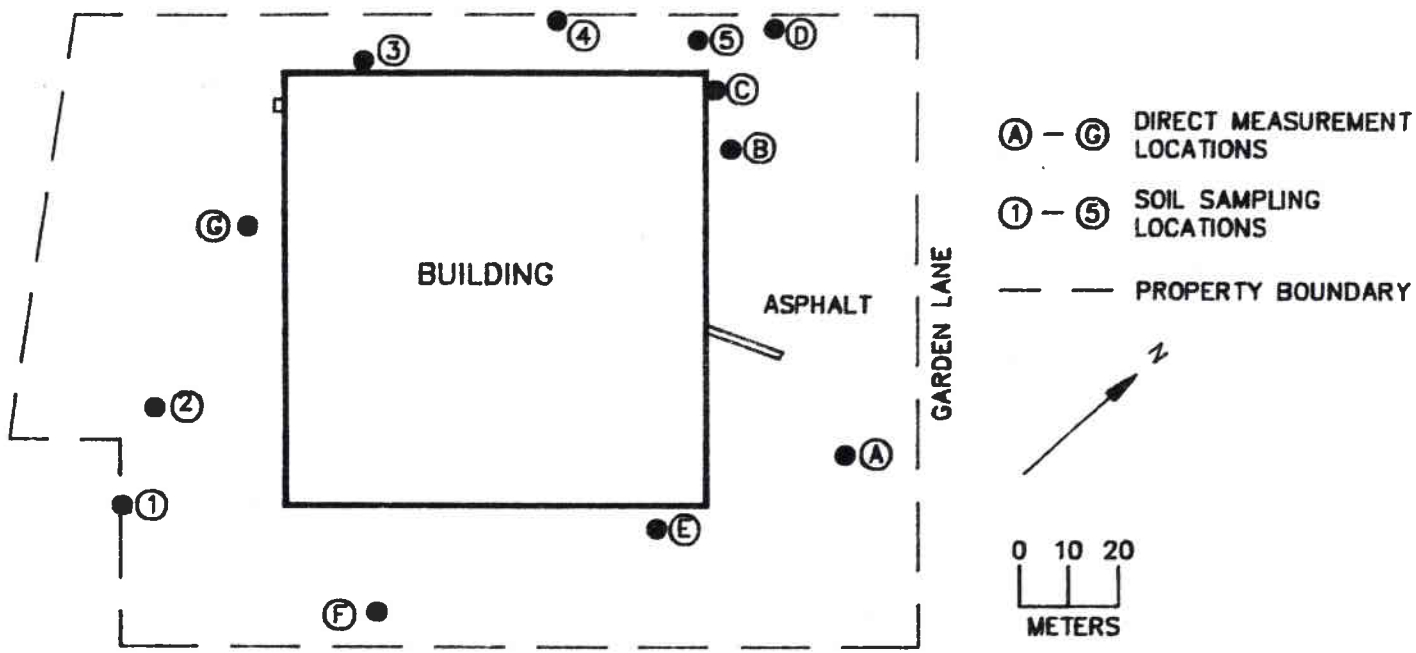

FIGURE 9: Plot Plan of Property at 10 Garden Lane, Indicating Locations of Independent Measurements and Sampling

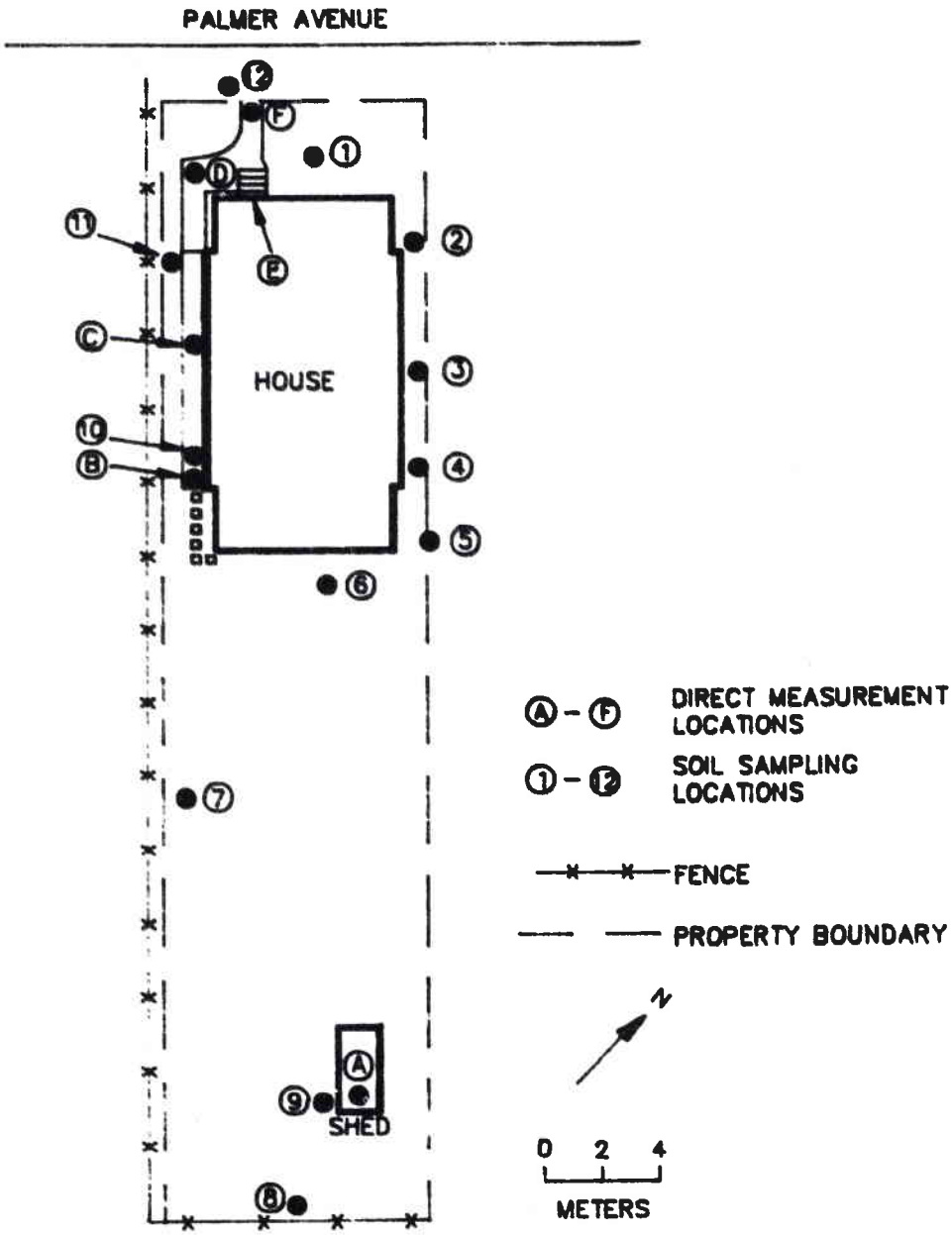

FIGURE 10: Plot Plan of Property at 7 Palmer Avenue, Indicating Locations of Independent Measurements and Sampling

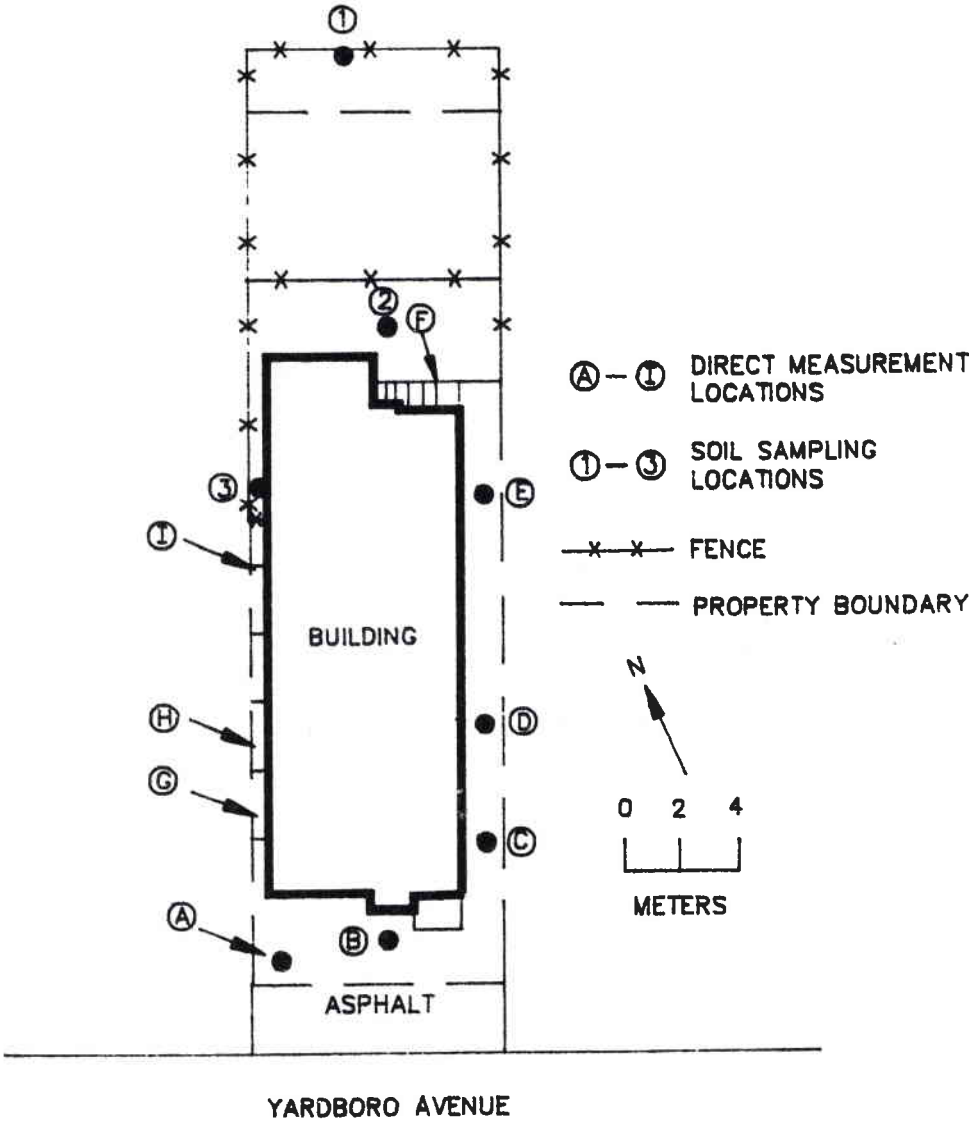

FIGURE 11: Plot Plan of Property at 24 Yardboro Avenue, Indicating Locations of Independent Measurements and Sampling

TABLE 1

RESULTS OF CONFIRMATORY U-238 ANALYSES ON SOIL SAMPLES FROM 1985 COLONIE REMEDIAL ACTION PROPERTIES

Property and Sample[a]	U-238 Concentration (pCi/g)	
	BNI Analysis	ORAU Analysis
1100 Central Avenue		
1	13.3 ± 5.0	10.2 ± 2.4[b]
1118 Central Avenue		
1	20.0 ± 4.0	21.4 ± 3.3
1129 Central Avenue		
2	0.5 ± 1.0	0.97 ± 0.70
4	<1.2	0.51 ± 0.69
1147 Central Avenue		
4	3.1 ± 0.1	3.27 ± 0.62
1148 Central Avenue		
5	14.3 ± 1.5	12.9 ± 2.4
10	2.1 ± 0.3	3.06 ± 0.61
1150 Central Avenue		
2	2.8 ± 0.1	3.24 ± 0.58
1152 Central Avenue		
3	9.4 ± 2.6	9.33 ± 1.12
4	13.1 ± 4.5	10.8 ± 1.4
7	33.3 ± 8.0	29.7 ± 1.5
1160/1162 Central Avenue		
1	13.2 ± 5.0	11.1 ± 1.0
5	17.5 ± 6.6	14.9 ± 2.7
7	14.2 ± 0.3	15.3 ± 1.2
1161 Central Avenue		
8	5.5 ± 1.3	6.84 ± 0.92
1166 Central Avenue		
2	2.1 ± 0.1	1.88 ± 0.55
10	28.5 ± 8.3	24.7 ± 4.0
1167 Central Avenue		
1	2.6 ± 1.1	3.66 ± 0.66
5	3.0 ± 1.1	4.16 ± 0.68

TABLE 1 (Continued)

RESULTS OF CONFIRMATORY U-238 ANALYSES ON SOIL SAMPLES FROM 1985 COLONIE REMEDIAL ACTION PROPERTIES

Property and Sample[a]	U-238 Concentration (pCi/g)	
	BNI Analysis	ORAU Analysis
1168 Central Avenue		
12	2.3 ± 0.9	1.42 ± 0.77
1170 Central Avenue		
2	15.4 ± 1.5	19.7 ± 1.3
6	5.0 ± 0.7	4.75 ± 1.01
1185 Central Avenue		
1	1.0 ± 0.7	0.82 ± 0.56
1195 Central Avenue		
2	2.2 ± 0.7	2.78 ± 0.64
4	7.8 ± 0.1	8.28 ± 1.01
10 Garden Lane		
1	4.7 ± 0.3	6.25 ± 1.15
2	11.7 ± 0.4	13.8 ± 2.7
5 Yardboro Avenue		
2	2.5 ± 1.3	2.51 ± 0.56
3	2.0 ± 0.8	1.42 ± 0.42
24 Yardboro Avenue		
4	2.4 ± 0.2	2.74 ± 0.55
25/27 Yardboro Avenue		
3	5.7 ± 0.5	4.42 ± 0.65

[a]Sample identification as presented in the BNI post-remedial action report.[25]
[b]Errors are 2σ based only on counting statistics.

TABLE 2

URANIUM-238 CONCENTRATIONS IN SOIL SAMPLES
FROM SELECTED COLONIE VICINITY PROPERTIES

Property and Location[a]	Sample Depth (cm)	U-238 Concentration (pCi/g)
1100 Central Avenue		
1A	0-5	13.3 ± 1.9[b]
1B	5-15	12.3 ± 1.1
2A	0-5	6.06 ± 0.76
2B	5-15	9.15 ± 2.13
3A	0-5	5.90 ± 0.80
3B	5-15	14.9 ± 1.2
4A	0-5	1.01 ± 0.76
4B	5-10	27.8 ± 3.1
5A	0-5	5.69 ± 0.73
5B	5-15	4.69 ± 1.63
6A	0-5	11.6 ± 1.1
6B	5-15	10.7 ± 0.9
7A	0-5	1.34 ± 0.67
1118 Central Avenue		
1A	0-15	0.63 ± 0.83
2A	0-5	35.2 ± 2.1
3A	0-5	220 ± 5
4A	0-5	8.53 ± 0.82
4B	5-15	5.32 ± 0.77
5A	0-5	0.86 ± 0.98
5B	5-15	0.70 ± 0.44
6A	0-5	7.41 ± 1.31
6B	5-15	6.41 ± 1.18
7A	0-5	8.33 ± 1.10
7B	5-15	3.80 ± 0.68
8A	0-5	0.41 ± 0.32
8B	5-15	1.24 ± 0.70
1129 Central Avenue		
1A	0-5	13.8 ± 2.6
1B	5-15	5.43 ± 1.48
2A	0-5	3.38 ± 0.64
2B	5-15	2.73 ± 1.39
3A	0-5	20.0 ± 1.8
3B	5-15	2.50 ± 1.27
4A	0-5	5.38 ± 0.78
4B	5-15	3.21 ± 1.29
5A	0-5	6.22 ± 1.49
5B	5-15	2.20 ± 0.52

TABLE 2 (Continued)

URANIUM-238 CONCENTRATIONS IN SOIL SAMPLES
FROM SELECTED COLONIE VICINITY PROPERTIES

Property and Location[a]	Sample Depth (cm)	U-238 Concentration (pCi/g)
1146 Central Avenue		
1A	0-5	18.6 ± 1.3
1B	5-15	10.2 ± 1.9
2A	0-5	10.3 ± 1.0
2B	5-15	3.80 ± 1.58
3A	0-5	30.8 ± 2.0
3B	5-15	8.55 ± 0.94
1147 Central Avenue		
1A	0-5	13.7 ± 1.3
1B	5-15	1.89 ± 0.63
2A	0-5	9.05 ± 1.34
3A	0-5	12.1 ± 1.1
3B	5-15	2.85 ± 0.93
4A	0-5	7.90 ± 0.99
1167 Central Avenue		
1A	0-5	8.52 ± 0.91
1B	5-15	6.94 ± 1.42
2A	0-5	11.1 ± 0.9
2B	5-15	10.4 ± 2.1
3A	0-5	13.8 ± 1.1
3B	5-15	5.27 ± 1.04
4A	0-5	31.0 ± 2.1
4B	5-15	18.3 ± 1.6
5A	0-5	<0.36
5B	5-15	4.47 ± 0.88
6A	0-5	1.21 ± 0.61
6B	5-15	6.18 ± 0.97
7A	0-5	12.3 ± 1.6
7B	5-15	9.22 ± 0.92
8A	0-5	8.68 ± 1.09
8B	5-15	11.7 ± 1.2

TABLE 2 (Continued)

URANIUM-238 CONCENTRATIONS IN SOIL SAMPLES
FROM SELECTED COLONIE VICINITY PROPERTIES

Property and Location[a]	Sample Depth (cm)	U-238 Concentration (pCi/g)
10 Garden Lane		
1A	0-5	40.7 ± 1.8
1B	5-15	18.3 ± 1.7
2A	0-5	4.94 ± 0.70
2B	5-15	6.71 ± 0.76
3A	0-5	4.74 ± 0.74
3B	5-15	1.34 ± 0.72
4A	0-5	1.89 ± 0.53
4B	5-15	9.74 ± 0.81
5A	0-5	1.08 ± 0.84
5B	5-15	1.28 ± 0.61
7 Palmer Avenue		
1A	0-5	11.4 ± 1.1
1B	5-15	2.34 ± 0.53
2A	0-5	14.0 ± 1.3
2B	5-15	7.51 ± 1.29
3A	0-5	9.68 ± 1.20
3B	5-15	5.31 ± 0.86
4A	0-5	19.2 ± 1.5
4B	5-15	14.6 ± 1.3
5A	0-5	11.1 ± 1.7
5B	5-15	6.39 ± 0.79
6A	0-5	10.2 ± 2.0
6B	5-15	5.45 ± 0.84
7A	0-5	9.58 ± 1.58
7B	5-15	5.36 ± 0.70
8A	0-5	19.3 ± 3.0
8B	5-15	9.18 ± 1.09
9A	0-5	18.8 ± 1.5
9B	5-15	6.27 ± 0.79
10A	0-5	9.53 ± 1.12
10B	5-15	10.2 ± 1.1
11A	0-5	9.62 ± 1.02
11B	5-15	6.78 ± 0.82
12A	0-5	7.87 ± 2.70
12B	5-15	9.75 ± 1.22

TABLE 2 (Continued)

URANIUM-238 CONCENTRATIONS IN SOIL SAMPLES
FROM SELECTED COLONIE VICINITY PROPERTIES

Property and Location[a]	Sample Depth (cm)	U-238 Concentration (pCi/g)
24 Yardboro Avenue		
1A	0-5	10.4 ± 2.0
1B	5-15	7.43 ± 0.97
2A	0-5	20.8 ± 1.5
2B	5-15	8.08 ± 1.02
3A	0-5	2.78 ± 0.53
3B	5-15	20.0 ± 2.3

[a]Refer to Figures 1-11.
[b]Errors are 2σ based only on counting statistics.

TABLE 3

BETA-GAMMA MEASUREMENTS ON SELECTED COLONIE VICINITY PROPERTIES

Property and Location[a]	Beta-Gamma Levels	
	dpm/100 cm^2	mrad/h
1100 Central Avenue		
A	2320	0.04
B	2890	0.05
C	1980	0.04
D	3080	0.06
E	1330	0.02
F	1820	0.03
1118 Central Avenue		
A	3420	0.06
B	7220	0.14
C	5050	0.09
D	3150	0.06
E	2200	0.04
F	2170	0.04
G	1980	0.04
H	1940	0.04
I	2470	0.05
J	3650	0.07
1129 Central Avenue		
A	1672	0.03
B	1180	0.02
C	2200	0.04
D	570	0.01
E	1860	0.04
1146 Central Avenue		
A	1100	0.02
B	3760	0.07
C	3720	0.07
D	2390	0.04
E	650	0.01
1167 Central Avenue		
A	950	0.02
B	1600	0.03
C	1180	0.02
D	840	0.02
E	800	0.02

TABLE 3 (Continued)

BETA-GAMMA MEASUREMENTS ON SELECTED
COLONIE VICINITY PROPERTIES

Property and Location[a]	Beta-Gamma Levels	
	dpm/100 cm^2	mrad/h
10 Garden Lane		
A	1220	0.02
B	2580	0.05
C	1560	0.03
D	910	0.02
E	650	0.01
F	<560[b]	<0.01
G	<560[b]	<0.01
7 Palmer Avenue		
A	<490[b]	<0.01
B	1110	0.02
C	1390	0.02
D	1310	0.02
E	530	0.01
F	1310	0.02
24 Yardboro Avenue		
A	860	0.02
B	1150	0.02
C	1150	0.02
D	2090	0.04
E	940	0.02
F	1350	0.02
G	4760	0.08
H	6030	0.10
I	5130	0.09

[a]Refer to Figures 1-11.
[b](<) Indicates value is less than the minimum detection capability of the instrumentation.

TABLE 4

URANIUM-238 CONCENTRATIONS IN SOIL SAMPLES FROM THE AREA AT 1118 CENTRAL AVENUE, WHERE ADDITIONAL REMEDIAL ACTION WAS PERFORMED

Location[a]	Sample Depth[b] (cm)	U-238 Concentration (pCi/g)
1R	0 - 15	8.9 ± 1.3[c]
2R	0 - 15	8.9 ± 1.1
3R	0 - 15	1.70 ± 0.96
4R	0 - 15	<0.43
5R	0 - 15	0.9 ± 1.6
6R	0 - 15	1.71 ± 0.92

[a] Refer to Figure 4.
[b] Depth below excavated surface, which ranged from 20 - 25 cm below the original surface level.
[c] Errors are 2σ based only on counting statistics.

REFERENCES

1. Teledyne Isotopes. A Survey of Uranium in Soil Surrounding the NL Bearings Plant, IWL-9488-461, October 31, 1980.

2. Oak Ridge National Laboratory. Results of the Radiological Survey at 1100 Central Avenue, Colonie, New York (AL 041), Oak Ridge, TN, July 1985.

3. Oak Ridge National Laboratory. Results of the Radiological Survey at 1118 Central Avenue, Colonie, New York (AL 022), Oak Ridge, TN, June 1985.

4. Oak Ridge National Laboratory. Results of the Radiological Survey at 1129 Central Avenue, Colonie, New York (AL 043), Oak Ridge, TN, July 1985.

5. Oak Ridge National Laboratory. Results of the Radiological Survey at 1146 Central Avenue, Colonie, New York (AL 024), Oak Ridge, TN, July 1985.

6. Oak Ridge National Laboratory. Results of the Radiological Survey at 1147 Central Avenue, Colonie, New York (AL 034), Oak Ridge, TN, July 1985.

7. Oak Ridge National Laboratory. Results of the Radiological Survey at 1148 Central Avenue, Colonie, New York (AL 025), Oak Ridge, TN, June 1985.

8. Oak Ridge National Laboratory. Results of the Radiological Survey at 1150 Central Avenue, Colonie, New York (AL 026), Oak Ridge, TN, June 1985.

9. Oak Ridge National Laboratory. Results of the Radiological Survey at 1152 Central Avenue, Colonie, New York (AL 027), Oak Ridge, TN, June 1985.

10. Oak Ridge National Laboratory. Results of the Radiological Survey at 1160 Central Avenue, Colonie, New York (AL 021), Oak Ridge, TN, June 1985.

11. Oak Ridge National Laboratory. Results of the Radiological Survey at 1160/1162 Central Avenue, Colonie, New York (AL 020), Oak Ridge, TN, July 1985.

12. Oak Ridge National Laboratory. Results of the Radiological Survey at 1163/1161 Central Avenue, Colonie, New York (AL 056), Oak Ridge, TN, July 1985.

13. Oak Ridge National Laboratory. Results of the Radiological Survey at 1166 Central Avenue, Colonie, New York (AL 053), Oak Ridge, TN, July 1985.

14. Oak Ridge National Laboratory. Results of the Radiological Survey at 1167 Central Avenue, Colonie, New York (AL 054), Oak Ridge, TN, unpublished.

15. Oak Ridge National Laboratory. Results of the Radiological Survey at 1168 Central Avenue, Colonie, New York (AL 052), Oak Ridge, TN, July 1985.

16. Oak Ridge National Laboratory. Results of the Radiological Survey at 1170 Central Avenue, Colonie, New York (AL 051), Oak Ridge, TN, July 1985.

17. Oak Ridge National Laboratory. Results of the Radiological Survey at 1185 Central Avenue, Colonie, New York (AL 032), Oak Ridge, TN, July 1985.

18. Oak Ridge National Laboratory. Results of the Radiological Survey at 1195 Central Avenue, Colonie, New York (AL 065), Oak Ridge, TN, unpublished.

19. Oak Ridge National Laboratory. Results of the Radiological Survey at 1148 Central Avenue-Rear, Colonie, New York (AL 023), Oak Ridge, TN, July 1985.

20. Oak Ridge National Laboratory. Results of the Radiological Survey at 7 Palmer Avenue, Albany, New York (AL 017), Oak Ridge, TN, June 1985.

21. Oak Ridge National Laboratory. Results of the Radiological Survey at 5 Yardboro Avenue, Albany, New York (AL 031), Oak Ridge, TN, July 1985.

22. Oak Ridge National Laboratory. Results of the Radiological Survey at 24 Yardboro Avenue, Albany, New York (AL 019), Oak Ridge, TN, June 1985.

23. Oak Ridge National Laboratory. Results of the Radiological Survey at 25/27 Yardboro Avenue, Albany, New York (AL 016), Oak Ridge, TN, June 1985.

24. Department of Energy. Remedial Action Work Plan for the Colonie Site, ORO-847, Revision 1, Oak Ridge, TN, August 1985.

25. Bechtel National, Inc. Post-Remedial Action Report for the Colonie Interim Storage Site Vicinity Properties - 1985 (DOE/OR/20722-92), Oak Ridge, TN, July 1986.

[redacted]

APPENDIX A

CRITERIA APPLICABLE TO THE COLONIE SITE

APPENDIX A

Criteria Applicable to the Colonie Site

Site specific criteria for Colonie properties were developed by DOE with input by New York state and EPA officials. These criteria are:

1. Soil

   a. Levels of depleted uranium (U-238) exceeding thirty-five pCi/g averaged over a 5 cm (2 in.) depth and a 100 m^2 (1,076 ft^2) area will be removed.

   b. One hundred pCi/g of depleted uranium (approximately three times criteria) averaged over a 5 cm (2 in.) depth and 1 m^2 (10 ft^2) will be removed.

2. Structures and paved surfaces

   a. Surface contamination of 5,000 dpm/100 cm^2 averaged over an area not exceeding 1 m^2, with a maximum of 15,000 dpm/100 cm^2 in areas of not more than 100 cm^2.

   b. Removable contamination of 1,000 dpm/100 cm^2.

   c. 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.

APPENDIX B

MAJOR SAMPLING AND ANALYTICAL EQUIPMENT

APPENDIX B

Major Sampling and Analytical Equipment

The display or description of a specific product is not to be construed as an endorsement of that product or its manufacturer by the authors or their employer.

A. Direct Radiation Measurements

Eberline RASCAL
Portable Scaler/Ratemeter
Model PRS-1
(Eberline, Sante Fe, NM)

Eberline PRM-6
Portable Ratemeter
(Eberline, Sante Fe, NM)

Eberline Beta-Gamma Pancake Probe
Model HP-260
(Eberline, Sante Fe, NM)

Victoreen NaI Gamma Scintillation Probe
Model 489-55
(Victoreen, Inc., Cleveland, OH)

B. Laboratory Analysis

Ge(Li) Detector
Model LGCC2220SD, 23% efficiency
(Princeton Gamma-Tech, Princeton, NJ)

Used in conjunction with:
Lead Shield, SPG-16
(Applied Physical Technology, Smyrna, GA)

High-Purity Germanium Detector
Model GMX-23195-S, 23% efficiency
(EG&G ORTEC, Oak Ridge, TN)

Used in conjunction with:
Lead Shield, G-16
(Gamma Products Inc., Palos Hills, IL)

Multichannel Analyzer
ND-66/ND-680 System
(Nuclear Data, Inc., Schaumburg, IL)

APPENDIX C

MEASUREMENT AND ANALYTICAL PROCEDURES

APPENDIX C

Measurement and Analytical Procedures

Gamma Surface Scans

Walkover surface scans were performed at 1 meter intervals, using Eberline Model PRM-6 portable ratemeters with Victoreen Model 489-55 gamma scintillation probes, containing 3.2 cm x 3.8 cm NaI(Tl) scintillation crystals. Relative count rates were monitored using earphones and increased rates above the ambient background levels were noted.

Beta-Gamma Dose Rate Measurements

Measurements of direct beta-gamma radiation levels were performed using Eberline Model PRS-1 portable scaler/ratemeters with Model HP-260 thin-window pancake G-M probes. Count rates (cpm) were converted to disintegration rates (dpm/100 cm^2) by dividing the net rate by the 4π efficiency and correcting for the active area of the detector. The effective window area is 15 cm^2 for the G-M detectors. The average background count rate was 40 cpm for the G-M probes. Dose rates were calculated by applying the conversion factor of 1,400 cpm/mrad/h to the net count rate.

Soil Sample Analysis

Gamma Spectrometry

Soil samples were dried, mixed, and a portion placed in a 0.5 l Marinelli beaker. The quantity placed in each beaker was chosen to reproduce the calibrated counting geometry and ranged from 600 to 900 g of soil. Net soil weights were determined and the samples counted using a high-purity intrinsic germanium detector coupled to a Nuclear Data Model ND-680 pulse height analyzer system. Background and Compton stripping, peak search, peak identification, and concentration calculations were performed using the computer capabilities inherent in the analyzer system. Energy peaks reviewed for determination of U-238 soil concentrations were:

U-238 - 0.094 MeV or 0.063 MeV from Th-234 or 1.001 MeV from Pa-234 (secular equilibrium assumed)

Errors and Detection Limits

The uncertainties associated with the analytical data, presented in the tables of this report, represent the 95% (2σ) confidence levels based only on counting statistics. Other sources of error associated with the sampling and analyses introduce an additional uncertainty of ± 6 to 10% in the results.

Calibration and Quality Assurance

Laboratory and field survey procedures are documented in manuals developed specifically for the Oak Ridge Associated Universities' Radiological Site Assessment Program. Instruments were calibrated with NBS-traceable standards. Quality control procedures on all instruments included daily background and check-source measurements to confirm equipment operation within acceptable statistical fluctuations. The ORAU laboratory participates in the EPA and EML Quality Assurance Programs. All sixty-four samples received by ORAU from BNI as part of this verification have been permanently archived.

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Energy

VERIFICATION OF REMEDIAL ACTIONS AT 1104 CENTRAL AVENUE AND 50 YARDBORO AVENUE COLONIE, NEW YORK

J. D. BERGER

Environmental Survey and Site Assessment Program
Energy/Environment Systems Division

FINAL REPORT
JUNE 1989

062033

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FINAL REPORT

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VERIFICATION OF REMEDIAL ACTIONS AT 1104 CENTRAL AVENUE AND 50 YARDBORO AVENUE COLONIE, NEW YORK

INTRODUCTION AND SITE HISTORY

Between 1958 and 1984, the National Lead Industries plant in Colonie, New York, performed various casting, machining, and milling operations on uranium. The plant primarily processed depleted uranium; however, small amounts of natural and slightly enriched uranium were also handled at the site. Operations resulted in small quantities of uranium dust being released through exhaust ventilation stacks. This dust was dispersed and residential and commercial properties in the vicinity of the plant became contaminated with low levels of uranium.

Teledyne Isotopes surveyed neighboring properties in 1980 and reported the extent of uranium contamination.[1] In October 1983, more detailed surveys of individual properties were initiated by Oak Ridge National Laboratory (ORNL) at the direction of the U.S. Department of Energy's (DOE) Division of Remedial Action Projects. The purpose of the ORNL surveys was to identify those properties with uranium contamination levels exceeding guidelines established by DOE, the Environmental Protection Agency (EPA), and New York State officials (Appendix A).

The House and Senate Conference Report accompanying the Energy and Water Development Appropriations Act of 1984 directed the Department to give priority to the undertaking of a decontamination research and development project involving the National Lead Industries site and vicinity properties. This work is being conducted under the Formerly Utilized Sites Remedial Action Program (FUSRAP). During 1985 Bechtel National, Inc. (BNI), the Project Management Contractor for FUSRAP, conducted additional characterization surveys, where necessary, to more accurately define the boundaries of the uranium contamination on 24 properties identified by ORNL. These properties were:

1100 Central Avenue
1104 Central Avenue
1118 Central Avenue
1129 Central Avenue
1146 Central Avenue
1147 Central Avenue
1148 Central Avenue
1148 Central Avenue-Rear (10 Garden Lane)
1150 Central Avenue
1152 Central Avenue
1160 Central Avenue
1160/1162 Central Avenue
1163/1161 Central Avenue
1166 Central Avenue
1167 Central Avenue
1168 Central Avenue
1170 Central Avenue
1185 Central Avenue
1195 Central Avenue
7 Palmer Avenue
5 Yardboro Avenue
24 Yardboro Avenue
25/27 Yardboro Avenue
50 Yardboro Avenue

During 1985 BNI performed remedial actions on the 24 properties identified above. The remedial actions were performed in accordance with BNI's August 1985 work plan for the Colonie Site.[2] Cleanup consisted primarily of excavation of contaminated surface soil; however, in several cases additional actions, such as removal of contaminated stone, scabbling, vacuuming of asphalt and concrete surfaces, and gutter cleaning, were required. Following completion of remedial actions, a followup survey was performed by BNI to demonstrate compliance with the cleanup guidelines. Remedial actions at each of the properties and results of the followup surveys are presented in a post-remedial action report prepared by BNI.[3] Activities to identify and remove contamination on additional vicinity properties are continuing.

It is the policy of DOE to perform independent (third party) verifications of the effectiveness of remedial actions conducted within FUSRAP. The Environmental Survey and Site Assessment Program of Oak Ridge Associated Universities (ORAU) has been designated by DOE as the organization responsible for this task at the Colonie site. During March and April 1986, ORAU performed verification activities for the 24 Colonie properties remediated in 1985. Twenty-two properties were found to satisfy the established remedial action guidelines, and a report describing the ORAU verification activities on these properties was prepared.[4] The two properties at 1104 Central Avenue and 50 Yardboro Avenue (Colonie vicinity properties

AL042 and AL013, respectively) were noted to have residual beta-gamma contamination levels on the roofs in excess of the guideline levels of 1.0 mrad/h, maximum, and/or 0.2 mrad/h, average. The locations of these two properties relative to the former National Lead plant, are shown on Figure 1. Bechtel National, Inc. performed assessments of the potential radiological doses to workers and the public, as a result of residual contamination on the roofs of these two buildings. These assessments demonstrated that the maximum committed effective dose equivalent to a member of the public would be only a small fraction (about 6% for the property with the higher contamination level) of the DOE radiation protection standard of 100 mrem/y, due to the residual uranium contamination.[5,6] This is considered the upper limit of possible doses, based on conservative assumptions and property use scenarios. Actual doses would be substantially lower and indistinguishable from natural background levels. On the basis of these assessments, it was determined by DOE that further remedial actions on the roofs of these two properties were not necessary. Following the determination that additional remedial action was not required, ORAU completed the review of supporting documents, provided a letter of verification to DOE,[7] and prepared this report, describing the procedures and findings of the verification activities.

PROCEDURES

Objectives

The objectives of the verification were to confirm that the surveys, sampling, and analyses conducted prior to, during and following remedial action and associated project documentation provide an accurate and complete description of the condition of the property and thereby, confirm that remedial actions have been effective in meeting established criteria.

Procedures

1. Radiological survey reports (references 8 and 9), BNI field characterization data, the work plan (reference 2), and the post-remedial action report (reference 3) were reviewed. Data were evaluated to assure that areas exceeding criteria were identified and

had undergone remedial action. Post-remedial action uranium soil concentrations and surface dose rate data were compared to criteria and the post-remedial action report was reviewed for general thoroughness and accuracy.

2. Thirty-one soil samples, collected during the post-remedial action survey, were obtained from BNI and independently analyzed for U-238 by the ORAU laboratory to confirm the accuracy of BNI analyses.

3. A survey team from ORAU visited the Colonie area and performed visual inspections and limited independent gamma scans, gamma and beta-gamma direct measurements, and soil sampling on the two properties.

Findings of the inspections and radiological surveys were compared with the post-remedial action report and the established Colonie criteria. Measurement and analytical equipment and procedures are described in further detail in Appendices B and C.

FINDINGS AND RESULTS

Document Review

Review of the ORNL survey reports indicated appropriate decisions in designating properties for remedial action. Each of the properties contained U-238 concentrations significantly above background levels for the Colonie/Albany area and "hot spot" locations exceeding 100 pCi/g. The ORNL surveys also identified beta-gamma dose rates on the roofs which exceeded 1.0 mrad/h, maximum, and/or 0.2 mrad/h, average.

The BNI characterization primarily utilized in-situ measurements with a FIDLER* detector, calibrated specifically for the Colonie site contaminant. Characterizations by BNI did not identify additional locations of contamination exceeding the 35 pCi/g average guideline for areas of 100 m^2 (1.076 ft^2). Several small soil areas on 1104 Central Avenue identified as

*Field Instrument for the Detection of Low Energy Radiation

having uranium contamination in the ORNL designation reports, were found to be below the 35 pCi/g average guideline level by the BNI survey and were therefore not remediated. No beta-gamma measurements were performed by BNI as part of the characterization of these two properties.

Visual inspection of the properties by ORAU confirmed the areas of remedial action indicated by BNI in the post-remedial action report. With the exception of one sample from 1104 Central Avenue, which contained 38.3 pCi/g, the U-238 concentrations reported in the BNI post remedial action report were below the criterion of 35 pCi/g.

Confirmatory Analyses

The results of gamma spectrometry analyses, performed independently by ORAU and BNI on thirty-one soil samples collected from the remediated Colonie properties, are presented in Table 1. A Student T test, using Minitab[10] statistical software, indicated that no difference exists between the means of paired data at the 95% confidence level. In addition, comparison of the two data sets yielded a linear correlation coefficient (Pearson) of 0.977. Paired results overlapped within their respective 95% confident intervals for 25 of the 31 samples analyzed and within the 99% confidence intervals for all of the samples. These findings demonstrate that the ORAU and BNI data are statistically indistinguishable; it is therefore, ORAU's opinion that the BNI data are accurate and should be accepted as presented.

Verification Surveys

1104 Central Avenue

Remediated areas were confirmed by visual inspection. Three soil samples were collected from two small areas along the west side of the building where remedial action was not performed. Exposure rates were slightly elevated at these locations. Levels of U-238 ranged from 0.17 to 27.2 pCi/g. The highest concentration was noted at the 0-5 cm (0-2 in) sampling depth from location 3 (refer to Table 2 and Figure 2 for sampling locations and results). The ORNL survey[8] identified significantly elevated beta-gamma levels on the roof,

ranging up to over two times the maximum 1 mrad/h dose rate criterion, established by the DOE for the Colonie vicinity properties. No remediation of the roof surface was performed; however, the assessment by BNI demonstrated that potential doses to the public would be well within the established DOE dose limits of 100 mrem/y. It was determined that the roofs are in compliance with supplemental limit provisions of the DOE guidelines; DOE has also determined that the residual levels on the roofs are ALARA (as-low-as-reasonably achievable).[11]

50 Yardboro Avenue

Areas of remedial action were confirmed by visual inspection. Walkover gamma scans identified slightly elevated levels along a portion of the west property fenceline. Samples collected from locations 3 and 4, however, contained less than 35 pCi/g of U-238 (Table 2 and Figure 3). Significantly elevated gamma exposure rates were noted on a bank located north of the main survey area. Samples collected from location 1 (Figure 3) contained up to 1950 pCi/g of U-238. This location is situated on the adjacent property, belonging to the Consolidated Rail Corporation, and will be addressed during surveys and remedial actions on the railroad right-of-way. Beta-gamma dose rate measurements on paved surfaces, ranged from 0.01 to 0.08 mrad/h (Table 3). Dose rates measured on the roof were significantly higher, ranging from 0.26 to 0.99 mrad/h. Although these levels exceed the 0.2 mrad/h criterion, the assessment of roof contamination demonstrated that such levels will not result in significant doses to the public; no remedial action was therefore required. Verification activities determined that the roofs are in compliance with supplemental limit provisions of the DOE guidelines. DOE has determined that residual roof contamination is ALARA.[12]

CONCLUSIONS

Based on the results and findings of the independent verification study, it is the opinion of Oak Ridge Associated Universities' Environmental Survey and Site Assessment Program, that remedial actions on the properties at 1104 Central Avenue and 50 Yardboro Avenue in Colonie, NY, have been effective in

satisfying DOE guidelines. It is also ORAU's opinion that the documentation supporting the remedial action process is adequate and accurately describes the radiological status of the properties.

COL14a

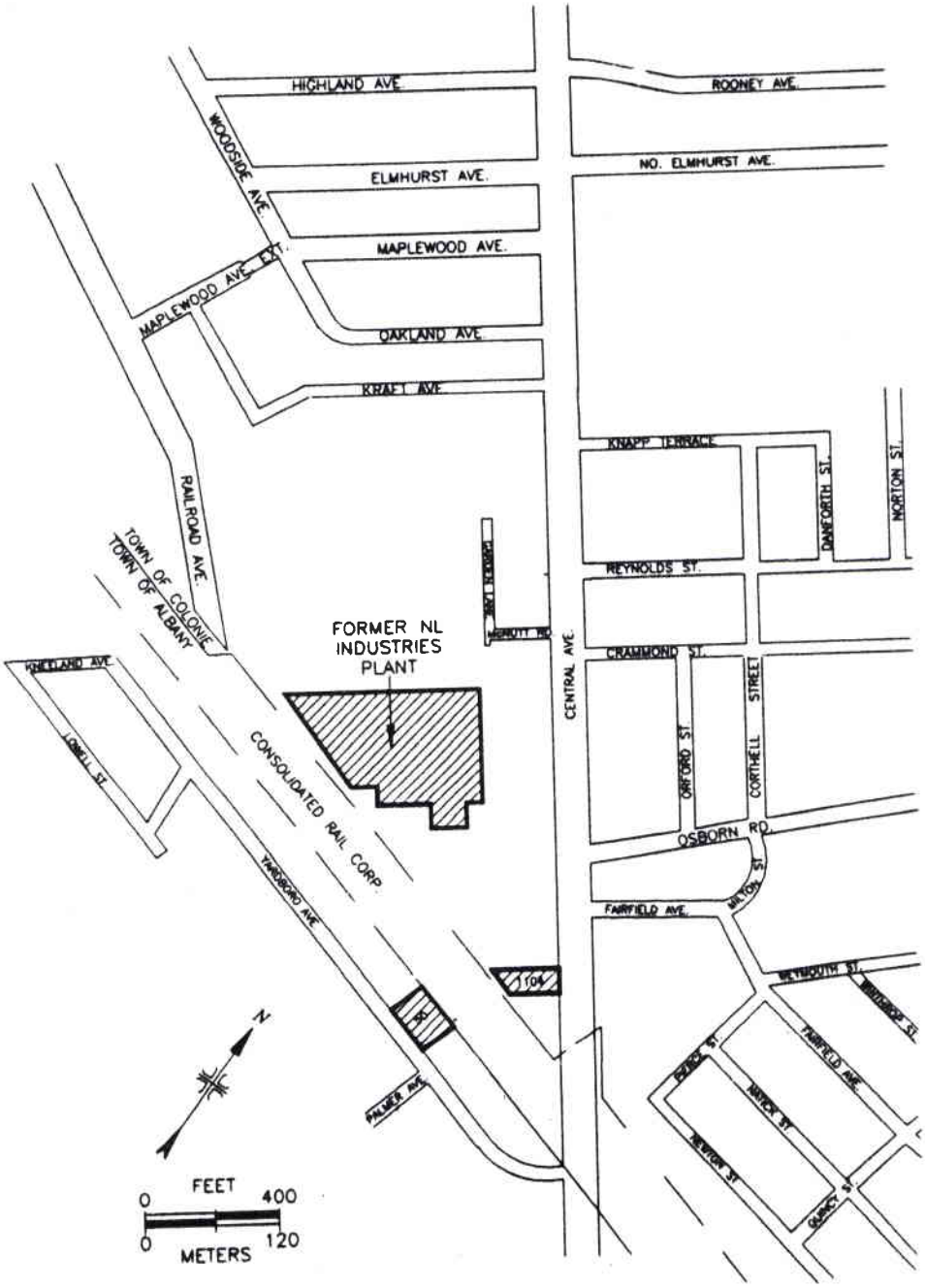

FIGURE 1: Section of Colonie, NY, Indicating Locations of Vicinity Properties Relative to the Former National Lead Industries Plant

COL5

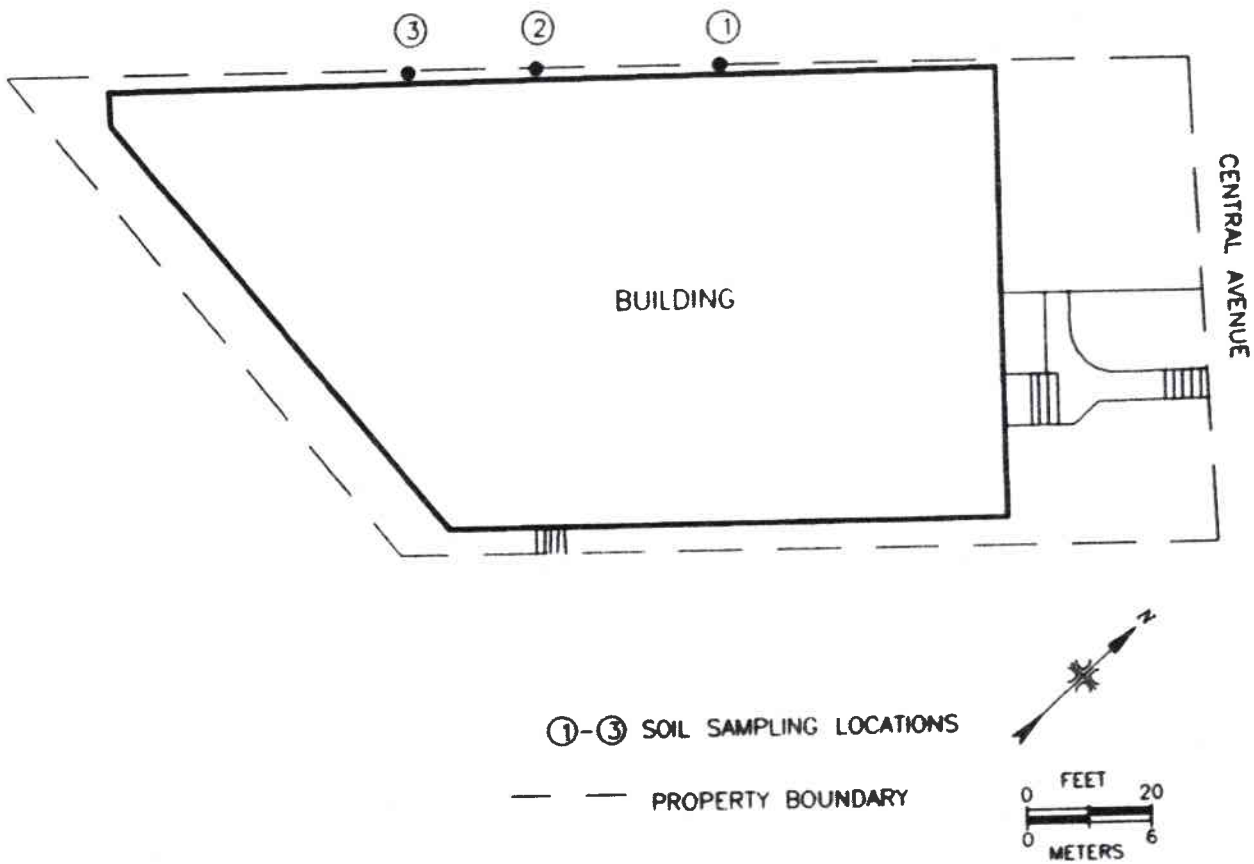

FIGURE 2: Plot Plan of Property at 1104 Central Avenue Indicating Soil Sampling Locations.

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COL13

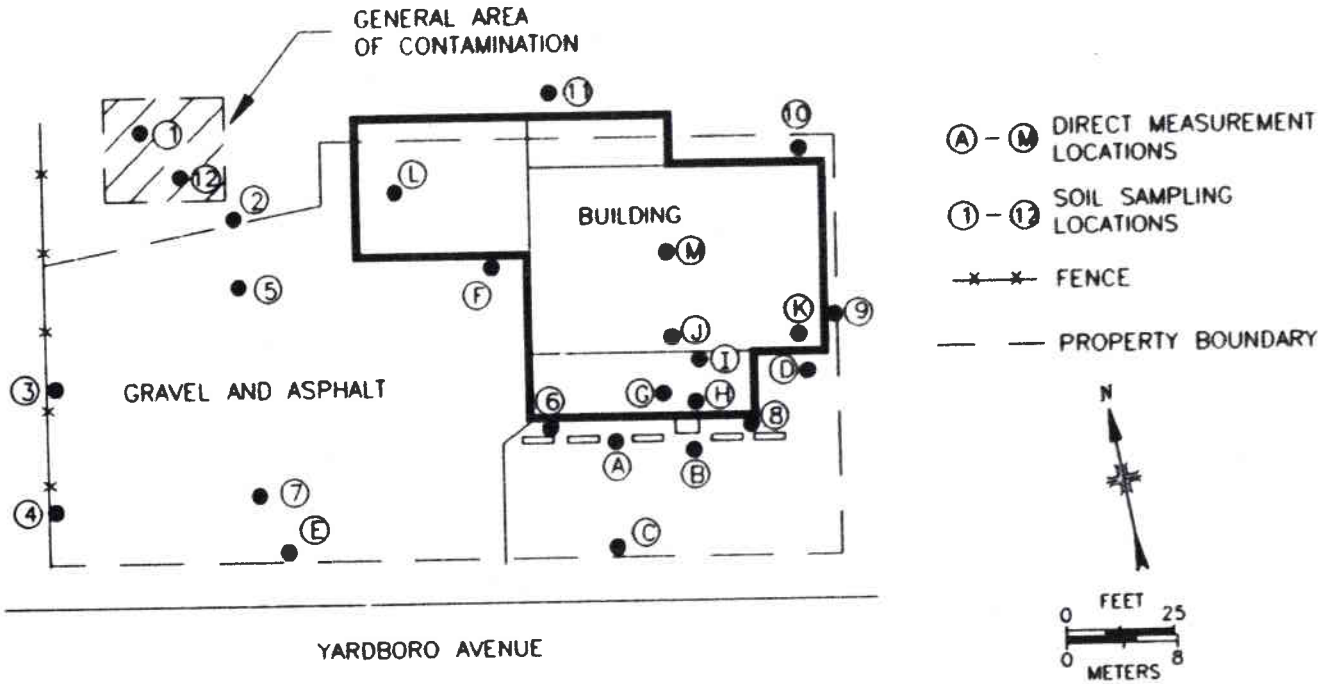

FIGURE 3: Plot Plan of Property at 50 Yardboro Avenue Indicating Locations of Independent Measurements and Sampling

TABLE 1

RESULTS OF CONFIRMATORY U-238 ANALYSES ON SOIL SAMPLES FROM 1985 COLONIE REMEDIAL ACTION PROPERTIES

Property and Sample[a]	U-238 Concentration (pCi/g)	
	BNI Analysis	ORAU Analysis
1100 Central Avenue		
1	13.3 ± 5.0	10.2 ± 2.4[b]
1118 Central Avenue		
1	20.0 ± 4.0	21.4 ± 3.3
1129 Central Avenue		
2	0.5 ± 1.0	0.97 ± 0.70
4	<1.2	0.51 ± 0.69
1147 Central Avenue		
4	3.1 ± 0.1	3.27 ± 0.62
1148 Central Avenue		
5	14.3 ± 1.5	12.9 ± 2.4
10	2.1 ± 0.3	3.06 ± 0.61
1150 Central Avenue		
2	2.8 ± 0.1	3.24 ± 0.58
1152 Central Avenue		
3	9.4 ± 2.6	9.33 ± 1.12
4	13.1 ± 4.5	10.8 ± 1.4
7	33.3 ± 8.0	29.7 ± 1.5
1160/1162 Central Avenue		
1	13.2 ± 5.0	11.1 ± 1.0
5	17.5 ± 6.6	14.9 ± 2.7
7	14.2 ± 0.3	15.3 ± 1.2
1161 Central Avenue		
8	5.5 ± 1.3	6.84 ± 0.92
1166 Central Avenue		
2	2.1 ± 0.1	1.88 ± 0.55
10	28.5 ± 8.3	24.7 ± 4.0
1167 Central Avenue		
1	2.6 ± 1.1	3.66 ± 0.66
5	3.0 ± 1.1	4.16 ± 0.68

TABLE 1 (Continued)

RESULTS OF CONFIRMATORY U-238 ANALYSES ON SOIL SAMPLES FROM 1985 COLONIE REMEDIAL ACTION PROPERTIES

Property and Sample[a]	U-238 Concentration (pCi/g)	
	BNI Analysis	ORAU Analysis
1168 Central Avenue		
12	2.3 ± 0.9	1.42 ± 0.77
1170 Central Avenue		
2	15.4 ± 1.5	19.7 ± 1.3
6	5.0 ± 0.7	4.75 ± 1.01
1185 Central Avenue		
1	1.0 ± 0.7	0.82 ± 0.56
1195 Central Avenue		
2	2.2 ± 0.7	2.78 ± 0.64
4	7.8 ± 0.1	8.28 ± 1.01
10 Garden Lane		
1	4.7 ± 0.3	6.25 ± 1.15
2	11.7 ± 0.4	13.8 ± 2.7
5 Yardboro Avenue		
2	2.5 ± 1.3	2.51 ± 0.56
3	2.0 ± 0.8	1.42 ± 0.42
24 Yardboro Avenue		
4	2.4 ± 0.2	2.74 ± 0.55
25/27 Yardboro Avenue		
3	5.7 ± 0.5	4.42 ± 0.65

[a]Sample identification as presented in the BNI post-remedial action report.[3]
[b]Uncertainties represent the 95% confidence levels, based only on counting statistics; additional laboratory uncertainties of ± 6 to 10% have not been propagated into these data.

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TABLE 2

URANIUM-238 CONCENTRATIONS IN SOIL SAMPLES
FROM REMEDIATED PROPERTIES
COLONIE, NEW YORK

Property and Location[a]	Sample Depth (cm)	U-238 Concentration (pCi/g)
1104 Central Avenue		
1A	0-5	0.17 ± 0.30[b]
1B	5-15	1.46 ± 0.66
2A	0-5	1.98 ± 0.53
2B	5-15	3.35 ± 0.85
3A	0-5	27.2 ± 1.9
3B	5-15	5.83 ± 1.73
50 Yardboro Avenue		
1A	0-15	1950 ± 20
1B	5-15	1060 ± 10
2A	0-5	19.6 ± 1.5
2B	5-15	8.31 ± 5.15
3A	0-5	11.3 ± 1.2
3B	5-15	18.8 ± 2.8
4A	0-5	3.10 ± 0.73
4B	5-15	3.00 ± 1.33
5A	0-5	4.84 ± 0.72
6A	0-5	6.78 ± 0.84
6B	5-15	2.91 ± 1.87
7A	0-5	2.96 ± 1.09
8A	0-5	2.29 ± 1.00
9A	5-15	6.02 ± 1.15
9B	0-5	0.56 ± 1.12
10A	5-15	1.87 ± 0.71
10B	0-5	2.42 ± 0.60
11A	5-15	3.05 ± 0.71
11B	0-5	4.30 ± 0.70
12A	5-15	7.20 ± 2.33
12B	0-5	25.4 ± 1.9

[a]Refer to Figures 2 and 3.
[b]Uncertainties represent the 95% confidence levels, based only on counting statistics; additional laboratory uncertainties of ± 6 to 10% have not been propagated into these data.

TABLE 3

RESULTS OF DIRECT MEASUREMENTS AT 50 YARDBORO AVENUE
COLONIE, NEW YORK

Property and Location[a]	Beta-Gamma Levels	
	dpm/100 cm^2	mrad/h
50 Yardboro Avenue		
A	4350	0.08
B	1760	0.03
C	1350	0.02
D	2990	0.05
E	861	0.02
F	820	0.01
G[b]	16800	0.29
H[b]	15100	0.26
I[b]	18600	0.32
J[b]	16480	0.29
K[b]	56700	0.99
L[b]	15300	0.27
M[b]	15700	0.27

[a]Refer to Figure 3.
[b]Measurement taken on roof.

REFERENCES

1. Teledyne Isotopes, A Survey of Uranium in Soil Surrounding the NL Bearings Plant, IWL-9488-461, October 31, 1980.

2. Department of Energy, Remedial Action Work Plan for the Colonie Site, ORO-847, Revision 1, Oak Ridge, TN, August 1985.

3. Bechtel National, Inc., Post-Remedial Action Report for the Colonie Interim Storage Site Vicinity Properties - 1985 (DOE/OR/20722-92), Oak Ridge, TN, 1988.

4. Oak Ridge Associated Universities, Verification of 1985 Remedial Action Vicinity Properties, Colonie Interim Storage Site, Colonie, New York, Oak Ridge, TN, November, 1986.

5. Bechtel National, Inc., Hazard Assessment for Radiological Contamination on the Roof of the Commercial Building at 1104 Central Avenue in Colonie, New York, Oak Ridge, TN, April 1989.

6. Bechtel National, Inc., Hazard Assessment for Radiological Contamination on the Roof of the Commercial Building at 50 Yardboro Avenue in Colonie, New York, Oak Ridge, TN, April 1989.

7. Letter from J.D. Berger (ORAU) to J.J. Fiore (DOE/NE), "Verification of Remedial Action at 1104 Central Avenue and 50 Yardboro Avenue: Colonie Interim Storage Site," Oak Ridge, TN, May 30, 1989.

8. Oak Ridge National Laboratory, Results of the Radiological Survey at 1104 Central Avenue, Colonie, New York (AL042), Oak Ridge, TN, July 1985.

9. Oak Ridge National Laboratory, Results of the Radiological Survey at 50 Yardboro Avenue, Albany, New York (AL013), Oak Ridge, TN, June 1985.

10. Minitab Statistical Project, Statistics Department, The Pennsylvania State University, University Park, PA.

11. Letter from J.J. Fiore (DOE/NE) to B. Walker (DOE/OR/TSD), "Approval of Supplemental Limits for Roof of the Commercial Building at 1104 Central Avenue, Colonie, New York (Colonie Vicinity Property AL042)," May 15, 1989.

12. Letter from J.J. Fiore (DOE/NE) to B. Walker (DOE/OR/TSD), "Approval of Supplemental Limits for Roof of the Commercial Building at 50 Yardboro Avenue, Colonie, New York (Colonie Vicinity Property AL013)," May 17, 1989.

APPENDIX A

CRITERIA APPLICABLE TO THE COLONIE SITE

Site specific criteria for Colonie properties were developed by DOE with input by New York state and EPA officials. These criteria are:

1. Soil

   a. Levels of depleted uranium (U-238) exceeding thirty-five pCi/g averaged over a 5 cm (2 in) depth and a 100 m^2 (1,076 ft^2) area will be removed.

   b. One hundred pCi/g of depleted uranium (approximately three times criteria) averaged over a 5 cm (2 in) depth and 1 m^2 (10.8 ft^2) will be removed.

2. Structures and paved surfaces

   a. Surface contamination of 5,000 dpm/100 cm^2 averaged over an area not exceeding 1 m^2 (10.8 ft^2), with a maximum of 15,000 dpm/100 cm^2 in areas of not more than 100 cm^2 (15.5 in^2).

   b. Removable contamination of 1,000 dpm/100 cm^2.

   c. Average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h at 1 cm (0.4 in) and 1.0 mrad/h at 1 cm respectively, measured through not more than 7 mg/cm^2 of total absorber.*

*Assessments of residual contamination on roofing of the buildings demonstrated that potential doses to the public from levels above these values would remain well below the established DOE limits. Based on these assessments, no further remedial action of the roof surfaces was required.

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APPENDIX B

MAJOR SAMPLING AND ANALYTICAL EQUIPMENT

APPENDIX B

MAJOR SAMPLING AND ANALYTICAL EQUIPMENT

The display or description of a specific product is not to be construed as an endorsement of that product or its manufacturer by the authors or their employer.

A. Direct Radiation Measurements

Eberline RASCAL
Portable Scaler/Ratemeter
Model PRS-1
(Eberline, Sante Fe, NM)

Eberline PRM-6
Portable Ratemeter
(Eberline, Sante Fe, NM)

Eberline Beta-Gamma Pancake Probe
Model HP-260
(Eberline, Sante Fe, NM)

Victoreen NaI Scintillation Detector
Model 489-55
(Victoreen, Cleveland, OH)

B. Laboratory Analyses

Ge(Li) Detector
Model LGCC2220SD, 23% efficiency
(Princeton Gamma-Tech, Princeton, NJ)

Used in conjunction with:
Lead Shield, SPG-16
(Applied Physical Technology, Smyrna, GA)

High-Purity Germanium Detector
Model GMX-23195-S, 23% efficiency
(EG&G ORTEC, Oak Ridge, TN)

Used in conjunction with:
Lead Shield, G-16
(Gamma Products, Inc., Palos Hills, IL)

Multichannel Analyzer
ND-66/ND-680 System
(Nuclear Data, Inc., Schaumburg, IL)

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APPENDIX C

MEASUREMENT AND ANALYTICAL PROCEDURES

APPENDIX C

MEASUREMENT AND ANALYTICAL PROCEDURES

Gamma Surface Scans

Walkover surface scans were performed at 1 meter intervals, using Eberline Model PRM-6 portable ratemeters with Victoreen Model 489-55 gamma scintillation probes, containing 3.2 cm (1.25 in) x 3.8 cm (1.50 in) NaI(Tl) scintillation crystals. Relative count rates were monitored using earphones and increased rates above the ambient background levels were noted.

Beta-Gamma Dose Rate Measurements

Measurements of direct beta-gamma radiation levels were performed using Eberline PRS-1 portable scaler/ratemeters with Model HP-260 thin-window pancake GM probes. Count rates (cpm) were converted to disintegration rates (dpm/100 cm^2) by dividing the net rate by the 4π efficiency and correcting for the active areas of the detectors. The effective window area is 15 cm^2 (2.3 in^2) for the GM detectors. The average background count rate was 40 cpm for the GM probes. Dose rates were calculated by applying the conversion factor of 1,400 cpm/mrad/h to the net count rate.

Soil Sample Analysis

Soil samples were dried, mixed, and a portion sealed in 0.5-liter (0.53 qt) Marinelli beaker. The quantity placed in each beaker was chosen to reproduce the calibrated counting geometry and ranged from 600 to 900 g (1.3 to 2.0 lb) of soil. Net soil weights were determined and the samples counted using a high-purity intrinsic germanium detector coupled to a Nuclear Data Model ND-680 pulse height analyzer system. Background and Compton stripping, peak search, peak identification, and concentration calculations were performed using the computer capabilities inherent in the analyzer system. Energy peaks used for determination of U-238 were - 0.094 MeV from Th-234 and 1.001 MeV from Pa-234 m.

Spectra were also reviewed for the presence of other photopeaks.

Uncertainties and Detection Limits

The uncertainties associated with the analytical data presented in the tables of this report, represent the 95% confidence levels for that data. These uncertainties were calculated based on both the gross sample count levels and the associated background count levels. When the net sample count was less than the 95% statistical deviation of the background count, the sample concentration was reported as less than the detection limit of the procedure. Because of variations in background levels, sample weights or volumes, and Compton contributions from other radionuclides in samples, the detection limits differ from sample to sample and instrument to instrument. Additional uncertainties of ± 6 to 10%, associated with sampling and laboratory procedures, have not been propagated into the data presented in this report.

Calibration and Quality Assurance

Laboratory and field survey procedures are documented in manuals developed specifically for the Oak Ridge Associated Universities' Environmental Survey and Site Assessment Program.

With the exception of the measurements conducted with portable gamma scintillation survey meters, instruments were calibrated with NBS-traceable standards. The calibration procedures for the portable gamma instruments are performed by comparison with an NBS calibrated pressurized ionization chamber.

Quality control procedures on all instruments included daily background and check-source measurements to confirm equipment operation within acceptable statistical fluctuations. The ORAU laboratory participates in the EPA and DOE/EML Quality Assurance Programs.

Contract No. W-7405-eng-26

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 78 YARDBORO AVENUE, ALBANY, NEW YORK (AL001)

March 1984

Work performed as part of the
RADIOLOGICAL SURVEY ACTIVITIES PROGRAM

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831
operated by
UNION CARBIDE CORPORATION
for the
U.S. DEPARTMENT OF ENERGY

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RESULTS OF THE RADIOLOGICAL SURVEY AT 78 YARDBORO AVENUE, ALBANY, NEW YORK (AL001)*

INTRODUCTION

In 1958, work with depleted uranium began at the National Lead Company's plant in Colonie, New York.[1] Beginning in 1961, the Atomic Energy Commission (AEC), its present successor, the Department of Energy (DOE), and other federal agencies have engaged in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contract, the work at the plant has been devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity since February 1980.

A number of properties in the Colonie/Albany area have been identified as being potentially contaminated with uranium originating from the National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 12 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period October 20-27, 1983. The property at 78 Yardboro Avenue in Albany, New York (AL001) was the subject of a radiological investigation on October 20, 1983.

This private property consisted of a two-story house with aluminum siding, surrounded mostly by concrete paving. In addition to the house, a small storage shed is located in the northeast corner of this lot. A diagram of the property showing the approximate property boundaries and grid network established for measurements outside the onsite structures is shown in Fig. 1. The rectangularly shaped lot included in the radiological survey was approximately 27.4 m deep by 14.3 m wide. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

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*This 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 W-7405-eng-26.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Reference 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha activity measurements on the house and shed roofs. A comprehensive description of the survey methods and instrumentation have been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. This data is 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 substracted from radionuclide concentrations in soil samples.

Gamma Measurements

Results of grid point/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 8 to 15 μR/h and averaged 10 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 8 to 16 μR/h and averaged 11 μR/h. For comparison, typical background radiation levels at 1 m above ground surface in the Albany area range from 8 to 10 μR/h and average 9 μR/h.

As can be observed in Fig. 4, the highest radiation level was measured on the driveway and is presumed to be due to its granite block composition. The maximum exposure rate observed during scanning the ground surface was 24 μR/h (grid block 0+08, 8R). Elevated radiation levels measured in areas

other than the driveway appeared to be associated with soil lodged in cracks in the concrete pavement, particularly those which correspond to the drip lines of the house roof.

Soil Sampling

Nine soil samples were taken on this property. Eight of these soil samples were taken at four locations that were chosen irrespective of gamma radiation levels (denoted systematic soil samples — AL1S); and one soil sample was taken at a location biased with respect to elevated gamma radiation measurements (denoted biased soil sample — AL1B). The sample locations are shown in Fig. 5, and the results of radionuclide analyses are given in Table 3. A concentration of ^{238}U is provided for each soil sample. Concentrations of ^{226}Ra were measured in soil samples to confirm that ^{226}Ra concentrations were within typical background levels.

Concentrations of ^{238}U in systematic soil samples ranged from 1.7 to 41 pCi/g. At each location, samples were taken from 0 to 5 cm in depth and 5 to 15 cm in depth. Concentrations of ^{238}U were approximately five to nineteen times higher in soil samples collected in the top 5 cm. The maximum concentration of ^{238}U in a systematic soil sample (41 pCi/g) was measured in a sample taken from a depth of 0-5 cm (AL1S2A). In the soil sample taken below sample AL1S2A (AL1S2B), from 5-15 cm, the ^{238}U concentration dropped to 2.4 pCi/g.

The highest concentration of ^{238}U in soil, 410 pCi/g, was measured in biased sample AL1B1. This sample was collected from the top of the pavement near the west side of the house.

It is evident from the results of the soil sample analyses that ^{238}U concentrations in the top few centimeters of soil are substantially elevated above the average background level (0.96 pCi/g). These elevated ^{238}U concentrations quickly decrease with increasing depth in soil. The highest concentrations of ^{238}U are observed in soil taken from areas where the concrete pavement has cracked or crumbled.

Alpha Measurements

Direct alpha activity measurements were taken on selected areas of the roofs on the house and shed. The activities ranged from 70 to 200 dpm/100 cm^2 and averaged 110 dpm/100 cm^2. These levels are all above the typical background level for roofs of that type (30 dpm/100 cm^2).

SIGNIFICANCE OF FINDINGS

A summary of the outdoor measurement results of the radiological survey conducted on this property is provided in Table 4. These results establish that elevated concentrations of ^{238}U are present on the property. Gamma exposure rates were generally slightly elevated throughout the lot, particularly on the granite stone driveway and in areas of deteriorated pavement which correspond to the drip lines of the house roof. Concentrations of ^{238}U in all surface soil samples (0-5 cm) exceeded the average background level. Direct alpha activity measurements taken on the house and shed roofs were all above typical background and indicated the presence of ^{238}U surface contamination.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).
2. *A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program*, DOE/EV-0097A (September 1980).
3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).
4. H. W. Jeter and D. M. Eagleson, *A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes*, IWL-9488-461 (October 31, 1980).
5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).
6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, *Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program*, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).
7. T. E. Myrick, B. A. Berven, and F. F. Haywood, *State Background Radiation Levels: Results of Measurements Taken During 1975-1979*, ORNL/TM-7343 (November 1981).

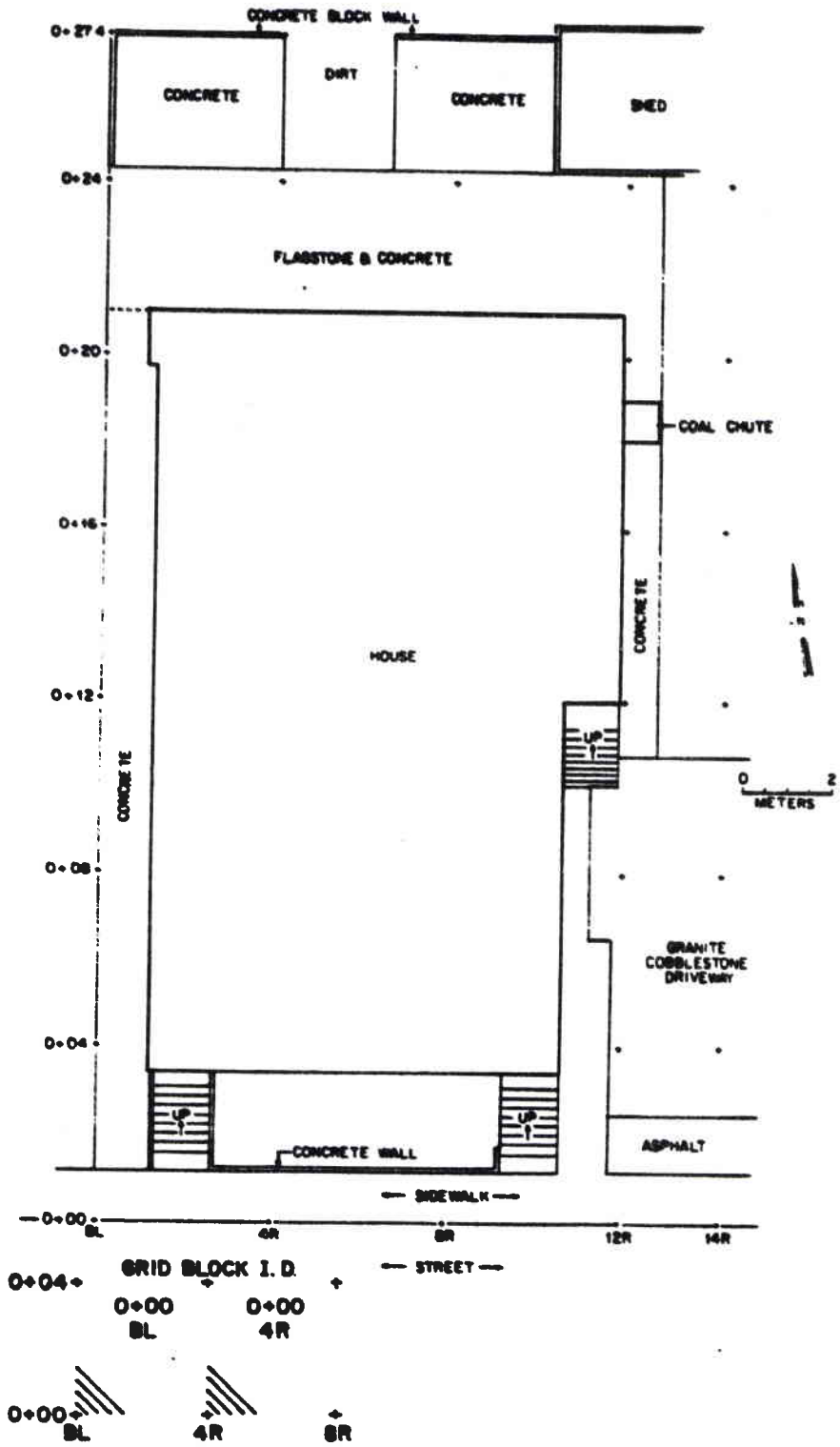

Fig. 1. Diagram showing grid point and grid block locations outdoors on property at 78 Yardboro Avenue, Albany, New York (AL001).

Fig. 2. Front view of property at 78 Yardboro Avenue, Albany, New York (AL001) looking north.

Fig. 3. Rear view of property at 78 Yardboro Avenue, Albany, New York (AL001) looking south.

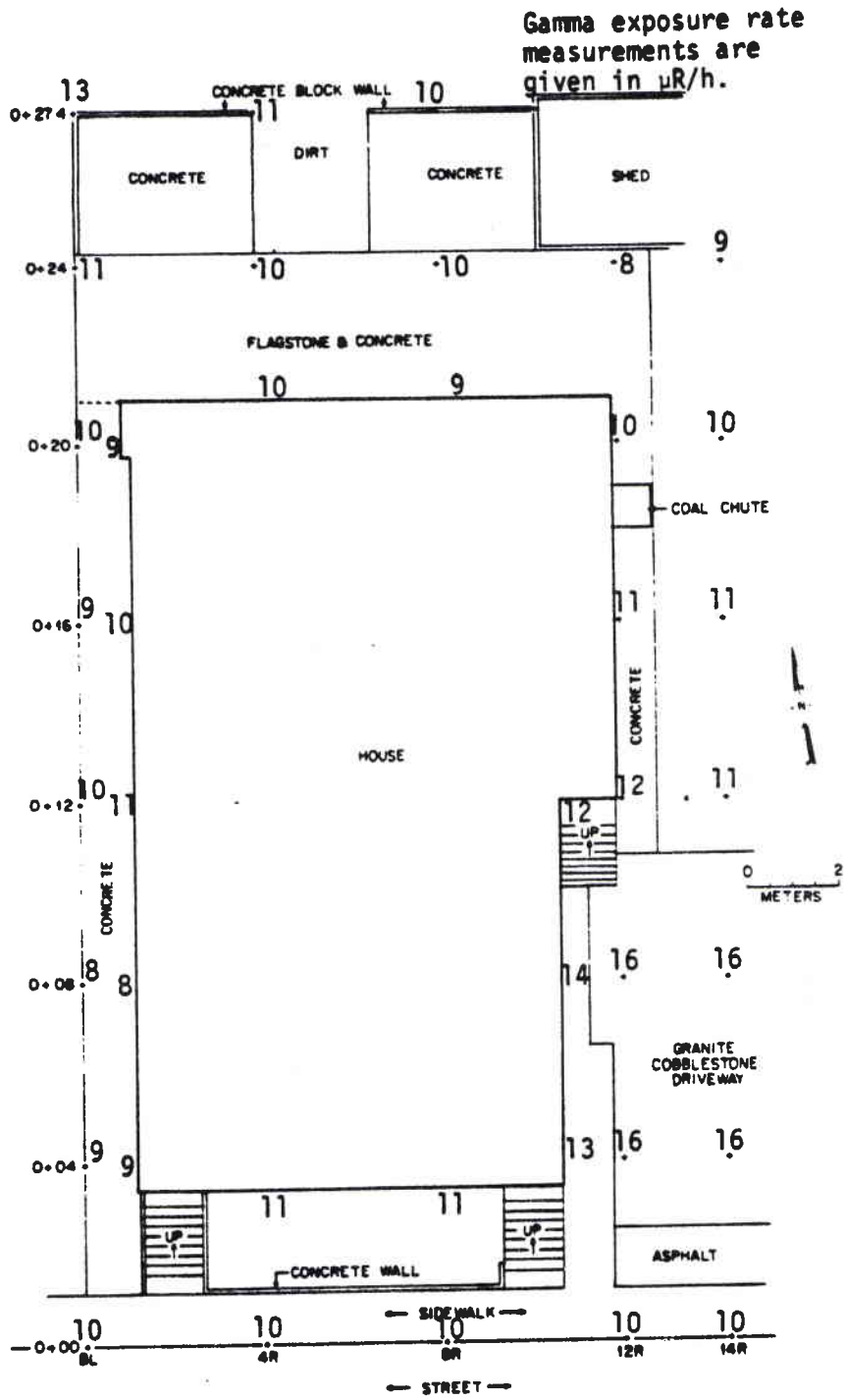

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on property at 78 Yardboro Avenue, Albany, New York (AL001).

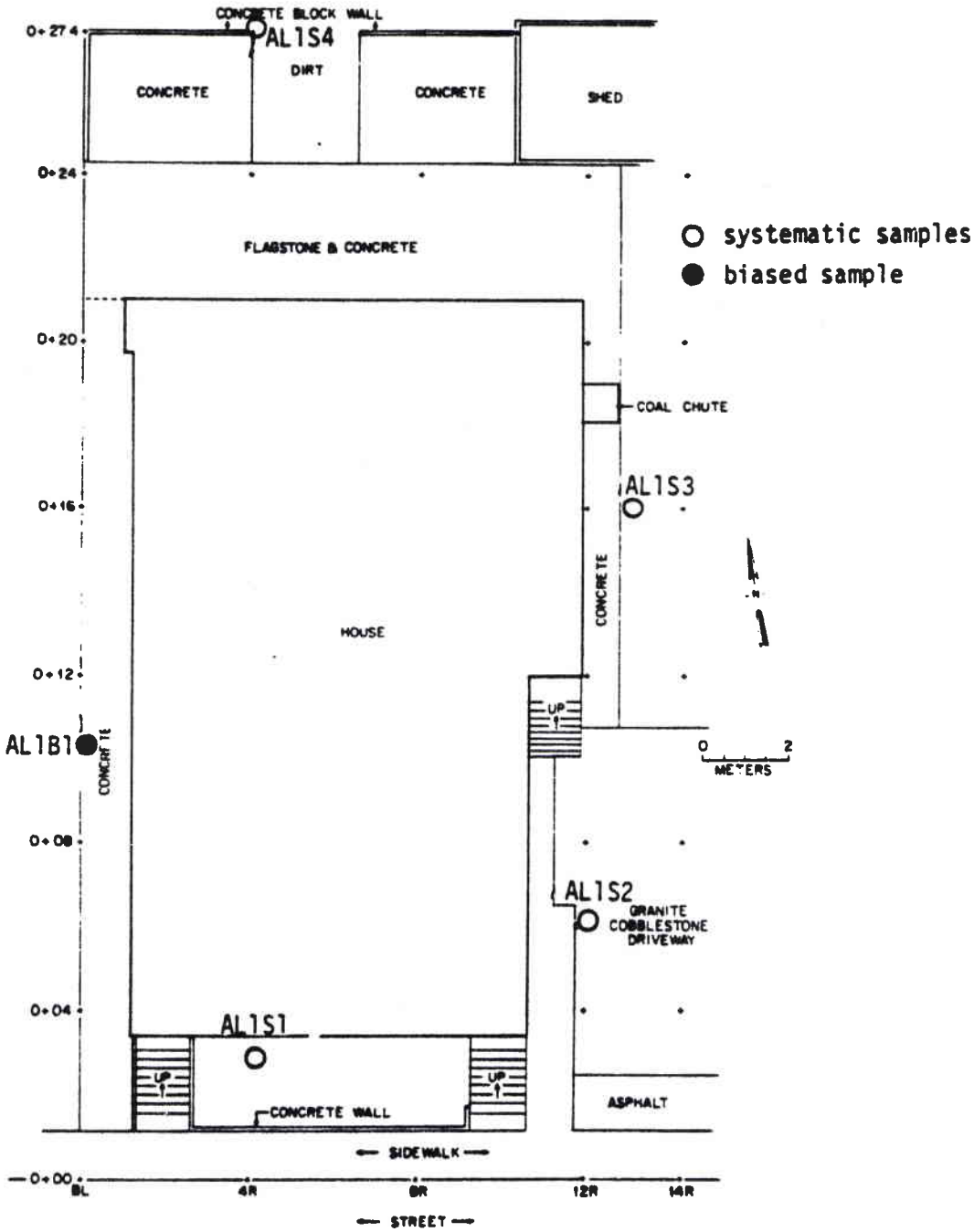

Fig. 5. Location of soil samples on property at 78 Yardboro Avenue, Albany, New York (AL001).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.

[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Outdoor measurement results on property at 78 Yardboro Avenue, Albany, New York (AL001)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rates during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	9	10	9-13
0+04, BL	10	9	8-10
0+08, BL	8	8	8-15
0+12, BL	9	10	10-12
0+16, BL	9	9	9-12
0+20, BL	10	10	9-10
0+24, BL	11	11	9-13
0+27.4, BL	12	13	—
0+20, 1.0R	9	9	—
0+04, 1.2R	9	9	—
0+08, 1.2R	9	8	—
0+12, 1.2R	11	11	—
0+16, 1.2R	9	10	—
0+00, 4R	10	10	10-12
0+03.3, 4R	11	11	—
0+04, 4R	e	e	—
0+08, 4R	e	e	—
0+12, 4R	e	e	—
0+16, 4R	e	e	—
0+20, 4R	e	e	10-12
0+21, 4R	8	10	—
0+24, 4R	10	10	10-13
0+27.4, 4R	11	11	—
0+00, 8R	10	10	10-17
0+03.3, 8R	11	11	—
0+04, 8R	e	e	11-19
0+08, 8R	e	e	12-24
0+12, 8R	e	e	11-13
0+16, 8R	e	e	10-12
0+21, 8R	9	9	—
0+24, 8R	10	10	10-17
0+27.4, 8R	9	10	—
0+04, 10.6R	13	13	—
0+08, 10.6R	14	14	—
0+12, 10.6R	12	12	—
0+16, 11.7R	9	11	—
0+20, 11.7R	9	10	—

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rates during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, 12R	10	10	10-17
0+04, 12R	14	16	11-19
0+08, 12R	15	16	14-17
0+12, 12R	12	12	12-14
0+16, 12R	10	11	10-12
0+20, 12R	8	10	8-10
0+24, 12R	8	8	8-9
0+27.4, 12R	e	e	—
0+00, 14.3R	10	10	—
0+04, 14.3R	14	16	—
0+08, 14.3R	14	16	—
0+12, 14.3R	10	11	—
0+16, 14.3R	10	11	—
0+20, 14.3R	9	10	—
0+24, 14.3R	8	9	—

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analyses on property at 78 Yardboro Avenue, Albany, New York (AL001)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{238}U[b]	^{226}Ra[c]
		Systematic Samples[d]		
AL1S1A	0+03, 4R	0-5	33	0.59 ± 0.07
AL1S1B	0+03, 4R	5-15	1.7	0.55 ± 0.07
AL1S2A	0+06, 12R	0-5	41	0.83 ± 0.2
AL1S2B	0+06, 12R	5-15	2.4	0.62 ± 0.1
AL1S3A	0+16, 12.8R	0-5	12	0.94 ± 0.2
AL1S3B	0+16, 12.8R	5-15	2.6	0.58 ± 0.08
AL1S4A	0+27.4, 4R	0-5	9.8	0.89 ± 0.2
AL1S4B	0+27.4, 4R	5-15	2.1	0.88 ± 0.09
		Biased Sample[e]		
AL1B1	0+10.5, 1R	0-5	410	0.70 ± 0.2

[a]Location indicated in Fig. 5.

[b]Total analytical error of results is less than ±3% (95% confidence level).

[c]Indicated counting error is at 95% confidence level (±2σ).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Summary of outdoor measurements and sample results on property at 78 Yardboro Avenue, Albany, New York (AL001)

Measurement or sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	42	8-15	10
Gamma exposure rate at surface (μR/h)[a]	42	8-16	11
Scan, gamma exposure rate near surface (μR/h)[b]	—	8-24	—
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	8	1.7-41	13
Concentration of ^{238}U in surface soil (pCi/g), biased locations[d]	1	—	410
Direct alpha activity on surface (dpm/100 cm^2), selected roof locations	8	70-200	110

[a]At grid points.

[b]Scan of entire property.

[c]Systematic samples, Table 3.

[d]Biased sample, Table 3.

Contract No. W-7405-eng-26

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 80 YARDBORO AVENUE, ALBANY, NEW YORK (AL002)

March 1984

Work performed as part of the
RADIOLOGICAL SURVEY ACTIVITIES PROGRAM

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831
operated by
UNION CARBIDE CORPORATION
for the
U.S. DEPARTMENT OF ENERGY

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RESULTS OF THE RADIOLOGICAL SURVEY AT 80 YARDBORO AVENUE, ALBANY, NEW YORK (AL002)*

INTRODUCTION

In 1958, work with depleted uranium began at the National Lead Company's plant in Colonie, New York.[1] Beginning in 1961, the Atomic Energy Commission (AEC), its present successor, the Department of Energy (DOE), and other federal agencies have engaged in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contract, the work at the plant has been devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity since February 1980.

A number of properties in the Colonie/Albany area have been identified as being potentially contaminated with uranium originating from the National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 12 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period October 20-27, 1983. The property at 80 Yardboro Avenue in Albany, New York (AL002) was the subject of a radiological investigation on October 20, 1983.

This private property consisted of a house surrounded by pavement and lawn areas. A diagram of the property showing the approximate property boundaries and grid network established for measurements outside the house is shown in Fig. 1. The rectangularly shaped lot included in the radiological survey was approximately 27.4 m deep by 14.3 m wide. The house was the only onsite structure. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

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*This 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 W-7405-eng-26.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Reference 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha activity measurements on the building roof. A comprehensive description of the survey methods and instrumentation have been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. This data is 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 substracted from radionuclide concentrations in soil samples.

Gamma Measurements

Results of grid point/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 8 to 15 μR/h and averaged 11 μR/h. Gamma exposure rates at the ground surface at grid points also ranged from 8 to 15 μR/h and averaged 12 μR/h. For comparison, typical background radiation levels at 1 m above ground surface in the Albany area range from 8 to 10 μR/h and average 9 μR/h.

As can be observed in Fig. 4, the highest radiation levels were measured in those areas on the east and west sides of the house. The maximum exposure rate observed during scanning the ground surface was 39 μR/h (grid block

0+16, 10L). The elevated radiation levels measured in areas adjacent to the house appeared to be associated with the drip lines from the roof of the structure.

Soil Sampling

Twenty soil samples were taken on this property. Twelve of these soil samples were taken at six locations that were chosen irrespective of gamma radiation levels (denoted systematic soil samples — AL2S); and eight soil samples were taken at three locations biased with respect to elevated gamma radiation measurements (denoted biased soil sample — AL2B). The sample locations are shown in Fig. 5, and the results of radionuclide analyses are given in Table 3. A concentration of ^{238}U is provided for each soil sample. Concentrations of ^{226}Ra were also measured in soil samples to confirm that ^{226}Ra concentrations were within typical background levels.

Concentrations of ^{238}U in systematic soil samples ranged from 2.7 to 110 pCi/g. At each location, samples were taken from 0 to 5 cm in depth and 5 to 15 cm in depth. Concentrations of ^{238}U were approximately five to sixteen times higher in soil samples collected in the top 5 cm. The maximum concentration of ^{238}U in systematic soil samples (110 pCi/g) was measured in two samples taken from a depth of 0-5 cm (AL2S2A and AL2S6A). The ^{238}U concentrations in soil samples taken below those samples dropped to an average of 12 pCi/g.

The three highest concentrations of ^{238}U in soil, ranging from 210 to 670 pCi/g, were measured in biased samples AL2B1A, AL2B2A, and AL2B3A. These samples were collected along the drip lines of the house roof in the upper 5 cm of soil or from concrete pavement surface. The ^{238}U concentrations in samples taken beneath two of those samples, at 5 to 15 cm in depth, averaged 16 pCi/g.

It is evident from the results of the soil sample analyses that ^{238}U concentrations in the top few centimeters of soil are substantially elevated above the average background level (0.96 pCi/g). These elevated ^{238}U concentrations quickly decrease with increasing depth in soil. The highest concentrations of ^{238}U are observed along the drip lines of the house roof.

Alpha Measurements

Direct alpha activity measurements were taken on selected areas of the roof on the house. The activities ranged from 36 to 98 dpm/100 cm^2 and averaged 72 dpm/100 cm^2. These levels are all above the typical background level for roofs of that type (30 dpm/100 cm^2).

SIGNIFICANCE OF FINDINGS

A summary of the outdoor measurement results of the radiological survey conducted on this property is provided in Table 4. These results establish that elevated concentrations of ^{238}U are present on the property. Gamma exposure rates were notably elevated only in areas adjacent to the east and west sides of the house which correspond to the drip lines from the roof. Concentrations of ^{238}U in all surface soil samples (0-5 cm) substantially exceeded the average background level. Direct alpha activity measurements taken on the roof were all above typical background and indicated the presence of ^{238}U surface contamination.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).
2. *A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program*, DOE/EV-0097A (September 1980).
3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).
4. H. W. Jeter and D. M. Eagleson, *A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes*, IWL-9488-461 (October 31, 1980).
5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).
6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, *Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program*, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).
7. T. E. Myrick, B. A. Berven, and F. F. Haywood, *State Background Radiation Levels: Results of Measurements Taken During 1975-1979*, ORNL/TM-7343 (November 1981).

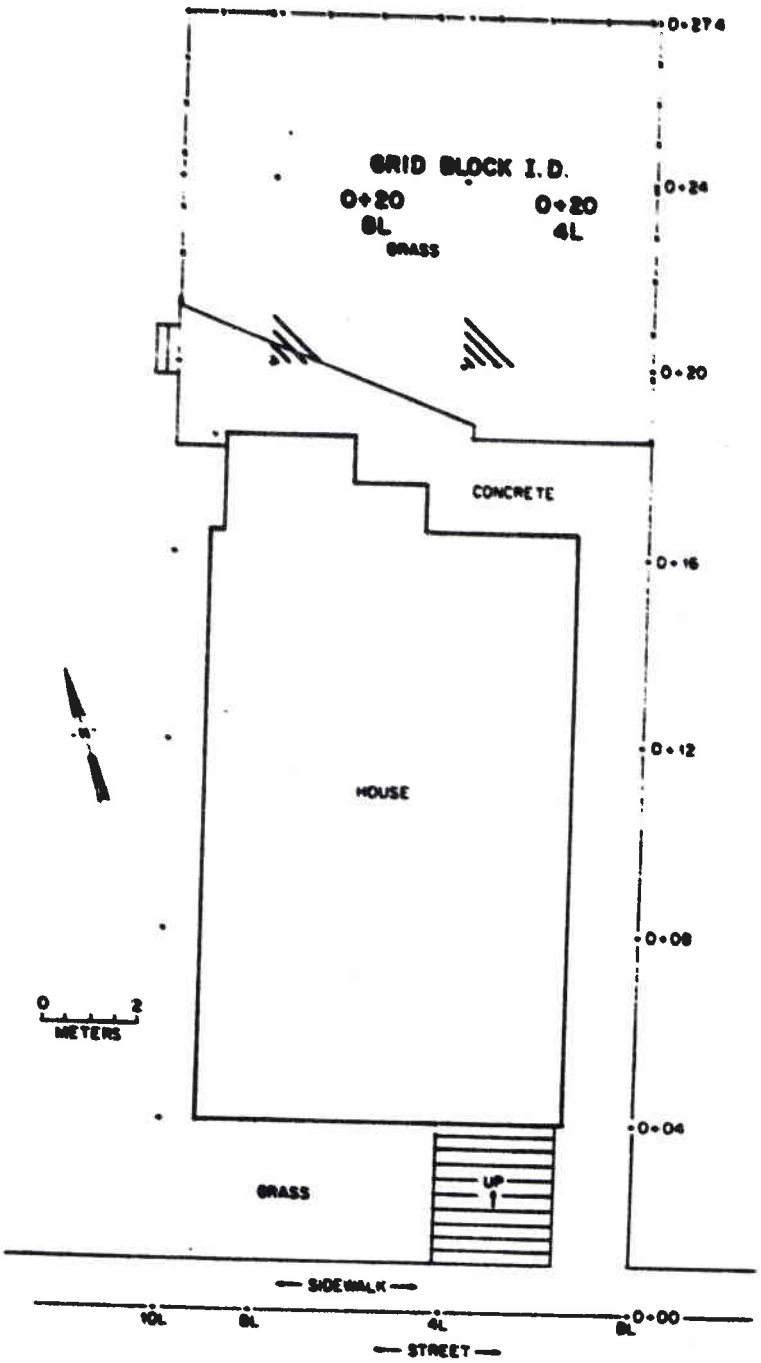

Fig. 1. Diagram showing grid point and grid block locations outdoors on property at 80 Yardboro Avenue, Albany, New York (AL002).

Fig. 2. Front view of property at 80 Yardboro Avenue, Albany, New York (AL002) looking north.

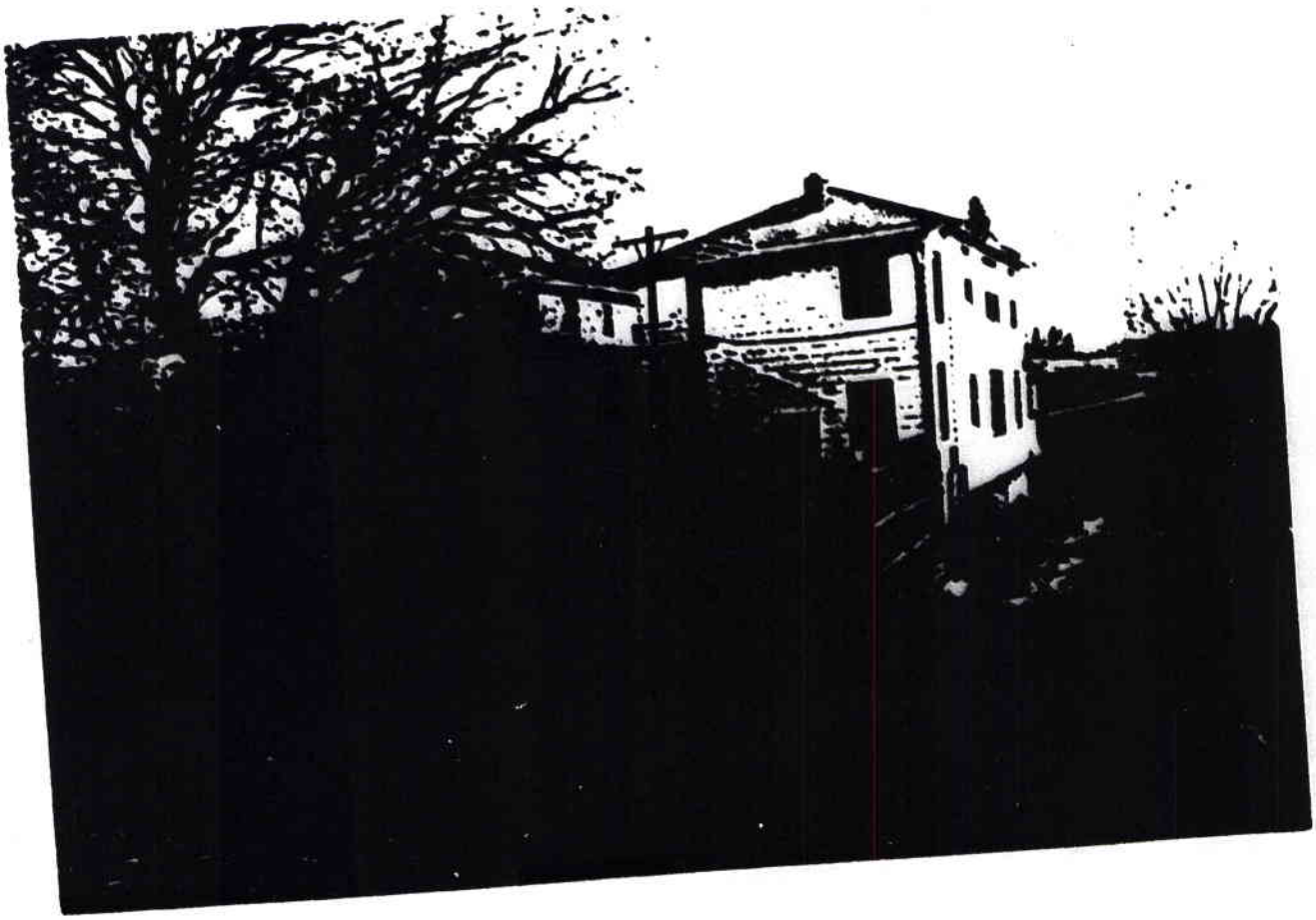

Fig. 3. Rear view of property at 80 Yardboro Avenue, Albany, New York (AL002) looking southeast.

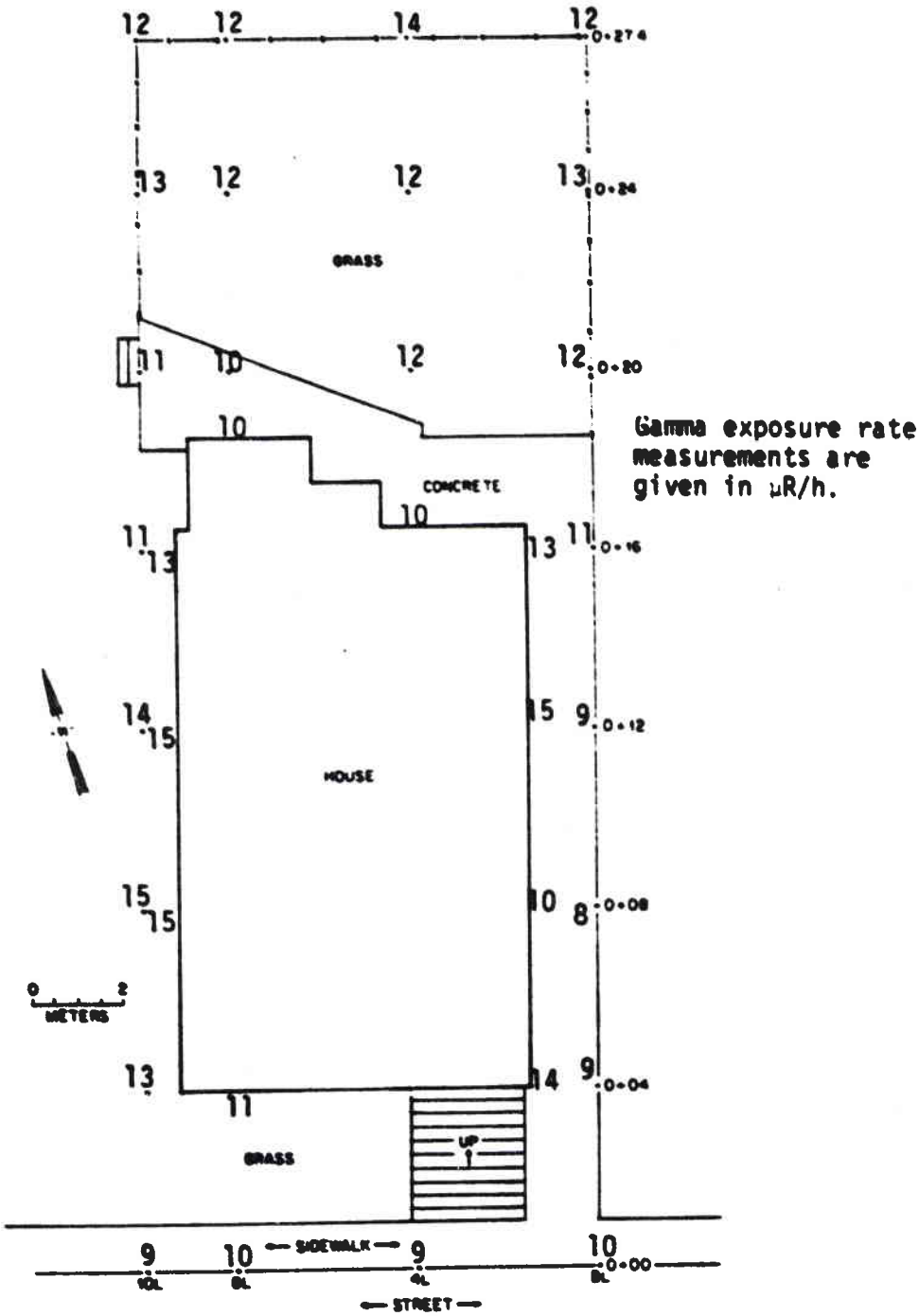

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on property at 80 Yardboro Avenue, Albany, New York (AL002).

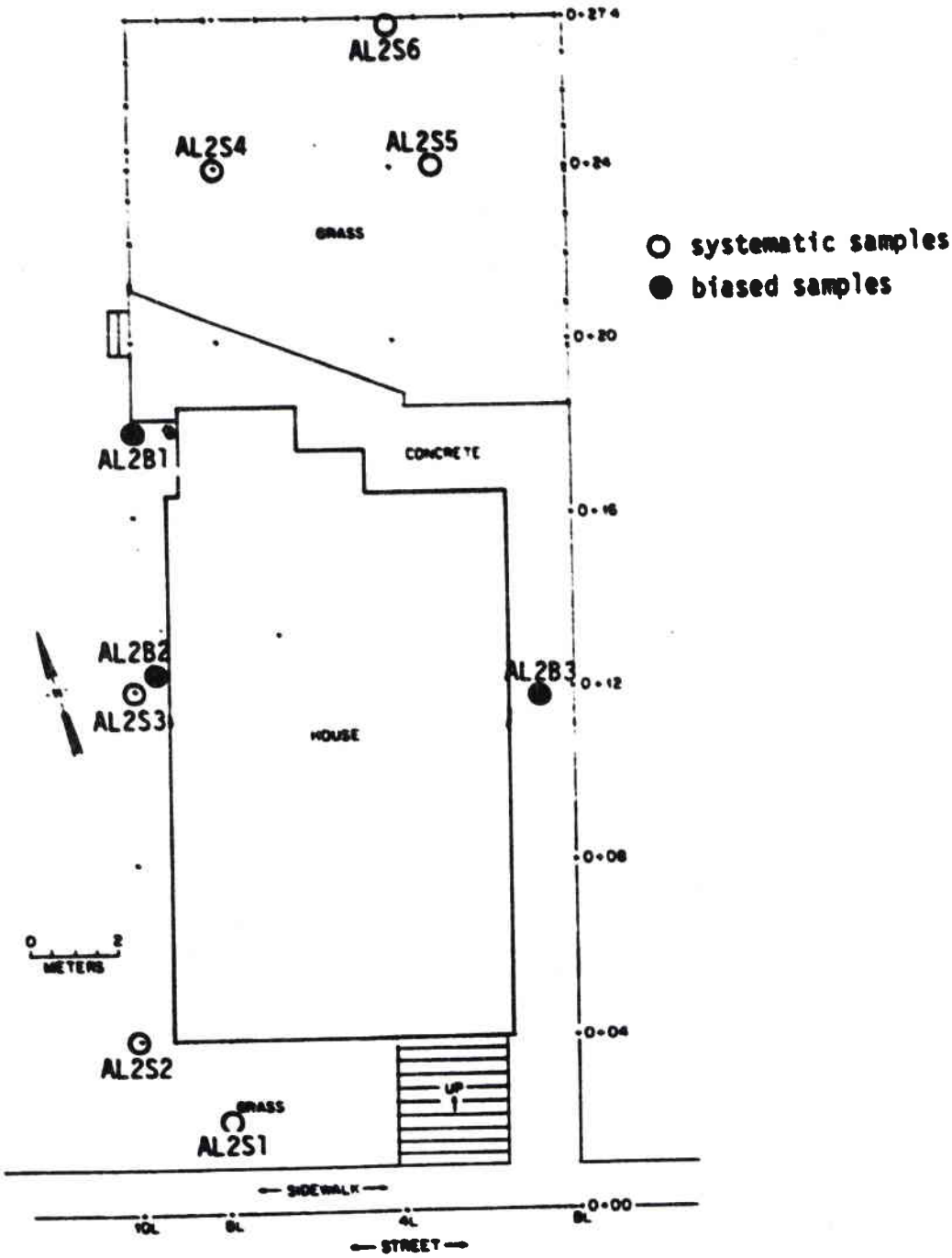

Fig. 5. Location of soil samples on property at 80 Yardboro Avenue, Albany, New York (AL002).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.

[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Outdoor measurement results on property at 80 Yardboro Avenue, Albany, New York (AL002)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rates during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	9	10	–
0+04, BL	10	9	–
0+08, BL	8	8	–
0+12, BL	9	9	–
0+16, BL	10	11	–
0+20, BL	11	12	–
0+24, BL	10	13	–
0+27.4, BL	12	12	–
0+08, 1.5L	10	10	–
0+12, 1.5L	9	15	–
0+16, 1.5L	9	13	–
0+04, 1.7L	15	14	–
0+00, 4L	9	9	6-15
0+04, 4L	e	e	9-11
0+08, 4L	e	e	9-17
0+12, 4L	e	e	10-13
0+16, 4L	e	e	10-14
0+16.7, 4L	10	10	–
0+20, 4L	12	12	11-14
0+24, 4L	12	12	11-15
0+27.4, 4L	13	14	–
0+00, 8L	10	10	10-13
0+04, 8L	11	11	10-16
0+04.4, 8L	11	11	–
0+08, 8L	e	e	–
0+12, 8L	e	e	–
0+16, 8L	e	e	10-12
0+18.5, 8L	10	10	–
0+20, 8L	10	10	10-12
0+24, 8L	12	12	12-15
0+27.4, 8L	12	12	–
0+08, 9.1L	13	15	–
0+12, 9.1L	14	15	–
0+16, 9.1L	12	13	–

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rates during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, 10L	9	9	9-12
0+04, 10L	12	13	13-17
0+08, 10L	13	15	15-27
0+12, 10L	14	14	14-29
0+16, 10L	11	11	11-39
0+20, 10L	11	11	11-13
0+24, 10L	12	13	12-13
0+27.4, 10L	12	12	—

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analyses on property at 80 Yardboro Avenue, Albany, New York (AL002)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{238}U[b]	^{226}Ra[c]
		Systematic Samples[d]		
AL2S1A	0+02, 8L	0-5	43	0.66 ± 0.2
AL2S1B	0+02, 8L	5-15	2.7	0.76 ± 0.2
AL2S2A	0+04, 10L	0-5	110	0.69 ± 0.2
AL2S2B	0+04, 10L	5-15	16	1.1 ± 0.2
AL2S3A	0+12, 10L	0-5	71	<0.19
AL2S3B	0+12, 10L	5-15	8.4	0.99 ± 0.1
AL2S4A	0+24, 8L	0-5	88	0.62 ± 0.06
AL2S4B	0+24, 8L	5-15	5.6	0.57 ± 0.06
AL2S5A	0+24, 3L	0-5	62	<0.21
AL2S5B	0+24, 3L	5-15	13	0.53 ± 0.1
AL2S6A	0+27, 4L	0-5	110	0.60 ± 0.4
AL2S6B	0+27, 4L	5-15	7.2	0.59 ± 0.05
		Biased Samples[e]		
AL2B1A	0+18, 10L	0-5	510	0.67 ± 0.4
AL2B1B	0+18, 10L	5-15	200	0.99 ± 0.1
AL2B1C	0+18, 10L	30-40	9.7	0.52 ± 0.2
AL2B2A	0+12.5, 9.5L	0-5	670	<0.25
AL2B2B	0+12.5, 9.5L	5-15	50	0.76 ± 0.4
AL2B2C	0+12.5, 9.5L	30-40	3.1	0.82 ± 0.2
AL2B2D	0+12.5, 9.5L	60-70	2.1	0.58 ± 0.2
AL2B3	0+11.8, 1L	0-3	210	0.60 ± 0.3

[a]Location indicated in Fig. 5.

[b]Total analytical error of results is less than ±3% (95% confidence level).

[c]Indicated counting error is at 95% confidence level (±2σ).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Summary of outdoor measurements and sample results on property at 80 Yardboro Avenue, Albany, New York (AL002)

Measurement or sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	35	8-15	11
Gamma exposure rate at surface (μR/h)[a]	35	8-15	12
Scan, gamma exposure rate near surface (μR/h)[b]	—	6-39	—
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	12	2.7-110	45
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	8	2.1-670	207
Direct alpha activity on surface (dpm/100 cm^2), selected roof locations	4	36-98	72

[a]At grid points.

[b]Scan of entire property.

[c]Systematic samples, Table 3.

[d]Biased samples, Table 3.

Contract No. W-7405-eng-26

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 74 YARDBORO AVENUE, ALBANY, NEW YORK (AL003)

March 1984

Work performed as part of the
RADIOLOGICAL SURVEY ACTIVITIES PROGRAM

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831
operated by
UNION CARBIDE CORPORATION
for the
U.S. DEPARTMENT OF ENERGY

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RESULTS OF THE RADIOLOGICAL SURVEY AT 74 YARDBORO AVENUE, ALBANY, NEW YORK (AL003)*

INTRODUCTION

In 1958, work with depleted uranium began at the National Lead Company's plant in Colonie, New York.[1] Beginning in 1961, the Atomic Energy Commission (AEC), its present successor, the Department of Energy (DOE), and other federal agencies have engaged in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contract, the work at the plant has been devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity since February 1980.

A number of properties in the Colonie/Albany area have been identified as being potentially contaminated with uranium originating from the National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 12 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period October 20-27, 1983. The property at 74 Yardboro Avenue in Albany, New York (AL003) was the subject of a radiological investigation on October 21, 1983.

This property consisted of an unoccupied brick house with a shed attached at the rear. Windows and doors were missing and the roof was in disrepair. A diagram of the property showing the approximate property boundaries and grid network established for measurements outside the onsite structures is shown in Fig. 1. The rectangularly shaped lot included in the radiological survey was approximately 28.2 m deep by 12.2 m wide. The house and shed occupied most of the property. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

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*This 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 W-7405-eng-26.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Reference 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct and transferable alpha activity measurements on the house roof. A comprehensive description of the survey methods and instrumentation have been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. This data is 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 substracted from radionuclide concentrations in soil samples.

Gamma Measurements

Results of grid point/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 7 to 14 μR/h and averaged 11 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 9 to 16 μR/h and averaged 12 μR/h. For comparison, typical background radiation levels at 1 m above ground surface in the Albany area range from 8 to 10 μR/h and average 9 μR/h.

As can be observed in Fig. 4, the highest radiation levels were measured around the periphery of the house and shed. The maximum exposure rate observed during scanning the ground surface was 18 μR/h (grid blocks

0+16, BL and 0+20, BL). The elevated radiation levels measured in areas adjacent to the house and shed appeared to be associated with the drip lines from the roofs of the structures.

Soil Sampling

Six soil samples were taken on this property at four locations that were chosen irrespective of gamma radiation levels (denoted systematic soil samples – AL3S). The sample locations are shown in Fig. 5, and the results of radionuclide analyses are given in Table 3. A concentration of ^{238}U is provided for each soil sample. Concentrations of ^{226}Ra were also measured to confirm that ^{226}Ra concentrations were within typical background levels.

Soil samples were taken at 0 to 5 cm in depth and 5 to 15 cm in depth. Concentrations of ^{238}U ranged from 6.9 to 190 pCi/g. The highest concentration of ^{238}U in soil was measured in a sample collected along the eastern drip line of the house roof in the upper 5 cm of soil (AL3S3A). In the soil sample taken below sample AL3S3A (AL3S3B), from 5-15 cm, the ^{238}U concentration dropped to 33 pCi/g. It is evident from the results of the soil sample analyses that ^{238}U concentrations in the top few centimeters of soil are substantially elevated above the average background level (0.96 pCi/g). These elevated ^{238}U concentrations generally decrease with increasing depth in soil.

Alpha Measurements

Direct and transferable alpha activity measurements were taken on selected areas of the roof on the house. The direct alpha activities ranged from 84 to 270 dpm/100 cm^2 and averaged 190 dpm/100 cm^2. These levels are all above the typical background level for roofs of that type (30 dpm/100 cm^2). Transferable alpha activities ranged from <4 to 11 dpm/100 cm^2 and averaged 6 dpm/100 cm^2. The average value exceeds the typical background level (<4 dpm/100 cm^2).

SIGNIFICANCE OF FINDINGS

A summary of the outdoor measurement results of the radiological survey conducted on this property is provided in Table 4. These results establish that elevated concentrations of ^{238}U are present on the property. Gamma exposure rates were notably elevated only in areas adjacent to the structures which correspond to the drip lines of the roofs. Concentrations of ^{238}U in all surface soil samples (0-5 cm) exceeded the average background level. Direct and transferable alpha activity measurements taken on the roof of the house were generally above typical background and indicated the presence of ^{238}U surface contamination.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).
2. *A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program*, DOE/EV-0097A (September 1980).
3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).
4. H. W. Jeter and D. M. Eagleson, *A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes*, IWL-9488-461 (October 31, 1980).
5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).
6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, *Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program*, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).
7. T. E. Myrick, B. A. Berven, and F. F. Haywood, *State Background Radiation Levels: Results of Measurements Taken During 1975-1979*, ORNL/TM-7343 (November 1981).

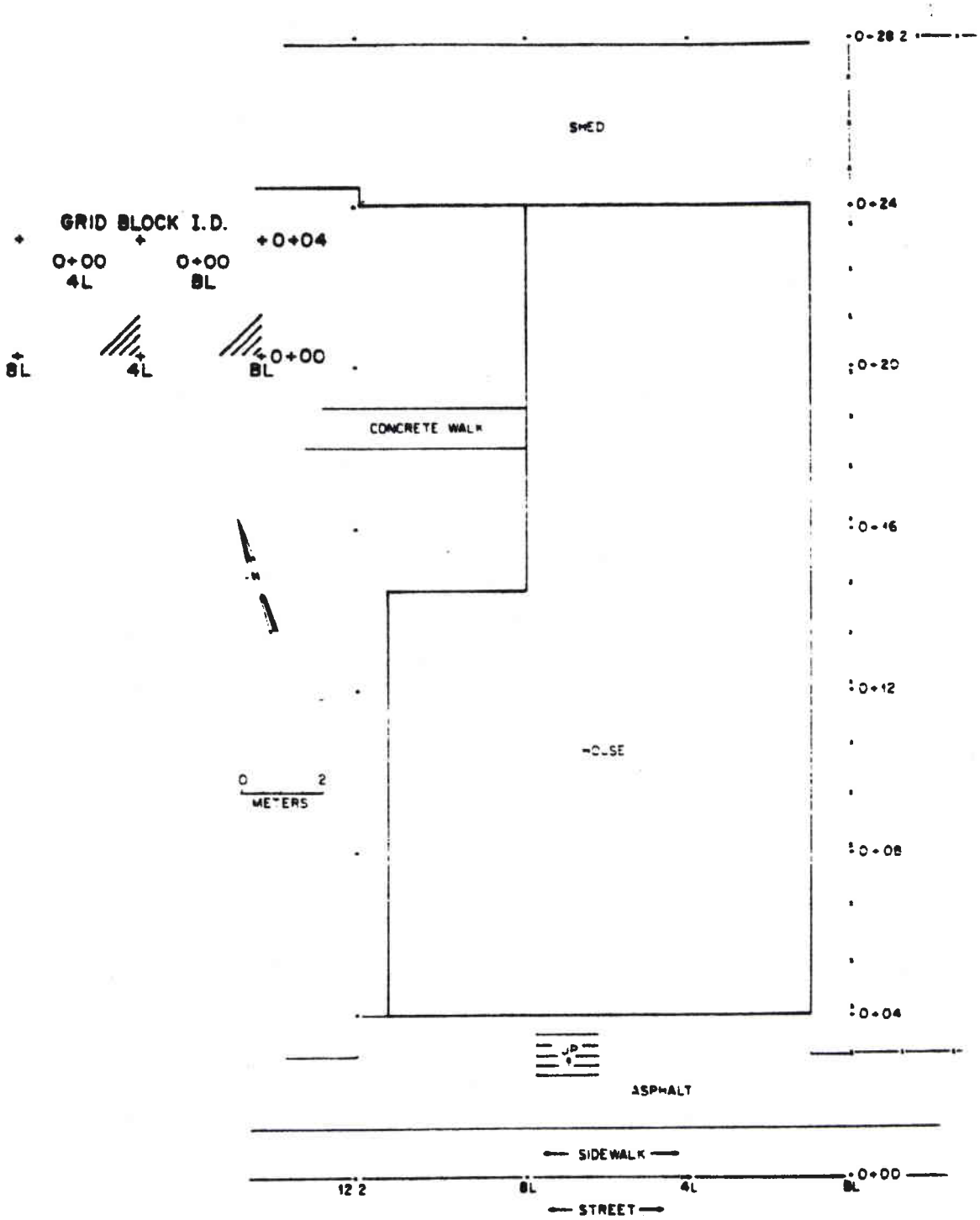

Fig. 1. Diagram showing grid point and grid block locations outdoors on property at 74 Yardboro Avenue, Albany, New York (AL003).

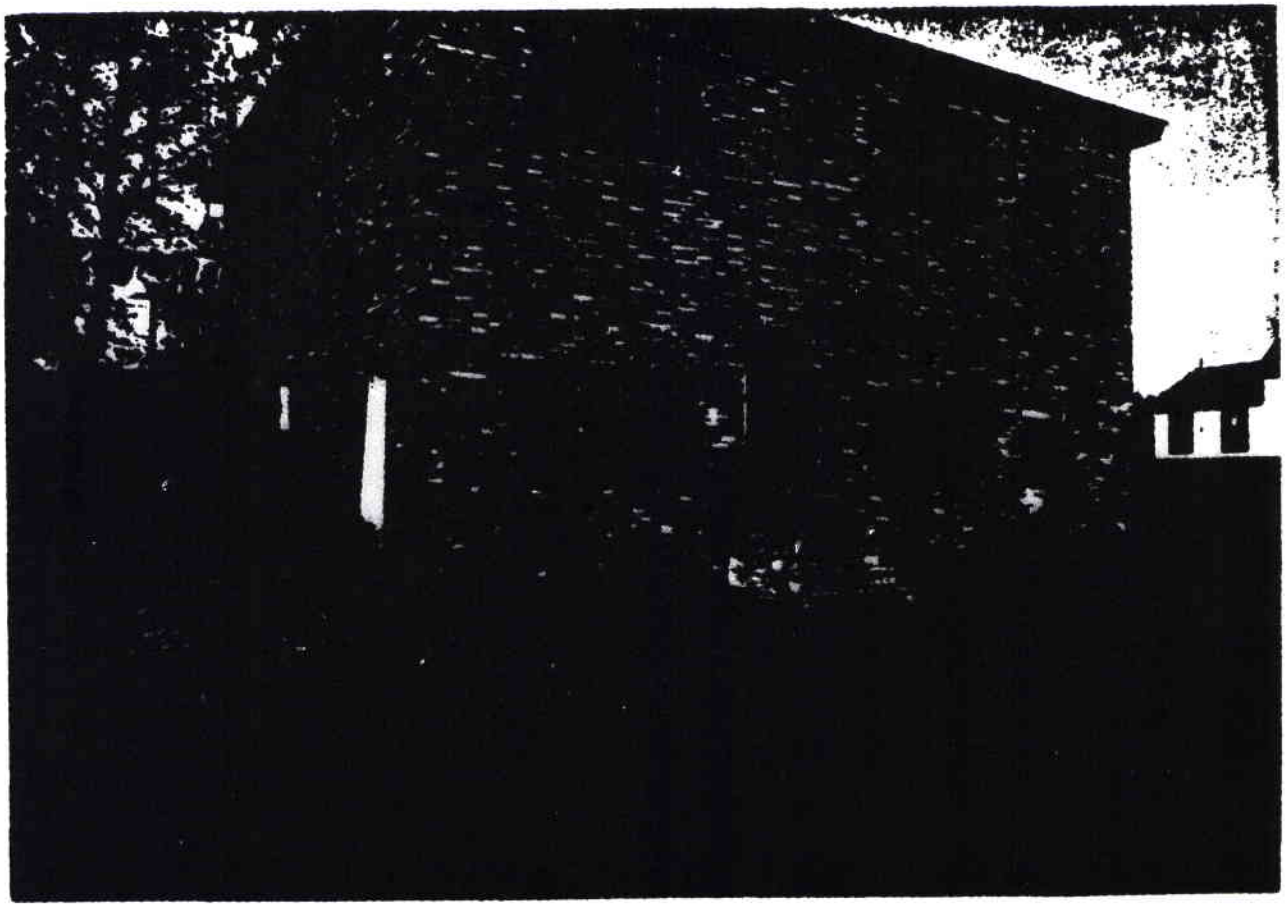

Fig. 2. Front view of property at 74 Yardboro Avenue, Albany, New York (AL003) looking north.

Fig. 3. Rear view of property at 74 Yardboro Avenue, Albany, New York (AL003) looking southeast.

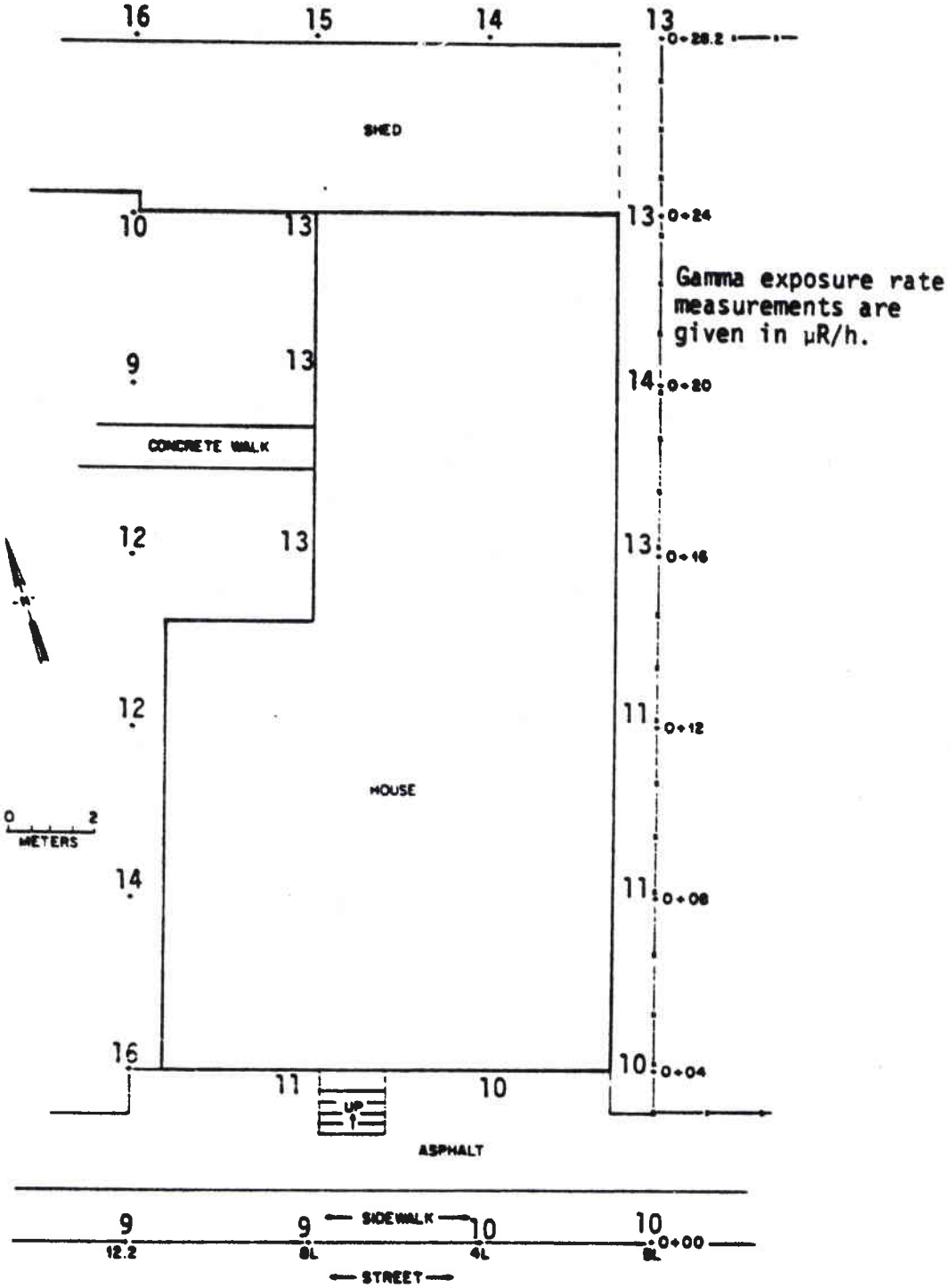

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on property at 74 Yardboro Avenue, Albany, New York (AL003).

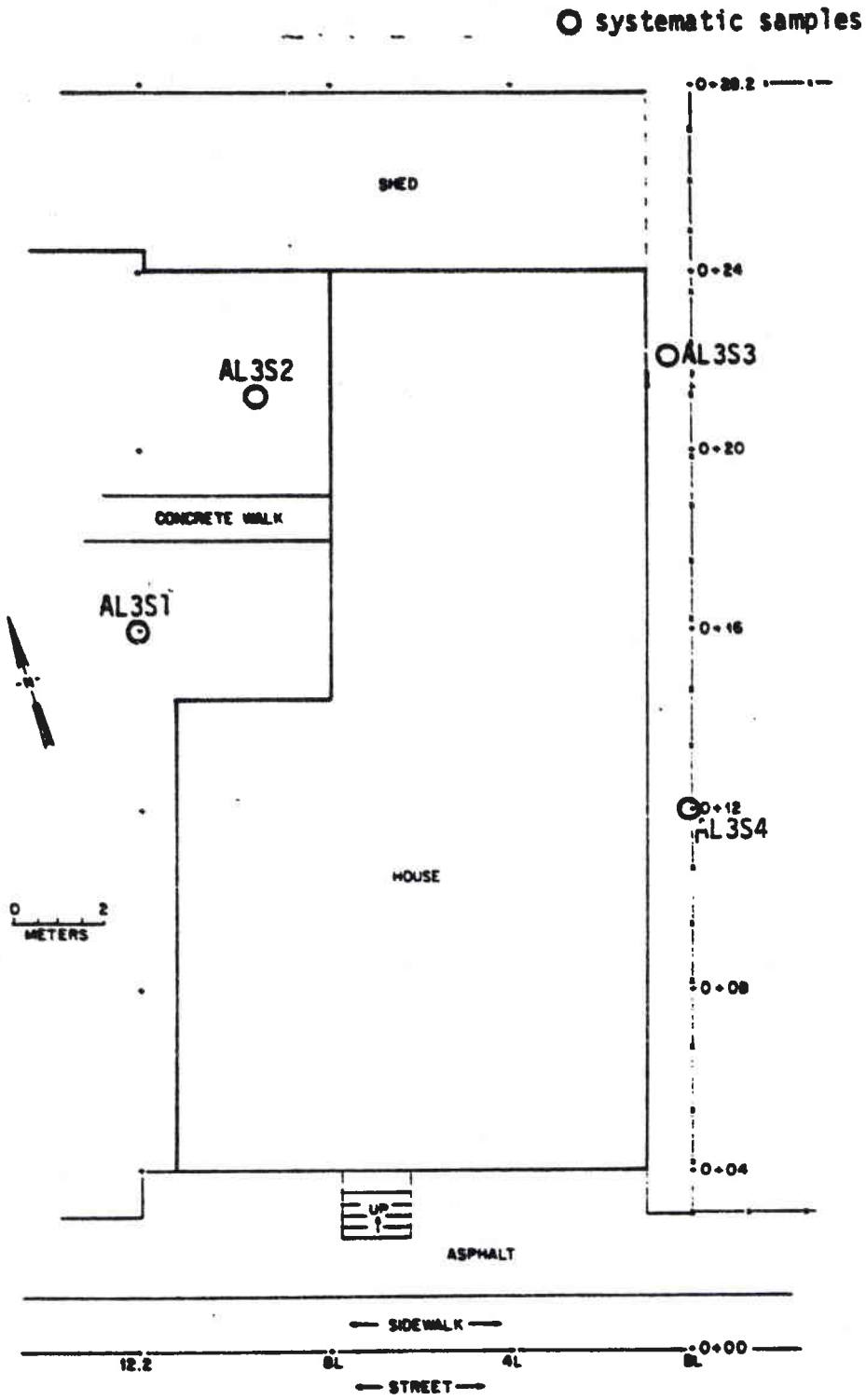

Fig. 5. Location of soil samples on property at 74 Yardboro Avenue, Albany, New York (AL003).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.

[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Outdoor measurement results on property at 74 Yardboro Avenue, Albany, New York (AL003)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rates during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	10	10	10-12
0+04, BL	10	10	10-13
0+08, BL	11	11	11-11
0+12, BL	11	11	11-17
0+16, BL	12	13	13-18
0+20, BL	12	14	14-18
0+24, BL	11	13	10-13
0+28.2, BL	11	13	–
0+00, 4L	10	10	10-11
0+04, 4L	10	10	–
0+08, 4L	e	e	–
0+12, 4L	e	e	–
0+16, 4L	e	e	–
0+20, 4L	e	e	–
0+24, 4L	e	e	–
0+28.2, 4L	14	14	–
0+00, 8L	9	9	9-12
0+04, 8L	10	11	11-14
0+08, 8L	e	e	12-14
0+12, 8L	e	e	12-14
0+16, 8L	13	13	10-13
0+20, 8L	13	13	10-16
0+24, 8L	13	13	–
0+28.2, 8L	13	15	–
0+00, 12.2L	9	9	–
0+04, 12.2L	14	16	–
0+08, 12.2L	14	14	–
0+12, 12.2L	12	12	–
0+16, 12.2L	12	12	–
0+20, 12.2L	7	9	–
0+24, 12.2L	8	10	–
0+28.2, 12.2L	13	16	–

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analyses on property at 74 Yardboro Avenue, Albany, New York (AL003)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{238}U[b]	^{226}Ra[c]
		Systematic Samples[d]		
AL3S1	0+16, 12.2L	0-5	16	0.79 ± 0.2
AL3S2A	0+21, 10L	0-5	27	0.71 ± 0.08
AL3S2B	0+21, 10L	5-15	26	0.67 ± 0.1
AL3S3A	0+22, 5L	0-5	190	0.59 ± 0.3
AL3S3B	0+22, 5L	5-15	33	0.56 ± 0.07
AL3S4	0+12, BL	0-5	6.9	0.69 ± 0.1

[a]Location indicated in Fig. 5.

[b]Total analytical error of results is less than ±3% (95% confidence level).

[c]Indicated counting error is at 95% confidence level (±2σ).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

Table 4. Summary of outdoor measurements and sample results on property at 74 Yardboro Avenue, Albany, New York (AL003)

Measurement or sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	25	7-14	11
Gamma exposure rate at surface (μR/h)[a]	25	9-16	12
Scan, gamma exposure rate near surface (μR/h)[b]	—	10-18	—
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	6	6.9-190	50
Direct alpha activity on surface (dpm/100 cm^2), selected roof locations	7	84-270	190
Transferable alpha activity on surface (dpm/100 cm^2), selected roof locations	6	<4-11	6

[a]At grid points.

[b]Scan of entire property.

[c]Systematic samples, Table 3.

Contract No. W-7405-eng-26

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 68 YARDBORO AVENUE, ALBANY, NEW YORK (AL004)

March 1984

Work performed as part of the
RADIOLOGICAL SURVEY ACTIVITIES PROGRAM

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831
operated by
UNION CARBIDE CORPORATION
for the
U.S. DEPARTMENT OF ENERGY

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RESULTS OF THE RADIOLOGICAL SURVEY AT 68 YARDBORO AVENUE, ALBANY, NEW YORK (AL004)*

INTRODUCTION

In 1958, work with depleted uranium began at the National Lead Company's plant in Colonie, New York.[1] Beginning in 1961, the Atomic Energy Commission (AEC), its present successor, the Department of Energy (DOE), and other federal agencies have engaged in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contract, the work at the plant has been devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity since February 1980.

A number of properties in the Colonie/Albany area have been identified as being potentially contaminated with uranium originating from the National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 12 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period October 20-27, 1983. The property at 68 Yardboro Avenue in Albany, New York (AL004) was the subject of a radiological investigation on October 21, 1983.

This property consisted of a church and paved parking lot. A diagram of the property showing the approximate property boundaries and grid network established for measurements outside the church is shown in Fig. 1. The rectangularly shaped lot included in the radiological survey was approximately 28.2 m deep by 36.8 m wide. The church on the east side of the lot was the only onsite structure. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

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*This 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 W-7405-eng-26.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Reference 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha activity measurements on the building roof. A comprehensive description of the survey methods and instrumentation have been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. This data is 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 substracted from radionuclide concentrations in soil samples.

Gamma Measurements

Results of grid point/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 8 to 16 μR/h and averaged 10 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 8 to 19 μR/h and averaged 11 μR/h. For comparison, typical background radiation levels at 1 m above ground surface in the Albany area range from 8 to 10 μR/h and average 9 μR/h.

As can be observed in Fig. 4, elevated radiation levels were measured throughout the lawn area which surrounded the church building. The maximum exposure rate observed during scanning the ground surface was 31 μR/h (grid

block 0+20, 24R). The highest radiation levels were measured in areas adjacent to the east and west sides of the church, and appeared to be associated with the drip lines from the roof of the structure.

Soil Sampling

Thirty-one soil samples were taken on this property. Twenty-four of these soil samples were taken at 12 locations that were chosen irrespective of gamma radiation levels (denoted systematic soil samples — AL4S); and seven soil samples were taken at two locations biased with respect to elevated gamma radiation measurements (denoted biased soil samples — AL4B). The sample locations are shown in Fig. 5, and the results of radionuclide analyses are given in Table 3. A concentration of ^{238}U is provided for each soil sample. Concentrations of ^{226}Ra were measured in several selected soil samples to confirm that ^{226}Ra concentrations were within typical background levels.

Concentrations of ^{238}U in systematic soil samples ranged from 0.90 to 110 pCi/g. At each location, samples were taken from 0 to 5 cm in depth and 5 to 15 cm in depth. Concentrations of ^{238}U were approximately six to eighty times higher in soil samples collected in the top 5 cm. The maximum concentration of ^{238}U in a systematic soil sample (110 pCi/g) was measured in a sample taken from a depth of 0-5 cm (AL4S8A). In the soil sample taken below sample AL4S8A (AL4S8B), from 5-15 cm, the ^{238}U concentration dropped to 3.2 pCi/g.

The two highest concentrations of ^{238}U in soil, 590 and 530 pCi/g, were measured in biased samples AL4B1A and AL4B2A, respectively. These samples were collected along the drip lines of the church roof in the upper 5 cm of soil. The ^{238}U concentrations in samples taken beneath those samples, from 5 to 15 cm in depth, averaged 16 pCi/g.

It is evident from the results of the soil sample analyses that ^{238}U concentrations in the top few centimeters of soil are substantially elevated above the average background level (0.96 pCi/g). These elevated ^{238}U concentrations quickly decrease with increasing depth in soil. The highest concentrations of ^{238}U were observed along the drip lines of the church roof.

Alpha Measurements

Direct alpha activity measurements were taken on selected areas of the roof on the church building. The activities ranged from 70 to 150 dpm/100 cm^2 and averaged 98 dpm/100 cm^2. These levels are all above the typical background level for roofs of that type (30 dpm/100 cm^2).

SIGNIFICANCE OF FINDINGS

A summary of the outdoor measurement results of the radiological survey conducted on this property is provided in Table 4. These results establish that elevated concentrations of ^{238}U are present on the property. Gamma exposure rates were generally within the range of typical background levels on the western half of the lot and elevated on the eastern half (notably those areas adjacent to the east and west sides of the church which correspond to the drip lines from the roof). Concentrations of ^{238}U in all surface soil samples (0-5 cm) substantially exceeded the average background level. Direct alpha activity measurements taken on the roof were all above typical background and indicated the presence of ^{238}U surface contamination.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).
2. *A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program*, DOE/EV-0097A (September 1980).
3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).
4. H. W. Jeter and D. M. Eagleson, *A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes*, IWL-9488-461 (October 31, 1980).
5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).
6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, *Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program*, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).
7. T. E. Myrick, B. A. Berven, and F. F. Haywood, *State Background Radiation Levels: Results of Measurements Taken During 1975-1979*, ORNL/TM-7343 (November 1981).

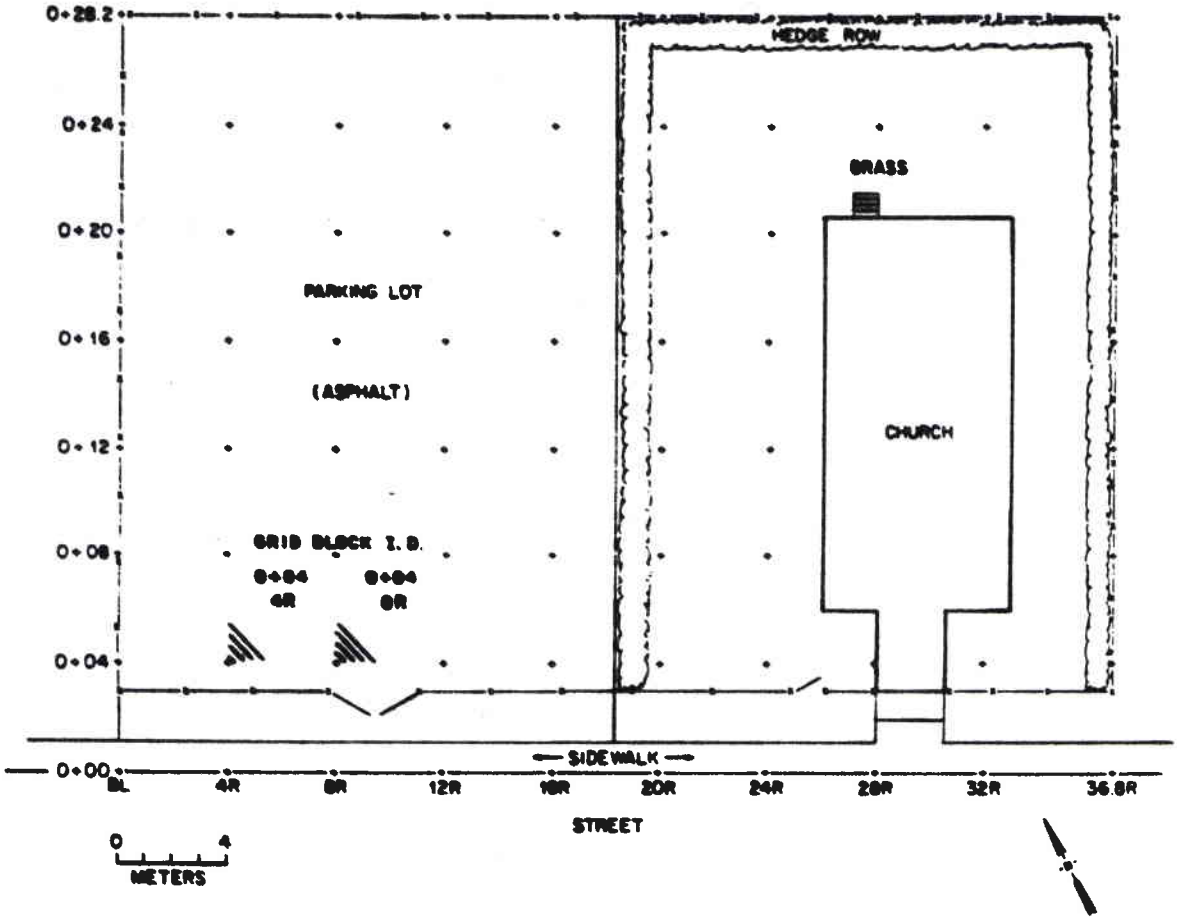

Fig. 1. Diagram showing grid point and grid block locations outdoors on property at 68 Yardboro Avenue, Albany, New York (AL004).

Fig. 2. Front view of property at 68 Yardboro Avenue, Albany, New York (AL004) looking north.

Fig. 3. Rear view of property at 68 Yardboro Avenue, Albany, New York (AL004) looking southeast.

Gamma exposure rate measurements are given in μR/h.

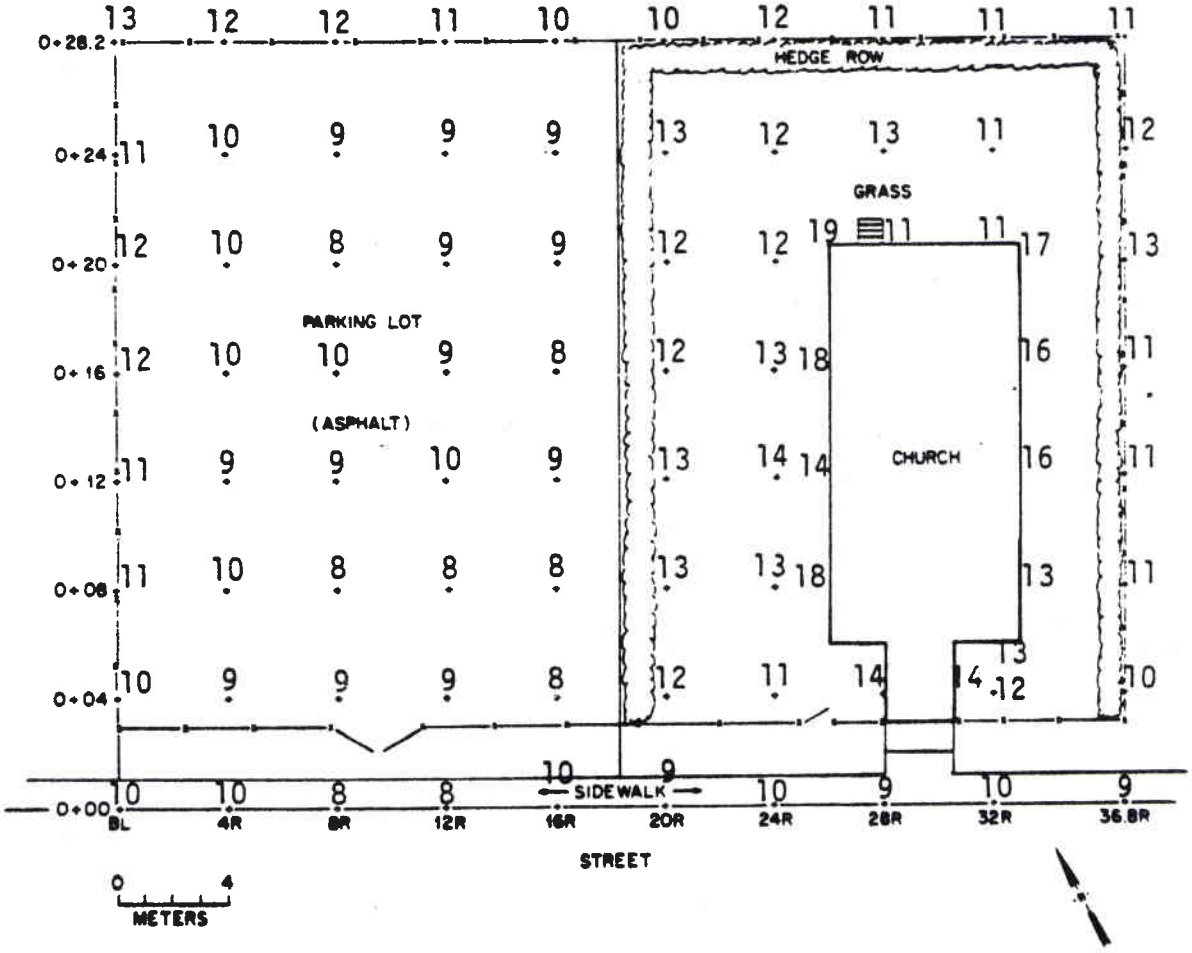

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on property at 68 Yardboro Avenue, Albany, New York (AL004).

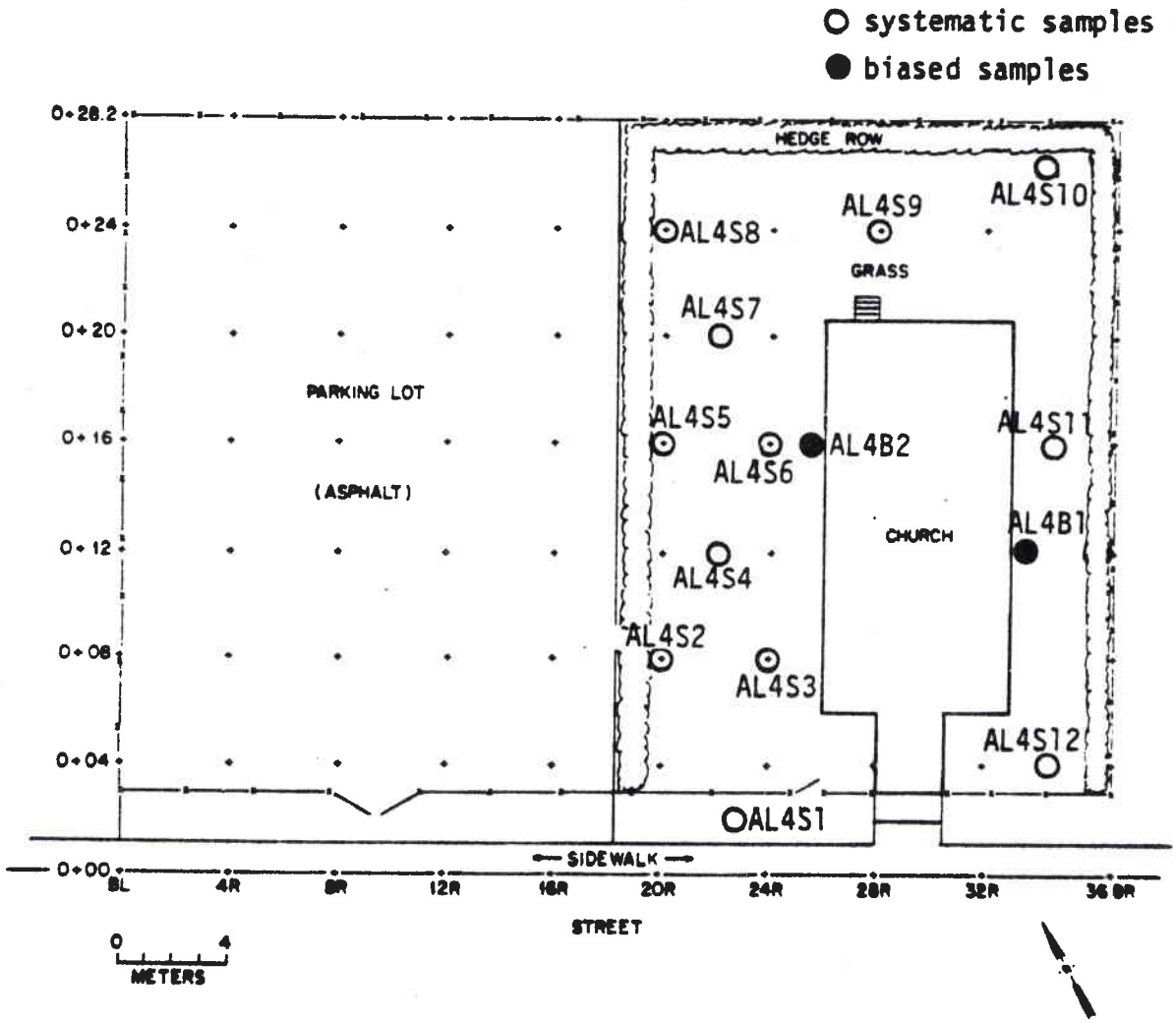

Fig. 5. Location of soil samples on property at 68 Yardboro Avenue, Albany, New York (AL004).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.

[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Outdoor measurement results on property at 68 Yardboro Avenue, Albany, New York (AL004)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rates during scan[d] of grid block (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate[c] at the surface	
0+00, BL	10	10	9-11
0+04, BL	10	10	10-11
0+08, BL	11	11	9-11
0+12, BL	11	11	10-11
0+16, BL	11	12	10-12
0+20, BL	10	12	10-12
0+24, BL	10	11	8-11
0+28.2, BL	11	13	—
0+00, 4R	10	10	8-11
0+04, 4R	8	9	8-11
0+08, 4R	10	10	8-11
0+12, 4R	9	9	8-11
0+16, 4R	10	10	8-11
0+20, 4R	10	10	8-11
0+24, 4R	10	10	8-13
0+28.2, 4R	12	12	—
0+00, 8R	8	8	8-11
0+04, 8R	10	9	8-10
0+08, 8R	8	8	8-10
0+12, 8R	9	9	8-10
0+16, 8R	10	10	8-10
0+20, 8R	8	8	8-10
0+24, 8R	10	9	8-12
0+28.2, 8R	12	12	—
0+00, 12R	8	8	8-11
0+04, 12R	8	9	8-10
0+08, 12R	9	8	8-10
0+12, 12R	10	10	8-10
0+16, 12R	9	9	8-10
0+20, 12R	9	9	8-11
0+24, 12R	9	9	8-12
0+28.2, 12R	10	11	—
0+00, 16R	9	10	8-11
0+04, 16R	8	8	8-13
0+08, 16R	8	8	8-13
0+12, 16R	9	9	8-13
0+16, 16R	8	8	8-13
0+20, 16R	9	9	8-13
0+24, 16R	8	9	8-13
0+28.2, 16R	10	10	—

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rates during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, 20R	9	9	8-13
0+04, 20R	12	12	11-14
0+08, 20R	12	13	12-14
0+12, 20R	12	13	12-14
0+16, 20R	12	12	12-14
0+20, 20R	12	12	12-14
0+24, 20R	13	13	11-16
0+28.2, 20R	11	10	—
0+00, 24R	10	10	8-16
0+04, 24R	11	11	10-29
0+08, 24R	12	13	12-29
0+12, 24R	12	14	12-29
0+16, 24R	12	13	12-29
0+20, 24R	12	12	12-31
0+24, 24R	12	12	12-14
0+28.2, 24R	12	12	—
0+08, 26R	14	18	—
0+12, 26R	13	14	—
0+16, 26R	16	18	—
0+20, 26R	14	19	—
0+00, 28R	9	9	9-16
0+04, 28R	11	14	11-16
0+08, 28R	e	e	—
0+12, 28R	e	e	—
0+16, 28R	e	e	—
0+20, 28R	e	e	11-13
0+20.5, 28R	10	11	—
0+24, 28R	12	13	11-13
0+28.2, 28R	11	11	—
0+04, 30.5R	11	14	—
0+00, 32R	10	10	10-12
0+04, 32R	11	12	10-27
0+05.7, 32R	11	13	—
0+08, 32R	e	e	11-29
0+12, 32R	e	e	11-29
0+16, 32R	e	e	12-29
0+20, 32R	e	e	11-29
0+20.5, 32R	10	11	—
0+24, 32R	12	11	11-13
0+28.2, 32R	11	11	—

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rates during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+08, 33R	12	13	–
0+12, 33R	13	16	–
0+16, 33R	13	16	–
0+20, 33R	13	17	–
0+00, 36.8R	8	9	–
0+04, 36.8R	10	10	–
0+08, 36.8R	11	11	–
0+12, 36.8R	11	11	–
0+16, 36.8R	10	11	–
0+20, 36.8R	12	13	–
0+24, 36.8R	11	12	–
0+28.2, 36.8R	10	11	–

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analyses on property at 68 Yardboro Avenue, Albany, New York (AL004)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{238}U[b]	^{226}Ra[c]
		Systematic Samples[d]		
AL4S1A	0+02, 23R	0-5	14	0.44 ± 0.1
AL4S1B	0+02, 23R	5-15	2.2	0.40 ± 0.06
AL4S2A	0+08, 20R	0-5	87	0.62 ± 0.2
AL4S2B	0+08, 20R	5-15	1.1	0.58 ± 0.02
AL4S3A	0+08, 24R	0-5	51	0.62 ± 0.02
AL4S3B	0+08, 24R	5-15	1.2	
AL4S4A	0+12, 22R	0-5	61	
AL4S4B	0+12, 22R	5-15	1.4	0.53 ± 0.1
AL4S5A	0+16, 20R	0-5	77	0.57 ± 0.2
AL4S5B	0+16, 20R	5-15	1.0	
AL4S6A	0+16, 24R	0-5	86	0.62 ± 0.4
AL4S6B	0+16, 24R	5-15	2.4	0.69 ± 0.08
AL4S7A	0+20, 22R	0-5	64	
AL4S7B	0+20, 22R	5-15	0.90	0.73 ± 0.2
AL4S8A	0+24, 20R	0-5	110	
AL4S8B	0+24, 20R	5-15	3.2	
AL4S9A	0+24, 28R	0-5	95	
AL4S9B	0+24, 28R	5-15	2.5	0.55 ± 0.1
AL4S10A	0+27, 34R	0-5	52	
AL4S10B	0+27, 34R	5-15	4.0	
AL4S11A	0+16, 34R	0-5	62	0.65 ± 0.1
AL4S11B	0+16, 34R	5-15	2.4	
AL4S12A	0+04, 34R	0-5	30	
AL4S12B	0+04, 34R	5-15	1.3	0.59 ± 0.5
		Biased Samples[e]		
AL4B1A	0+12, 33.5R	0-5	590	0.79 ± 0.3
AL4B1B	0+12, 33.5R	5-15	18	
AL4B1C	0+12, 33.5R	15-25	2.7	0.80 ± 0.1
AL4B2A	0+16, 25.8R	0-5	530	<0.26
AL4B2B	0+16, 25.8R	5-15	14	0.79 ± 0.1
AL4B2C	0+16, 25.8R	20-30	3.5	
AL4B2D	0+16, 25.8R	30-40	2.2	0.82 ± 0.1

[a]Location indicated in Fig. 5.

[b]Total analytical error of results is less than ±3% (95% confidence level).

[c]Indicated counting error is at 95% confidence level (±2σ).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Summary of outdoor measurements and sample results on property at 68 Yardboro Avenue, Albany, New York (AL004)

Measurement or sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	84	8-16	10
Gamma exposure rate at surface (μR/h)[a]	84	8-19	11
Scan, gamma exposure rate near surface (μR/h)[b]	–	8-31	–
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	24	0.90-110	34
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	7	2.2-590	166
Direct alpha activity on surface (dpm/100 cm^2), selected roof locations	7	70-150	98

[a]At grid points.

[b]Scan of entire property.

[c]Systematic samples, Table 3.

[d]Biased samples, Table 3.

Contract No. W-7405-eng-26

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 52 YARDBORO AVENUE, ALBANY, NEW YORK (AL005)

March 1984

Work performed as part of the
RADIOLOGICAL SURVEY ACTIVITIES PROGRAM

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831
operated by
UNION CARBIDE CORPORATION
for the
U.S. DEPARTMENT OF ENERGY

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RESULTS OF THE RADIOLOGICAL SURVEY AT 52 YARDBORO AVENUE, ALBANY, NEW YORK (AL005)*

INTRODUCTION

In 1958, work with depleted uranium began at the National Lead Company's plant in Colonie, New York.[1] Beginning in 1961, the Atomic Energy Commission (AEC), its present successor, the Department of Energy (DOE), and other federal agencies have engaged in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contract, the work at the plant has been devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity since February 1980.

A number of properties in the Colonie/Albany area have been identified as being potentially contaminated with uranium originating from the National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 12 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period October 20-27, 1983. The property at 52 Yardboro Avenue in Albany, New York (AL005) was the subject of a radiological investigation on October 22, 1983.

This private property consisted of a two-story house constructed of granite block and a fairly large lawn area. A diagram of the property showing the approximate property boundaries and grid network established for measurements outside the onsite structure is shown in Fig. 1. The square-shaped area included in the radiological survey was approximately 27.5 m deep by 28 m wide. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

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*This 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 W-7405-eng-26.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Reference 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha activity measurements on the house roof. A comprehensive description of the survey methods and instrumentation have been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. This data is 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 substracted from radionuclide concentrations in soil samples.

Gamma Measurements

Results of grid point/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 7 to 22 μR/h and averaged 12 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 8 to 24 μR/h, also averaging 12 μR/h. For comparison, typical background radiation levels at 1 m above ground surface in the Albany area range from 8 to 10 μR/h and average 9 μR/h.

As can be observed in Fig. 4, gamma radiation levels were generally slightly elevated above the range of background on the property. Further gamma scanning indicated that the elevated gamma exposure rates measured around the periphery of the house were attributable to its granite block composition. Elevated radiation levels were also detected in a small area

near the northeastern corner of the lot and in areas near the sides of the house which correspond to the drip lines of the roof. The maximum exposure rate observed during scanning of the ground surface, 29 μR/h, was measured along the drip line near the northwest side of the house.

Soil Sampling

Forty-three soil samples were taken on this property. Thirty-one of these soil samples were taken at 20 locations that were chosen irrespective of gamma radiation levels (denoted systematic soil samples — AL5S); and twelve soil samples were taken at four locations biased with respect to elevated gamma radiation measurements (denoted biased soil samples — AL5B). The sample locations are shown in Fig. 5, and the results of radionuclide analyses are given in Table 3. A concentration of ^{238}U is provided for each soil sample. Concentrations of ^{226}Ra were measured in several selected soil samples to confirm that ^{226}Ra concentrations were within typical background levels.

Concentrations of ^{238}U in systematic soil samples ranged from 0.80 to 44 pCi/g. Samples at each location were taken from 0 to 5 cm in depth and 5 to 15 cm in depth. Concentrations of ^{238}U were approximately two to twelve times higher in soil samples collected in the top 5 cm. The maximum concentration of ^{238}U in a systematic soil sample (44 pCi/g) was measured in a sample taken from a depth of 0-5 cm. In the soil sample taken below sample AL5S15A (AL5S15B), from 5-15 cm, the ^{238}U concentration dropped to 8.1 pCi/g.

Two of the three highest concentrations of ^{238}U in soil, 160 and 120 pCi/g, were measured in biased samples AL5B1A and AL5B2A, respectively. These samples were collected along the northwestern drip line of the house roof in the upper 5 cm of soil. The ^{238}U concentrations in samples taken beneath those samples, from 5 to 15 cm in depth, averaged 7.5 pCi/g. The maximum concentration of ^{238}U measured (290 pCi/g) was found in sample AL5B4A which was taken from 0-5 cm near the northeastern corner of the property. The ^{238}U concentration in the sample taken beneath sample AL5B4A (AL5B4B), at 5-15 cm, was 23 pCi/g.

It is evident from the results of the soil sample analyses that ^{238}U concentrations in the top few centimeters of soil are substantially elevated above the average background level (0.96 pCi/g). These elevated ^{238}U concentrations quickly decrease with increasing depth in soil. The highest concentrations of ^{238}U were found in soil samples taken along the drip lines of the house roof and from a small area near the northeastern corner of the property.

Alpha Measurements

Direct alpha activity measurements were taken on selected areas of the roof on the house. The direct alpha activity measured on the new roof over the attic portion of the house was 14 dpm/100 cm^2. On the older sections of roof which are over enclosed porches, activities ranged from 84 to 130 dpm/100 cm^2 and averaged 110 dpm/100 cm^2. With the exception of the alpha activity measured on the new roof, these levels are above the typical background level for roofs of that type (30 dpm/100 cm^2).

SIGNIFICANCE OF FINDINGS

A summary of the outdoor measurement results of the radiological survey conducted on this property is provided in Table 4. These results establish that elevated concentrations of ^{238}U are present on the property. Gamma exposure rates were generally elevated, notably in the area adjacent to the northwest side of the house which corresponds to the drip line of the roof and in a small area near the northeastern corner of the lot. Concentrations of ^{238}U in all surface soil samples (0-5 cm) substantially exceeded the average background level. Direct alpha activity measurements taken on the older sections of the house roof were all above typical background and indicated the presence of ^{238}U surface contamination.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).
2. *A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program*, DOE/EV-0097A (September 1980).
3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).
4. H. W. Jeter and D. M. Eagleson, *A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes*, IWL-9488-461 (October 31, 1980).
5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).
6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, *Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program*, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).
7. T. E. Myrick, B. A. Berven, and F. F. Haywood, *State Background Radiation Levels: Results of Measurements Taken During 1975-1979*, ORNL/TM-7343 (November 1981).

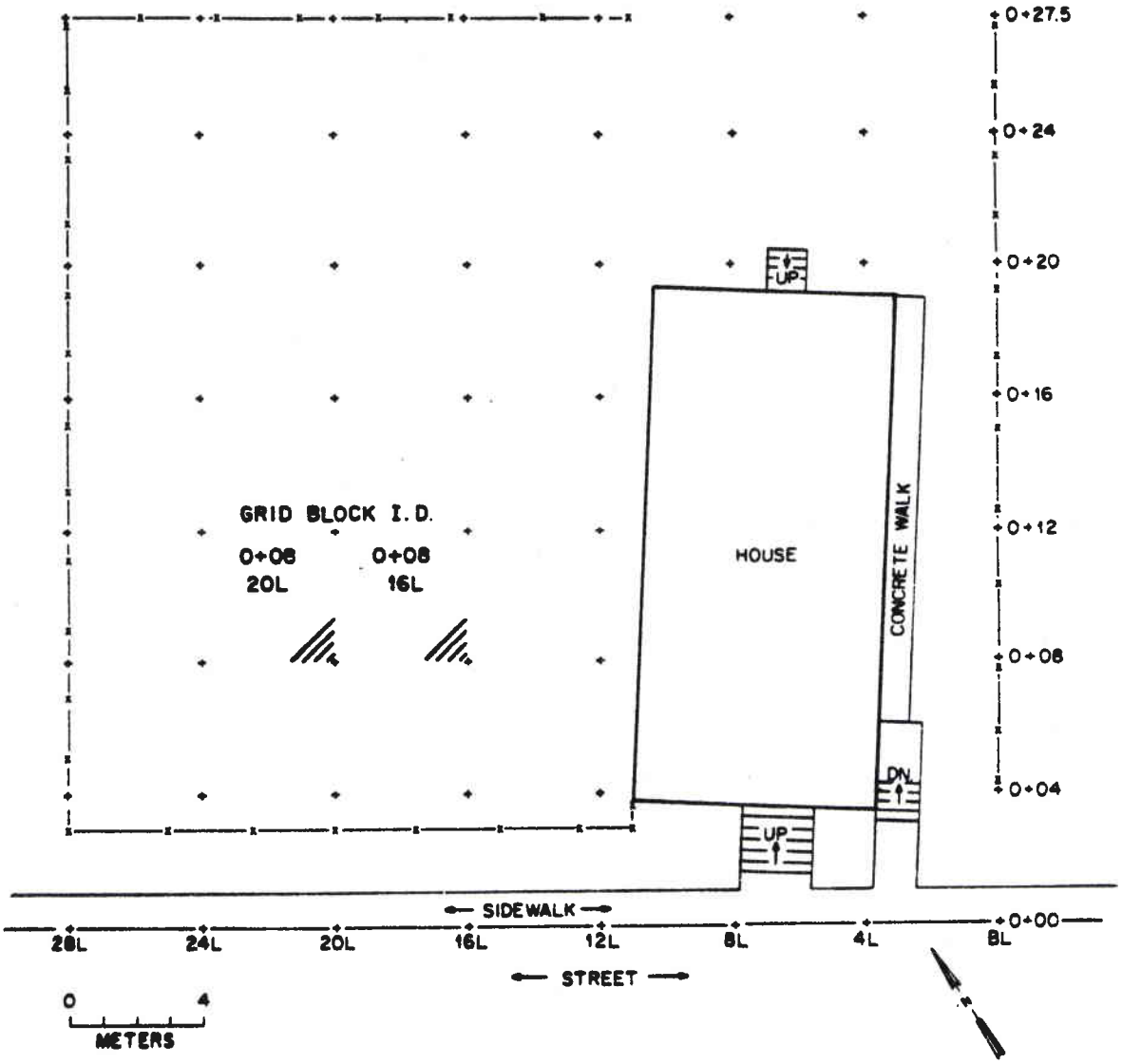

Fig. 1. Diagram showing grid point and grid block locations outdoors on property at 52 Yardboro Avenue, Albany, New York (AL005).

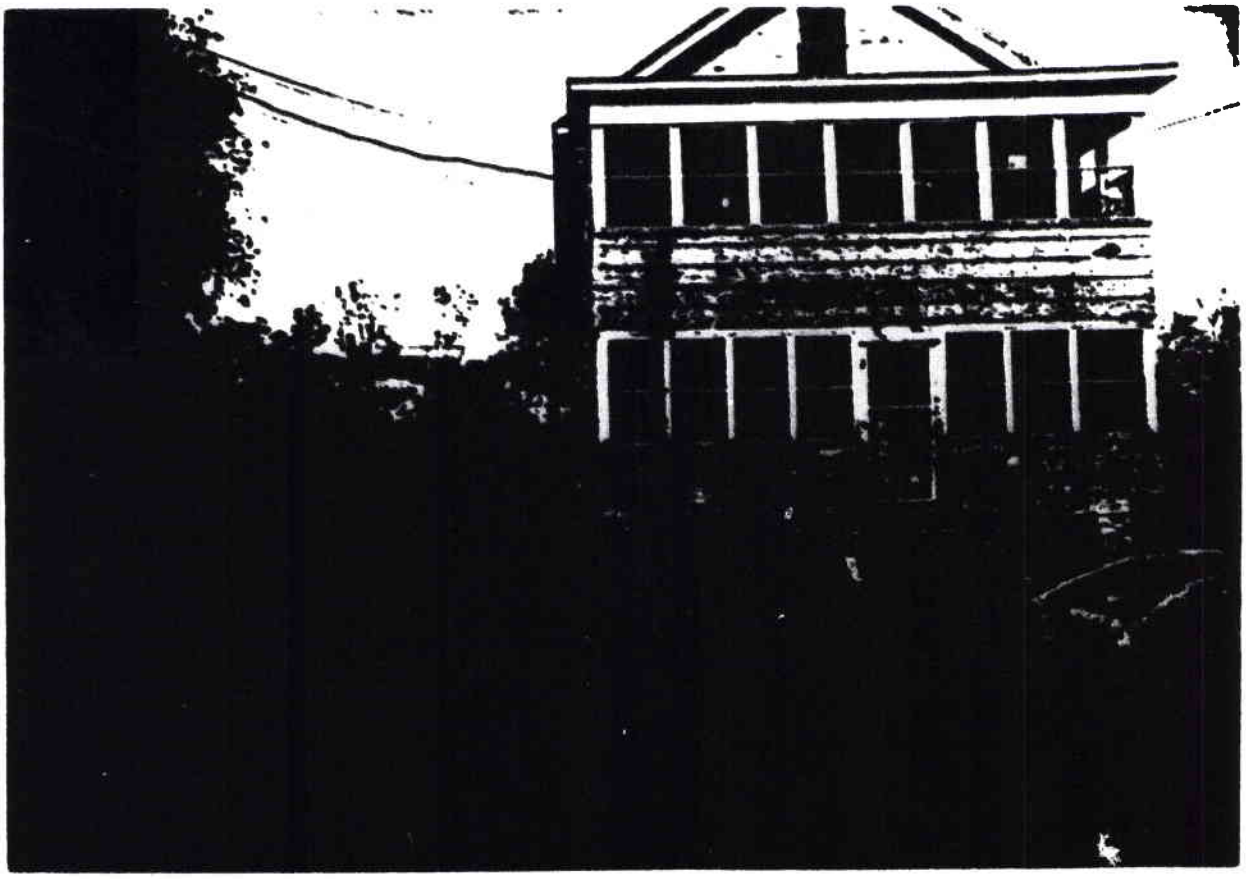

Fig. 2. Front view of property at 52 Yardboro Avenue, Albany, New York (AL005) looking north.

Fig. 3. Rear view of property at 52 Yardboro Avenue, Albany, New York (AL005) looking south.

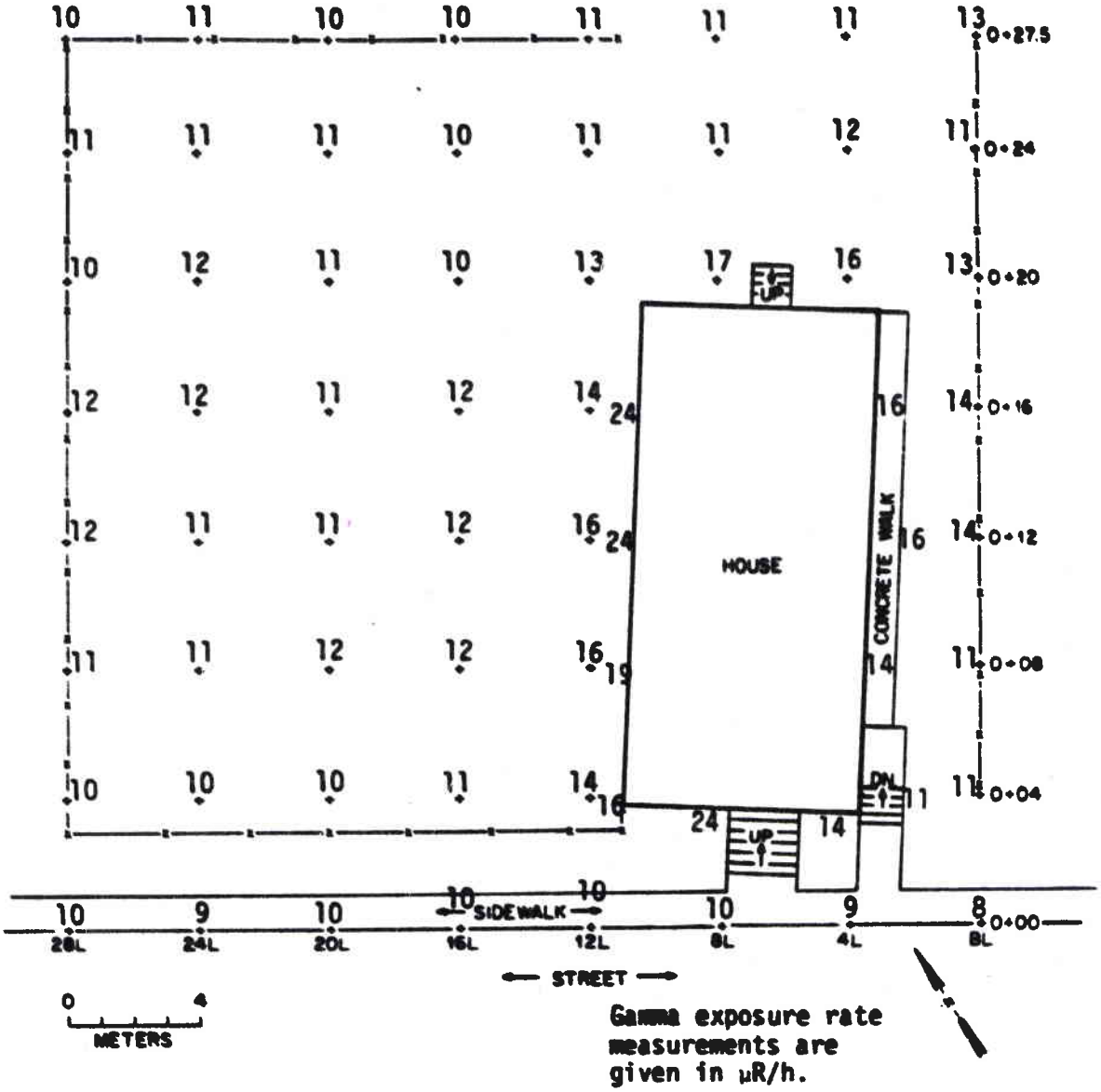

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on property at 52 Yardboro Avenue, Albany, New York (AL005).

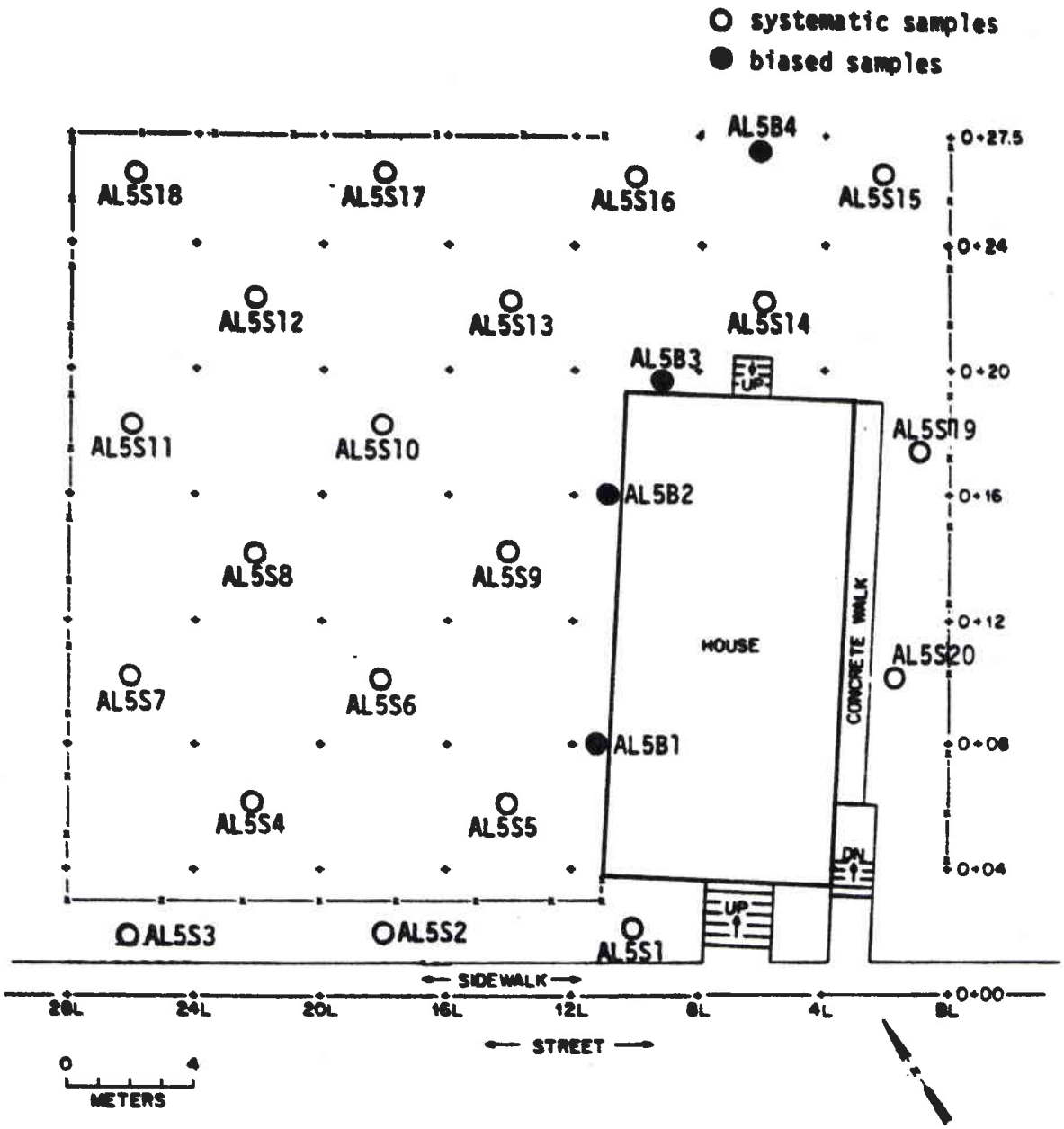

Fig. 5. Location of soil samples on property at 52 Yardboro Avenue, Albany, New York (AL005).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.

[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Outdoor measurement results on property at 52 Yardboro Avenue, Albany, New York (AL005)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rates during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	8	8	8-16
0+04, BL	11	11	11-18
0+08, BL	11	11	11-18
0+12, BL	12	14	13-17
0+16, BL	12	14	12-18
0+20, BL	11	13	11-13
0+24, BL	11	11	11-13
0+27.5, BL	10	13	—
0+16, 3.3L	18	16	—
0+12, 3.5L	18	16	—
0+08, 3.7L	14	14	—
0+04, 3.8L	13	11	—
0+00, 4L	7	9	8-19
0+03.8, 4L	13	14	—
0+04, 4L	e	e	—
0+08, 4L	e	e	—
0+12, 4L	e	e	—
0+16, 4L	e	e	14-17
0+20, 4L	14	16	10-16
0+24, 4L	12	12	10-29
0+27.5, 4L	10	11	—
0+00, 8L	9	10	10-22
0+03.8, 8L	14	24	—
0+04, 8L	e	e	14-29
0+08, 8L	e	e	14-29
0+12, 8L	e	e	14-29
0+16, 8L	e	e	14-29
0+20, 8L	14	17	10-17
0+24, 8L	11	11	10-12
0+27.5, 8L	11	11	—
0+16, 10.5L	18	24	—
0+12, 10.8L	22	24	—
0+08, 11L	16	19	—
0+04, 11.1L	14	16	—
0+00, 12L	10	10	10-13
0+04, 12L	13	14	11-16
0+08, 12L	16	16	11-16
0+12, 12L	14	16	11-16
0+16, 12L	14	14	11-16
0+20, 12L	13	13	10-13
0+24, 12L	11	11	10-12
0+27.5, 12L	10	11	—

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rates during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, 16L	10	10	8-12
0+04, 16L	11	11	10-12
0+08, 16L	12	12	10-12
0+12, 16L	12	12	10-12
0+16, 16L	12	12	10-12
0+20, 16L	11	10	8-11
0+24, 16L	10	10	8-11
0+27.5, 16L	10	10	—
0+00, 20L	10	10	8-11
0+04, 20L	10	10	10-12
0+08, 20L	11	12	10-12
0+12, 20L	11	11	10-12
0+16, 20L	11	11	10-12
0+20, 20L	11	11	10-12
0+24, 20L	11	11	10-12
0+27.5, 20L	10	10	—
0+00, 24L	10	9	8-11
0+04, 24L	10	10	8-11
0+08, 24L	10	11	10-13
0+12, 24L	11	11	10-13
0+16, 24L	11	12	10-12
0+20, 24L	10	12	10-12
0+24, 24L	10	11	10-12
0+27.5, 24L	10	11	—
0+00, 28L	10	10	—
0+04, 28L	10	10	—
0+08, 28L	11	11	—
0+12, 28L	11	12	—
0+16, 28L	11	12	—
0+20, 28L	10	10	—
0+24, 28L	11	11	—
0+27.5, 28L	11	10	—

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analyses on property at 52 Yardboro Avenue, Albany, New York (AL005)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{238}U[b]	^{226}Ra[c]
		Systematic Samples[d]		
AL5S1A	0+02, 10L	0-5	25	
AL5S1B	0+02, 10L	5-15	6.1	0.59 ± 0.06
AL5S2A	0+02, 18L	0-5	22	
AL5S2B	0+02, 18L	5-15	1.8	0.46 ± 0.06
AL5S3A	0+02, 26L	0-5	20	
AL5S3B	0+02, 26L	5-15	5.4	0.52 ± 0.08
AL5S4A	0+06, 22L	0-5	35	
AL5S5A	0+06, 14L	0-5	27	0.60 ± 0.09
AL5S5B	0+06, 14L	5-15	8.7	
AL5S6A	0+10, 18L	0-5	26	0.58 ± 0.2
AL5S7A	0+10, 26L	0-5	8.1	0.63 ± 0.08
AL5S7B	0+10, 26L	5-15	0.80	
AL5S8A	0+14, 22L	0-5	7.0	
AL5S9A	0+14, 14L	0-5	25	0.61 ± 0.1
AL5S9B	0+14, 14L	5-15	7.7	
AL5S10A	0+18, 18L	0-5	20	
AL5S11A	0+18, 26L	0-5	38	0.59 ± 0.2
AL5S11B	0+18, 26L	5-15	14	
AL5S12A	0+22, 22L	0-5	23	
AL5S13A	0+22, 14L	0-5	20	
AL5S13B	0+22, 14L	5-15	9.5	0.54 ± 0.07
AL5S14A	0+22, 6L	0-5	30	
AL5S15A	0+26, 2L	0-5	44	
AL5S15B	0+26, 2L	5-15	8.1	1.0 ± 0.1
AL5S16A	0+26, 10L	0-5	32	0.71 ± 0.1
AL5S17A	0+26, 18L	0-5	27	
AL5S17B	0+26, 18L	5-15	11	
AL5S18A	0+26, 26L	0-5	24	
AL5S19A	0+17.5, 1L	0-5	8.6	1.1 ± 0.1
AL5S19B	0+17.5, 1L	5-15	4.7	
AL5S20A	0+10, 2L	0-5	3.3	1.0 ± 0.1
		Biased Samples[e]		
AL5B1A	0+08, 11.3L	0-5	160	
AL5B1B	0+08, 11.3L	5-15	4.0	
AL5B1C	0+08, 11.3L	30-40	1.3	0.66 ± 0.4
AL5B2A	0+16, 10.7L	0-5	120	0.64 ± 0.2
AL5B2B	0+16, 10.7L	5-15	11	
AL5B2C	0+16, 10.7L	20-28	4.2	

Table 3 (continued)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{238}U[b]	^{226}Ra[c]
AL5B3A	0+19.7, 9L	0-5	43	0.63 ± 0.3
AL5B3B	0+19.7, 9L	5-15	5.4	
AL5B3C	0+19.7, 9L	15-25	0.90	0.59 ± 0.1
AL5B4A	0+27, 6L	0-5	290	0.74 ± 0.3
AL5B4B	0+27, 6L	5-15	23	
AL5B4C	0+27, 6L	40-45	2.8	0.58 ± 0.06

[a]Location indicated in Fig. 5.

[b]Total analytical error of results is less than ±3% (95% confidence level).

[c]Indicated counting error is at 95% confidence level (±2σ).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Summary of outdoor measurements and sample results on property at 52 Yardboro Avenue, Albany, New York (AL005)

Measurement or sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	66	7-22	12
Gamma exposure rate at surface (μR/h)[a]	66	8-24	12
Scan, gamma exposure rate near surface (μR/h)[b]	—	8-29	—
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	31	0.80-44	18
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	12	0.90-290	55
Direct alpha activity on surface (dpm/100 cm^2), selected roof locations	4	14-130	85

[a]At grid points.

[b]Scan of entire property.

[c]Systematic samples, Table 3.

[d]Biased samples, Table 3.

Contract No. W-7405-eng-26

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 33 PALMER AVENUE, ALBANY, NEW YORK (AL006)

March 1984

Work performed as part of the
RADIOLOGICAL SURVEY ACTIVITIES PROGRAM

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831
operated by
UNION CARBIDE CORPORATION
for the
U.S. DEPARTMENT OF ENERGY

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RESULTS OF THE RADIOLOGICAL SURVEY AT 33 PALMER AVENUE, ALBANY, NEW YORK (AL006)*

INTRODUCTION

In 1958, work with depleted uranium began at the National Lead Company's plant in Colonie, New York.[1] Beginning in 1961, the Atomic Energy Commission (AEC), its present successor, the Department of Energy (DOE), and other federal agencies have engaged in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contract, the work at the plant has been devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity since February 1980.

A number of properties in the Colonie/Albany area have been identified as being potentially contaminated with uranium originating from the National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 12 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period October 20-27, 1983. The property at 33 Palmer Avenue in Albany, New York (AL006) was the subject of a radiological investigation on October 23, 1983.

This private property consisted of a two-story wood-frame house with a separate small shed located at the southern edge of the lawn. A diagram of the property showing the approximate property boundaries and grid network established for measurements outside the onsite structures is shown in Fig. 1. The irregularly shaped lot included in the radiological survey was approximately 34 m deep by 23 m wide. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

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*This 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 W-7405-eng-26.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Reference 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha activity measurements on the house roof. A comprehensive description of the survey methods and instrumentation have been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. This data is 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 substracted from radionuclide concentrations in soil samples.

Gamma Measurements

Results of grid point/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 7 to 13 μR/h and averaged 9 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 7 to 18 μR/h and averaged 10 μR/h. For comparison, typical background radiation levels at 1 m above ground surface in the Albany area range from 8 to 10 μR/h and average 9 μR/h.

As can be observed in Fig. 4, gamma exposure rates were generally within the range of background throughout the property. Further gamma scanning revealed elevated levels in areas near the sides of the house. The maximum exposure rate observed during scanning the ground surface, 18 μR/h, was measured next to the asphalt walk adjacent to the north side of the house and it appeared to be associated with runoff from the drip line of the roof.

Soil Sampling

Twenty-one soil samples were taken on this property. Seventeen of these soil samples were taken at nine locations that were chosen irrespective of gamma radiation levels (denoted systematic soil samples – AL6S); and four soil samples were taken at two locations biased with respect to elevated gamma radiation measurements (denoted biased soil samples – AL6B). The sample locations are shown in Fig. 5, and the results of radionuclide analyses are given in Table 3. A concentration of ^{238}U is provided for each soil sample. Concentrations of ^{226}Ra were measured in several selected soil samples to confirm that ^{226}Ra concentrations were within typical background levels.

Concentrations of ^{238}U in systematic soil samples ranged from 1.4 to 35 pCi/g. With two exceptions, samples at each location were taken from 0 to 5 cm in depth and 5 to 15 cm in depth. Concentrations of ^{238}U were approximately two to twenty times higher in soil samples collected in the top 5 cm. The maximum concentration of ^{238}U in a systematic soil sample (35 pCi/g) was measured in a sample taken from a depth of 0-5 cm (AL6S8A). In the soil sample taken below sample AL6S8A (AL6S8B), from 5-15 cm, the ^{238}U concentration dropped to 1.8 pCi/g.

The highest concentration of ^{238}U in soil, 120 pCi/g, was measured in biased sample AL6B2A. This sample was collected from the upper 5 cm of soil near the asphalt walk which is located directly beneath the northern drip line of the house roof. The ^{238}U concentration in the sample taken beneath sample AL6B2A (AL6B2B), from 5 to 18 cm in depth, was 7.2 pCi/g.

It is evident from the results of the soil sample analyses that ^{238}U concentrations in the top few centimeters of soil are elevated above the average background level (0.96 pCi/g). These elevated ^{238}U concentrations quickly decrease with increasing depth in soil. The highest concentration of ^{238}U was observed in an area near the north side of the house where runoff from the drip line of the house roof would collect.

Alpha Measurements

Direct alpha activity measurements were taken in selected areas on the roof of the house. The direct alpha activities ranged from 14 to 42 dpm/100 cm^2 and averaged 28 dpm/100 cm^2. These levels are generally equivalent to the typical background level for roofs of that type (30 dpm/100 cm^2).

SIGNIFICANCE OF FINDINGS

A summary of the outdoor measurement results of the radiological survey conducted on this property is provided in Table 4. These results establish that elevated concentrations of ^{238}U are present on the property. Gamma exposure rates were notably elevated only in areas adjacent to the sides of the house which correspond to the drip lines from the roof. Concentrations of ^{238}U in all surface soil samples (0-5 cm) exceeded the average background level. Direct alpha activity measurements taken on the house roof averaged slightly less than typical background and indicated the presence of minimal ^{238}U surface contamination.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).
2. *A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program*, DOE/EV-0097A (September 1980).
3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).
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5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).
6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, *Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program*, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).
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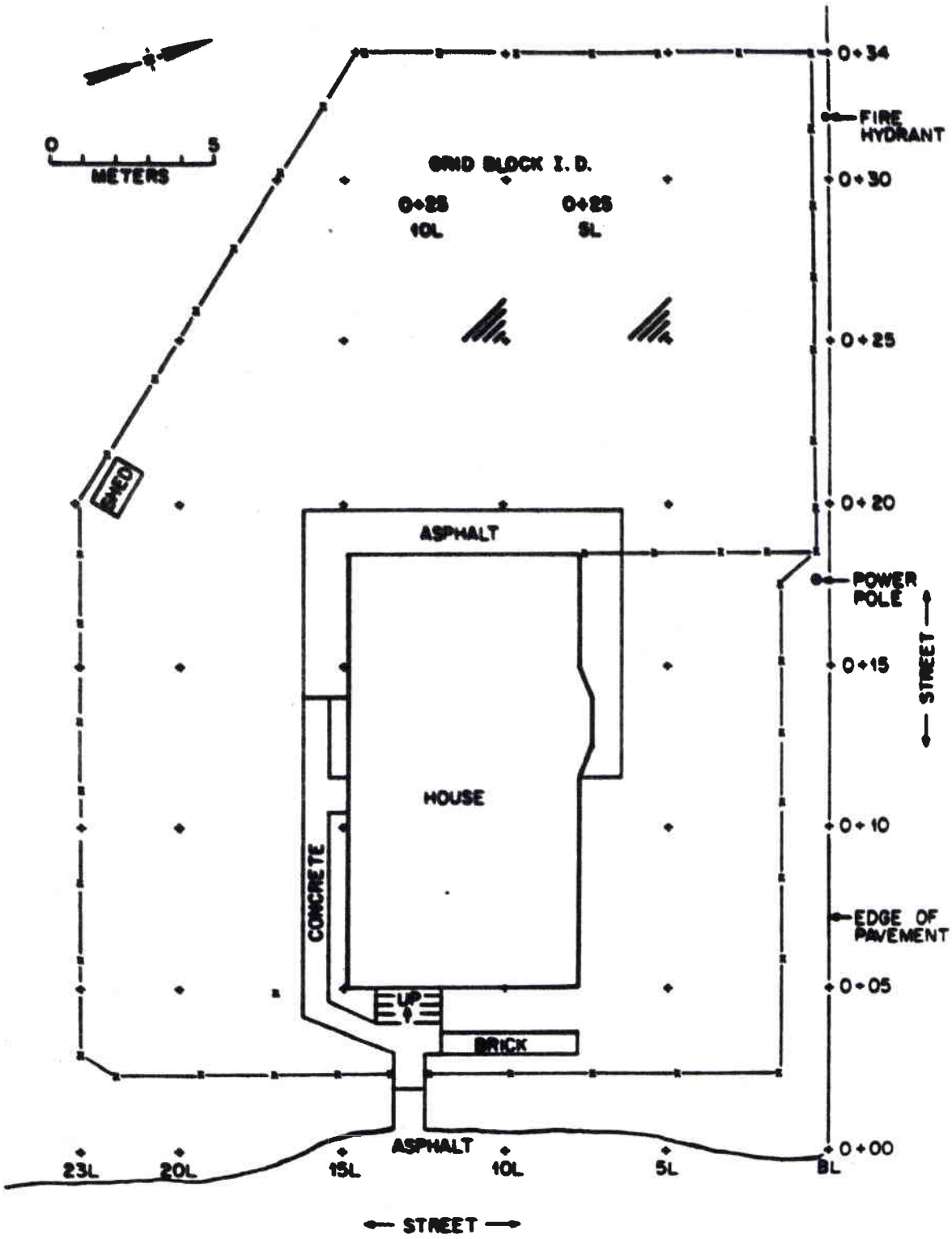

Fig. 1. Diagram showing grid point and grid block locations outdoors on property at 33 Palmer Avenue, Albany, New York (AL006).

Fig. 2. Front view of property at 33 Palmer Avenue, Albany, New York (AL006) looking west.

Fig. 3. Rear view of property at 33 Palmer Avenue, Albany, New York (AL006) looking east.

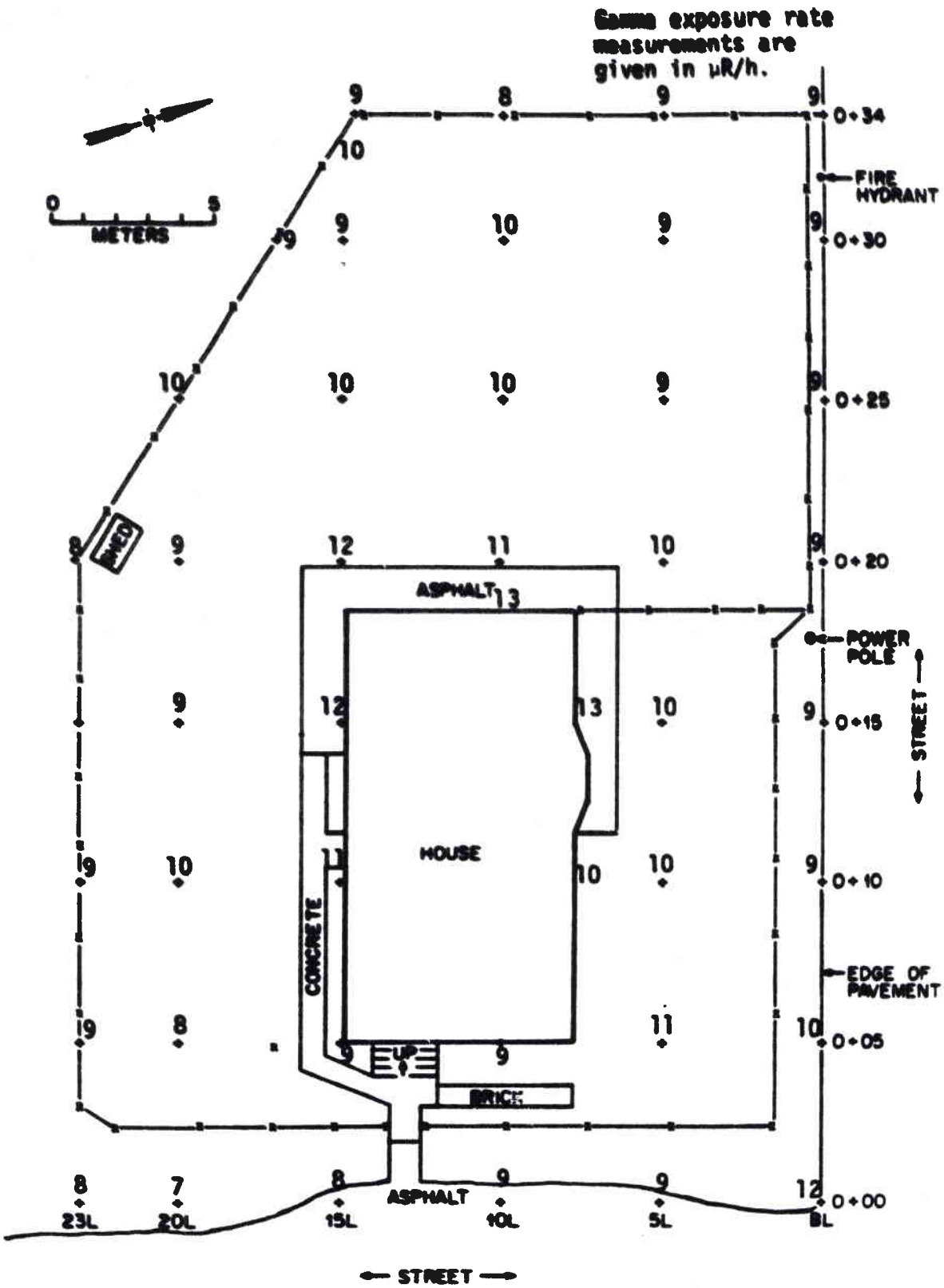

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on property at 33 Palmer Avenue, Albany, New York (AL006).

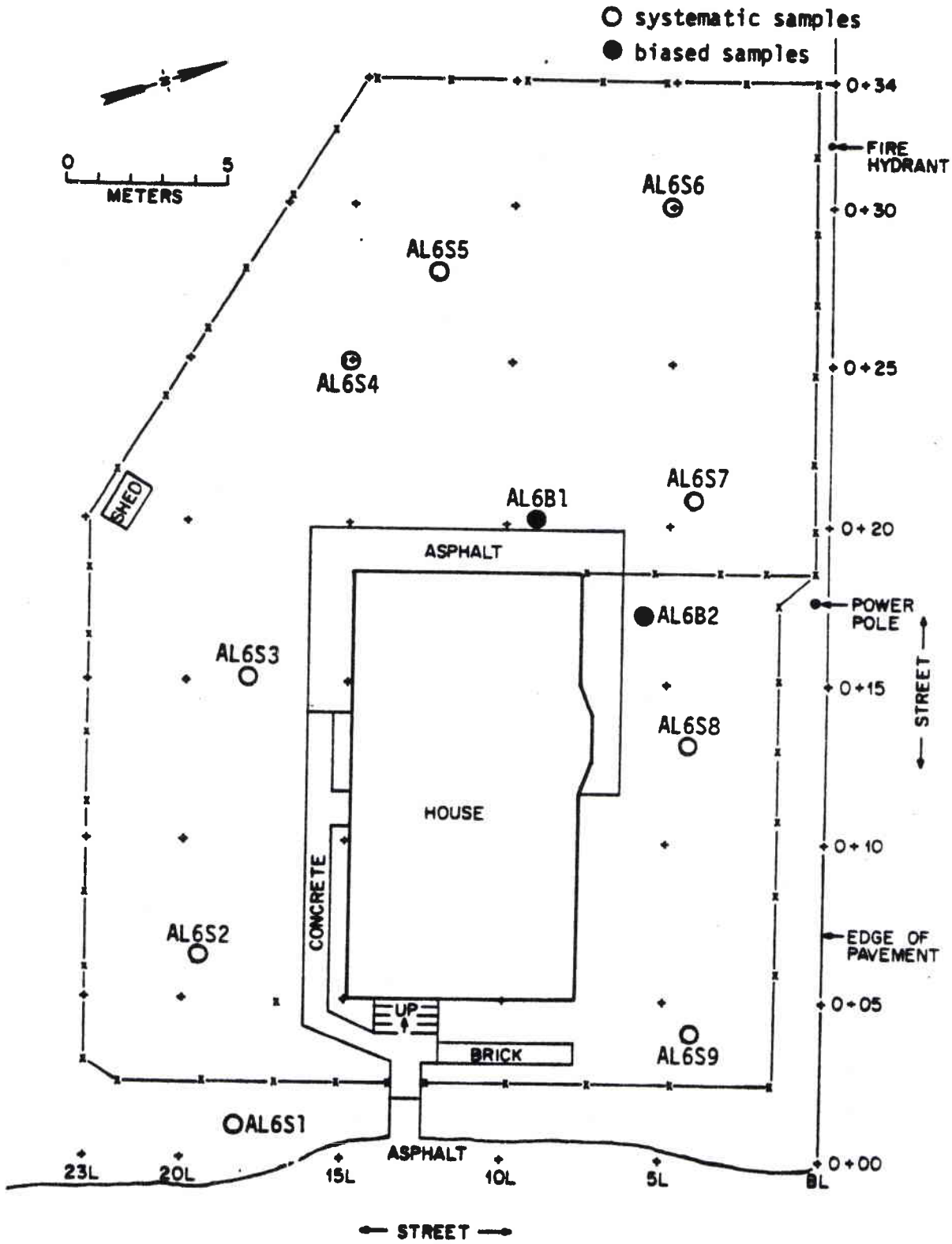

Fig. 5. Location of soil samples on property at 33 Palmer Avenue, Albany, New York (AL006).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.

[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Outdoor measurement results on property at 33 Palmer Avenue, Albany, New York (AL006)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rates during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	9	12	8-12
0+05, BL	9	10	10-12
0+10, BL	9	9	9-12
0+15, BL	9	9	9-12
0+20, BL	9	9	8-11
0+25, BL	9	9	8-11
0+30, BL	9	9	7-10
0+34, BL	8	9	—
0+00, 5L	9	9	8-13
0+05, 5L	10	11	8-11
0+10, 5L	10	10	10-17
0+15, 5L	10	10	10-18
0+20, 5L	10	10	10-12
0+25, 5L	8	9	8-10
0+30, 5L	9	9	8-10
0+34, 5L	8	9	—
0+10, 7.8L	10	10	—
0+15, 7.8L	13	13	—
0+00, 10L	9	9	8-10
0+05, 10L	9	9	—
0+10, 10L	e	e	—
0+15, 10L	e	e	—
0+18.5, 10L	10	13	—
0+20, 10L	11	11	10-12
0+25, 10L	10	10	8-11
0+30, 10L	10	10	8-10
0+34, 10L	8	8	—
0+34, 14.6L	9	9	—
0+00, 15L	8	8	7-11
0+05, 15L	9	9	7-11
0+10, 15L	10	11	8-11
0+15, 15L	11	12	8-14
0+20, 15L	12	12	8-12
0+25, 15L	10	10	8-10
0+30, 15L	9	9	8-10
0+32.5, 15L	10	10	—
0+30, 16.3L	9	9	—
0+25, 19.7L	9	10	—

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rates during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, 20L	7	7	7-11
0+05, 20L	8	8	7-10
0+10, 20L	10	10	7-10
0+15, 20L	9	9	7-10
0+20, 20L	8	9	8-10
0+00, 23L	8	8	—
0+05, 23L	9	9	—
0+10, 23L	9	9	—
0+15, 23L	e	e	—
0+20, 23L	8	8	—

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analyses on property at 33 Palmer Avenue, Albany, New York (AL006)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{238}U[b]	^{226}Ra[c]
		Systematic Samples[d]		
AL6S1A	0+01, 18L	0-5	9.3	0.74 ± 0.2
AL6S1B	0+01, 18L	5-15	5.8	
AL6S2A	0+6.5, 19L	0-5	9.2	
AL6S2B	0+6.5, 19L	5-15	3.8	0.64 ± 0.1
AL6S3A	0+15, 18L	0-5	8.1	0.71 ± 0.1
AL6S4A	0+25, 15L	0-5	18	0.58 ± 0.06
AL6S4B	0+25, 15L	5-15	3.8	
AL6S5A	0+28, 12L	0-5	21	0.62 ± 0.03
AL6S6A	0+30, 5L	0-5	21	
AL6S6B	0+30, 5L	5-15	1.9	
AL6S7A	0+21, 4L	0-5	9.8	0.49 ± 0.2
AL6S7B	0+21, 4L	5-15	2.3	
AL6S8A	0+13.5, 4L	0-5	35	0.66 ± 0.2
AL6S8B	0+13.5, 4L	5-15	1.8	
AL6S9A	0+04, 4L	0-5	28	0.76 ± 0.07
AL6S9C	0+04, 4L	23-30	3.4	
AL6S9D	0+04, 4L	45-50	1.4	0.63 ± 0.05
		Biased Samples[e]		
AL6B1A	0+20, 9L	0-5	28	1.0 ± 0.1
AL6B1B	0+20, 9L	5-15	4.9	1.7 ± 0.1
AL6B2A	0+17, 6L	0-5	120	0.72 ± 0.2
AL6B2B	0+17, 6L	5-18	7.2	0.72 ± 0.2

[a]Location indicated in Fig. 5.

[b]Total analytical error of results is less than ±3% (95% confidence level).

[c]Indicated counting error is at 95% confidence level (±2σ).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Summary of outdoor measurements and sample results on property at 33 Palmer Avenue, Albany, New York (AL006)

Measurement or sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	45	7-13	9
Gamma exposure rate at surface (μR/h)[a]	45	7-13	10
Scan, gamma exposure rate near surface (μR/h)[b]	—	7-18	—
Concentration of ^{238}U in soil (pCi/g), systematic locations[c]	17	1.4-35	11
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	4	4.9-120	40
Direct alpha activity on surface (dpm/100 cm^2), selected roof locations	2	14-42	28

[a]At grid points.

[b]Scan of entire property.

[c]Systematic samples, Table 3.

[d]Biased samples, Table 3.

Contract No. W-7405-eng-26

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 1144 CENTRAL AVENUE, COLONIE, NEW YORK (AL010)

March 1984

Work performed as part of the
RADIOLOGICAL SURVEY ACTIVITIES PROGRAM

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831
operated by
UNION CARBIDE CORPORATION
for the
U.S. DEPARTMENT OF ENERGY

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1144 CENTRAL AVENUE, COLONIE, NEW YORK (AL010)*

INTRODUCTION

In 1958, work with depleted uranium began at the National Lead Company's plant in Colonie, New York.[1] Beginning in 1961, the Atomic Energy Commission (AEC), its present successor, the Department of Energy (DOE), and other federal agencies have engaged in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contract, the work at the plant has been devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity since February 1980.

A number of properties in the Colonie/Albany area have been identified as being potentially contaminated with uranium originating from the National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 12 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period October 20-27, 1983. The property at 1144 Central Avenue in Colonie, New York (AL010) was the subject of a radiological investigation during the period October 25-27, 1983.

This property consisted of a two-story wood-frame house to the rear of which is an asphalt pad. A diagram of the property showing the approximate property boundaries and grid network established for measurements outside the house is shown in Fig. 1. The rectangularly shaped lot included in the radiological survey was approximately 118 m deep by 16 m wide. The house on the north end of the lot was the only onsite structure. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

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*This 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 W-7405-eng-26.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Reference 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha activity measurements on the house roof. A comprehensive description of the survey methods and instrumentation have been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. This data is 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 substracted from radionuclide concentrations in soil samples.

Gamma Measurements

Results of grid point/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 7 to 23 μR/h and averaged 13 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 7 to 29 μR/h and averaged 15 μR/h. For comparison, typical background radiation levels at 1 m above ground surface in the Albany area range from 8 to 10 μR/h and average 9 μR/h.

As can be observed in Fig. 4, the generally elevated gamma radiation levels increased with proximity to the location of the alleged emission source at the National Lead Company plant. Accordingly, the highest radiation levels were measured in the southwest end of the lot. The maximum

exposure rate observed during scanning the ground surface was 31 μR/h (grid block 1+12, 8R). It was noted that elevated gamma exposure rates measured beneath the crown of a large tree (located near grid point 0+80, 8R) ranged from 19 to 26 μR/h.

Soil Sampling

Fifty-one soil samples were taken on this property. Thirty-one of these soil samples were taken at 15 locations that were chosen irrespective of gamma radiation levels (denoted systematic soil samples — AL10S); twenty soil samples were taken at eight locations biased with respect to elevated gamma radiation measurements (denoted biased soil samples — AL10B). The sample locations are shown in Fig. 5, and the results of radionuclide analyses are given in Table 3. A concentration of ^{238}U is provided for each soil sample. Concentrations of ^{226}Ra were measured in several selected soil samples to confirm that ^{226}Ra concentrations were within typical background levels.

Concentrations of ^{238}U in systematic soil samples ranged from 0.56 to 310 pCi/g. At each location, samples were taken from 0 to 5 cm in depth and 5 to 15 cm in depth. Concentrations of ^{238}U were approximately four to sixty times higher in soil samples collected in the top 5 cm. The maximum concentration of ^{238}U in a systematic soil sample (310 pCi/g) was measured in a sample taken from a depth of 0-5 cm (AL10S15A). The ^{238}U concentration in the soil sample taken below sample AL10S15A (AL10S15B), from 5-15 cm, dropped to 7.5 pCi/g.

The maximum concentration of ^{238}U in soil, 740 pCi/g, was measured in biased sample AL10B7A. This sample was collected next to the fence in the extreme southwest corner of the property from the upper 5 cm of soil. The ^{238}U concentration in the sample taken beneath sample AL10B7A (AL10B7B), from 5 to 15 cm in depth, was 10 pCi/g.

Biased soil sample AL10B4A was taken from a depth of 0-5 cm at a location of the maximum gamma exposure rate measured beneath the crown of the large tree. The concentrations of ^{238}U in this sample and the sample taken below it (AL10B4B), from 5-15 cm, were 160 and 13 pCi/g, respectively.

It is evident from the results of the soil sample analyses that ^{238}U concentrations in the top few centimeters of soil are substantially elevated above the average background level (0.96 pCi/g). These elevated ^{238}U concentrations quickly decrease with increasing depth in soil. The highest concentrations of ^{238}U are observed at the southwest end of the property and in the area adjacent to the asphalt pad which is located in the north central portion of the lot.

Alpha Measurements

Direct alpha activity measurements were taken on selected areas of the house roof which was approximately five years old at the time of the survey. The activities ranged from 14 to 63 dpm/100 cm^2 and averaged 35 dpm/100 cm^2. This average level is slightly above the typical background level for roofs of that type (30 dpm/100 cm^2).

SIGNIFICANCE OF FINDINGS

A summary of the outdoor measurement results of the radiological survey conducted on this property is provided in Table 4. These results establish that elevated concentrations of ^{238}U are present on the property. Gamma exposure rates were within the range of typical background levels on the northeastern quarter of the lot, becoming increasingly elevated toward the southwestern end. Concentrations of ^{238}U in all surface soil samples (0-5 cm) substantially exceeded the average background level. Direct alpha activity measurements taken on the roof averaged slightly above typical background and indicated the presence of minimal ^{238}U surface contamination.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).
2. *A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program*, DOE/EV-0097A (September 1980).
3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).
4. H. W. Jeter and D. M. Eagleson, *A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes*, IWL-9488-461 (October 31, 1980).
5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).
6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, *Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program*, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).
7. T. E. Myrick, B. A. Berven, and F. F. Haywood, *State Background Radiation Levels: Results of Measurements Taken During 1975-1979*, ORNL/TM-7343 (November 1981).

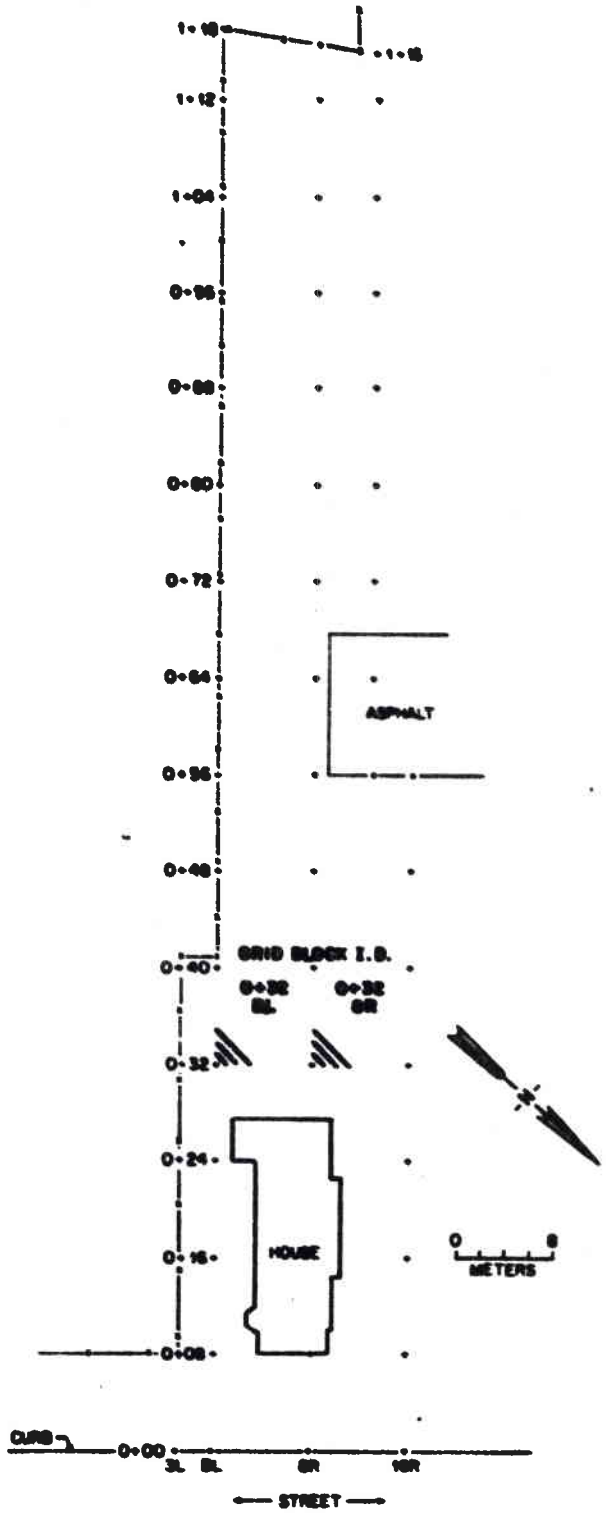

Fig. 1. Diagram showing grid point and grid block locations outdoors on property at 1144 Central Avenue, Colonie, New York (AL010).

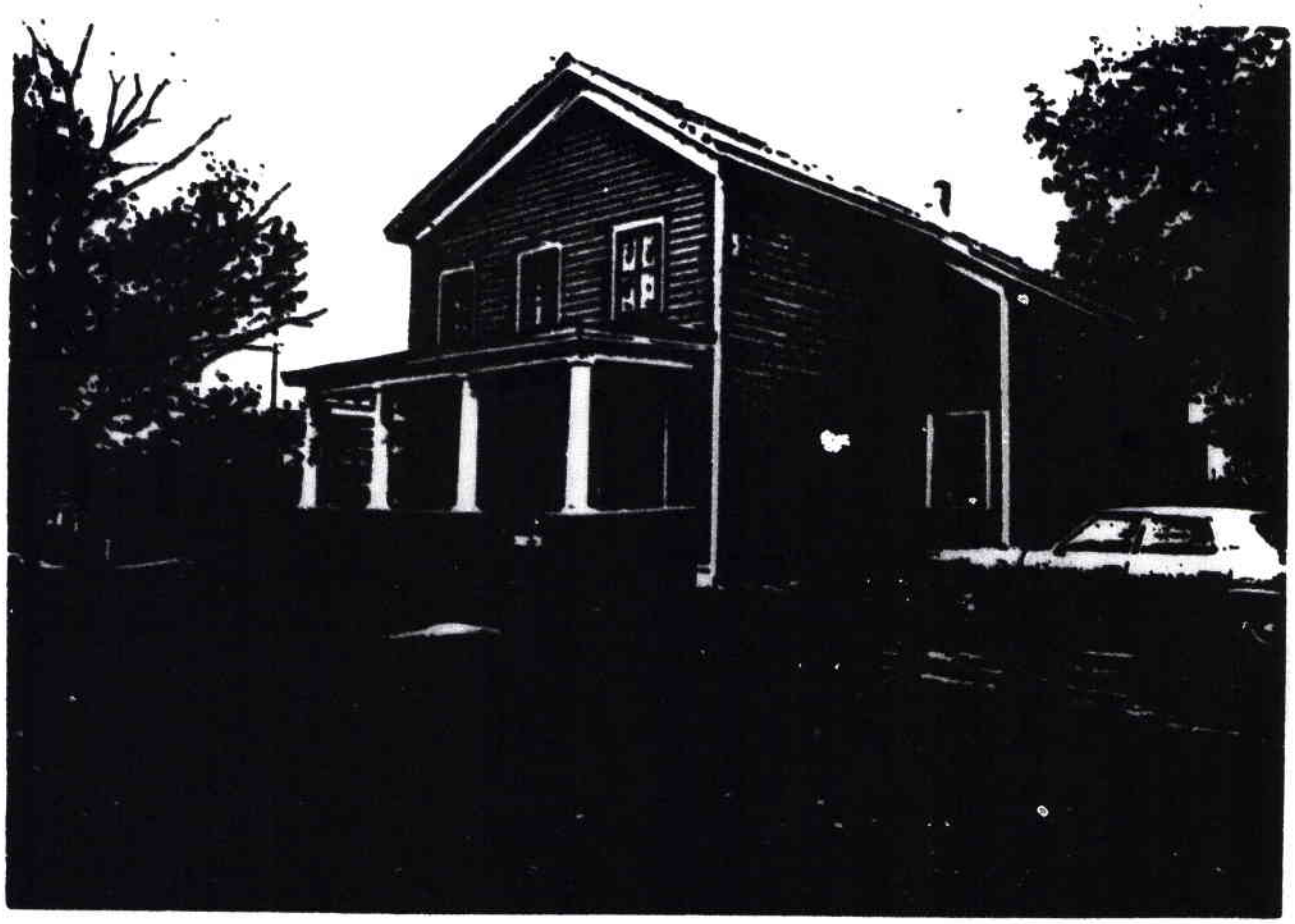

Fig. 2. Front view of property at 1144 Central Avenue, Colonie, New York (AL010) looking south.

Fig. 3. Rear view of property at 1144 Central Avenue, Colonie, New York (AL010) looking northeast.

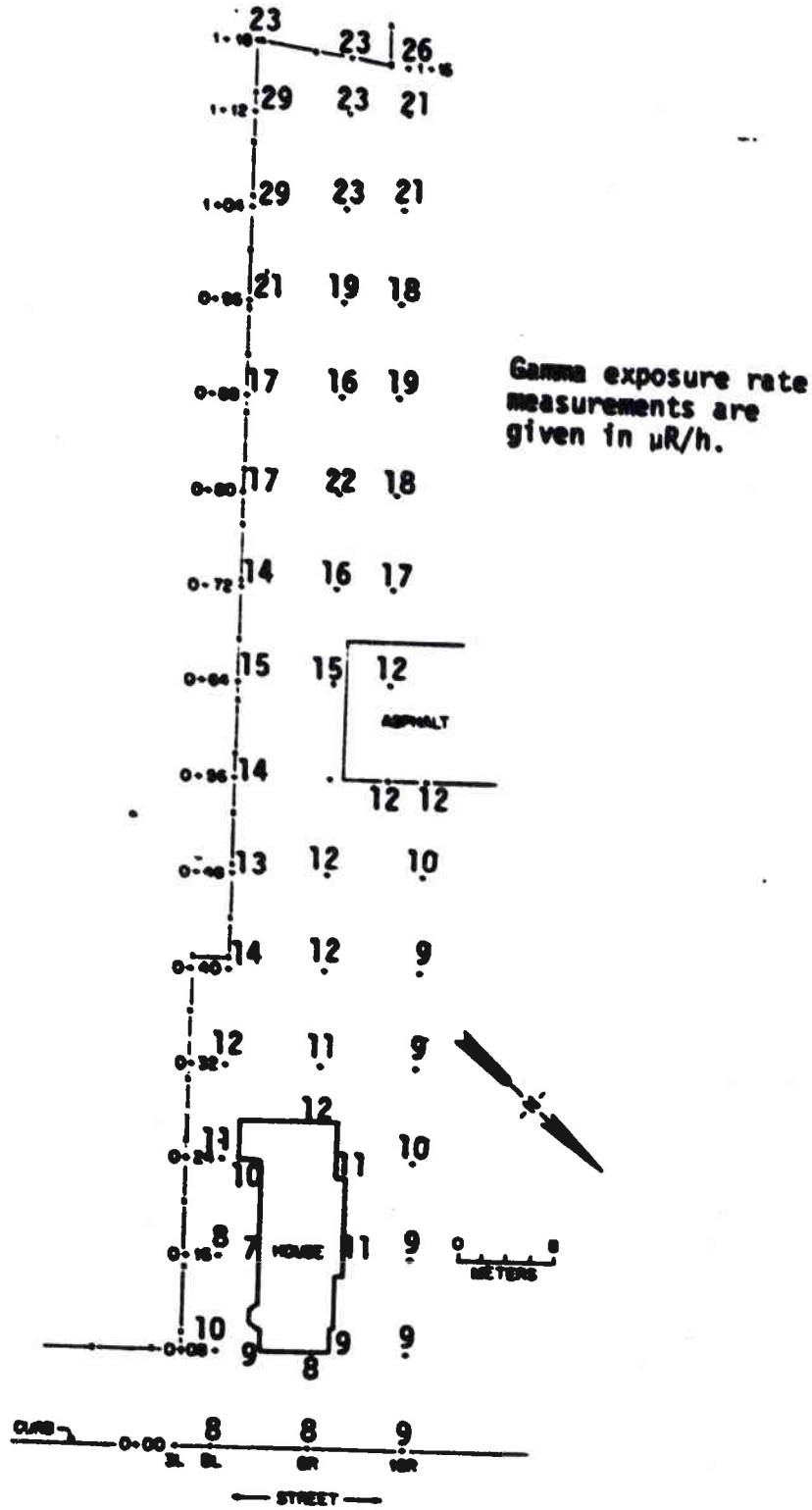

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on property at 1144 Central Avenue, Colonie, New York (AL010).

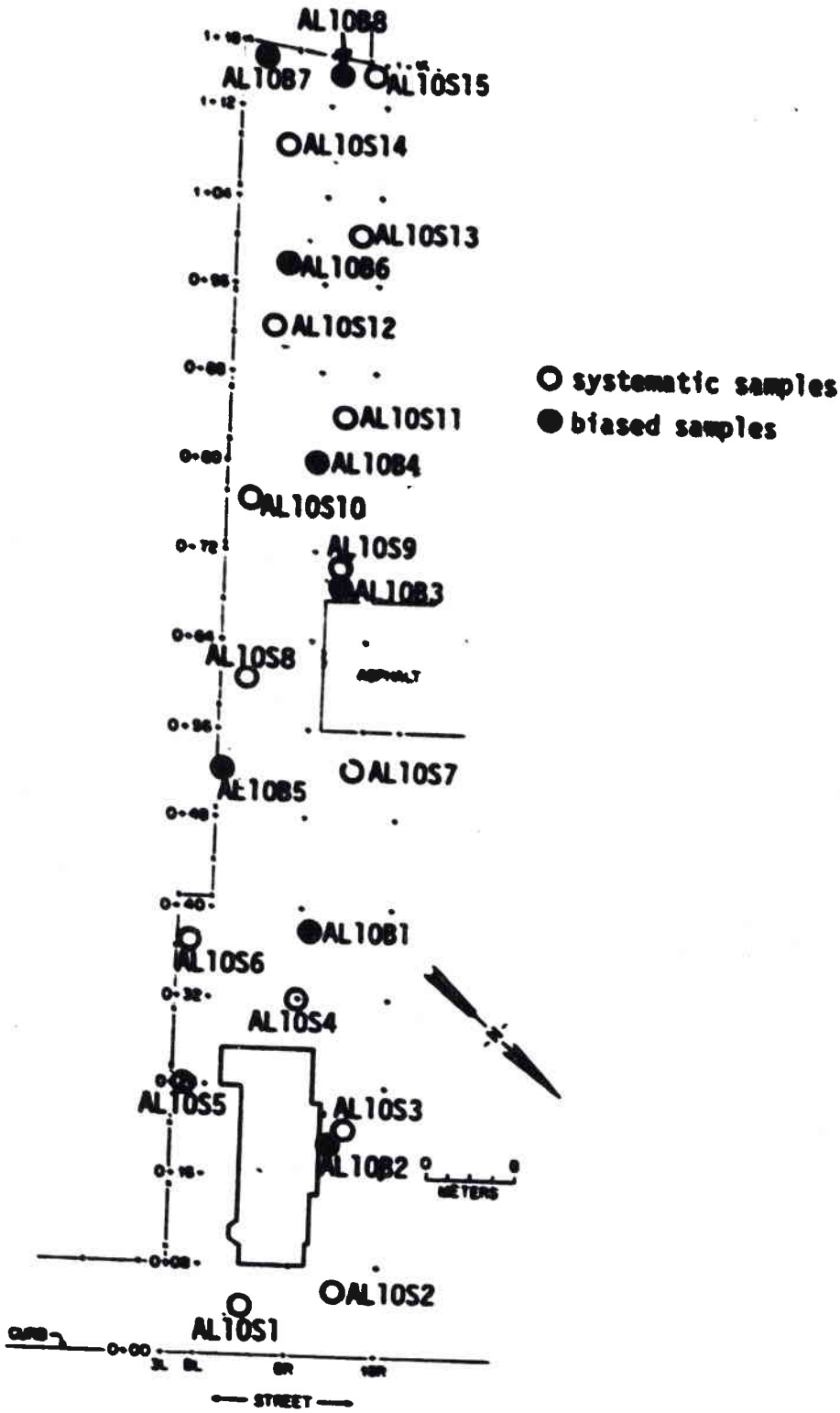

Fig. 5. Location of soil samples on property at 1144 Central Avenue, Colonie, New York (AL010).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.

[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Outdoor measurement results on property at 1144 Central Avenue, Colonie, New York (AL010)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rates during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	8	8	7-11
0+08, BL	10	10	8-12
0+16, BL	8	8	8-12
0+24, BL	10	10	10-14
0+32, BL	12	12	11-15
0+40, BL	13	14	11-15
0+48, BL	13	13	10-16
0+56, BL	14	14	12-16
0+64, BL	15	15	12-16
0+72, BL	14	14	12-26
0+80, BL	17	17	12-26
0+88, BL	17	17	12-23
0+96, BL	17	21	17-26
1+04, BL	23	29	21-29
1+12, BL	21	29	23-29
1+18, BL	21	23	—
0+16, 3.4R	8	7	—
0+24, 3.4R	10	10	—
0+08, 3.6R	8	9	—
0+00, 8R	7	8	7-10
0+08, 8R	8	8	7-13
0+16, 8R	e	e	8-14
0+24, 8R	e	e	9-16
0+27.5, 8R	10	12	—
0+32, 8R	10	11	7-16
0+40, 8R	12	12	9-15
0+48, 8R	12	12	9-15
0+56, 8R	13	14	12-23
0+64, 8R	15	15	10-26
0+72, 8R	16	16	13-26
0+80, 8R	19	22	16-26
0+88, 8R	15	16	14-19
0+96, 8R	19	19	16-23
1+04, 8R	23	23	21-26
1+12, 8R	21	23	23-31
1+16.6, 8R	21	23	—
0+08, 9.5R	9	9	—
0+24, 10R	9	11	—
0+16, 10.2R	10	11	—

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rates during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+56, 12.8R	12	12	–
0+64, 12.8R	12	12	–
0+72, 12.8R	16	17	–
0+80, 12.8R	17	18	–
0+88, 12.8R	17	19	–
0+96, 12.8R	18	18	–
1+04, 12.8R	18	21	–
1+12, 12.8R	17	21	–
1+16, 12.8R	21	26	–
0+00, 16R	7	9	–
0+08, 16R	7	9	–
0+16, 16R	9	9	–
0+24, 16R	9	10	–
0+32, 16R	9	9	–
0+40, 16R	9	9	–
0+48, 16R	9	10	–
0+56, 16R	12	12	–

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analyses on property at 1144 Central Avenue, Colonie, New York (AL010)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{238}U[b]	^{226}Ra[c]
		Systematic Samples[d]		
AL10S1A	0+04, 4R	0-5	34	0.56 ± 0.08
AL10S1B	0+04, 4R	5-15	1.3	
AL10S2A	0+06, 12R	0-5	21	
AL10S2B	0+06, 12R	5-15	2.4	0.58 ± 0.08
AL10S2C	0+06, 12R	30-35	0.86	
AL10S3A	0+20, 12R	0-5	3.4	1.3 ± 0.2
AL10S3B	0+20, 12R	5-15	0.56	
AL10S4A	0+32, 8R	0-5	41	
AL10S4B	0+32, 8R	5-15	1.0	0.58 ± 0.03
AL10S5A	0+24, 2L	0-5	24	
AL10S5B	0+24, 2L	5-15	4.4	
AL10S6A	0+37, 2L	0-5	84	1.2 ± 0.3
AL10S6B	0+37, 2L	5-15	5.8	
AL10S7A	0+52, 12R	0-5	50	
AL10S7B	0+52, 12R	5-15	14	0.62 ± 0.1
AL10S8A	0+60, 2R	0-5	51	0.49 ± 0.1
AL10S8B	0+60, 2R	5-15	4.0	
AL10S9A	0+69, 10R	0-5	81	0.54 ± 0.2
AL10S9B	0+69, 10R	5-15	2.3	
AL10S10A	0+76, 2R	0-5	110	
AL10S10B	0+76, 2R	5-15	1.8	
AL10S11A	0+84, 10R	0-5	52	
AL10S11B	0+84, 10R	5-15	6.3	
AL10S12A	0+92, 3R	0-5	15	0.48 ± 0.09
AL10S12B	0+92, 3R	5-15	0.80	
AL10S13A	1+00, 11R	0-5	140	
AL10S13B	1+00, 11R	5-15	3.7	0.44 ± 0.05
AL10S14A	1+08, 4R	0-5	99	
AL10S14B	1+08, 4R	5-15	2.4	
AL10S15A	1+15, 12R	0-5	310	
AL10S15B	1+15, 12R	5-15	7.5	
		Biased Samples[e]		
AL10B1A	0+38, 9R	0-5	10	2.5 ± 0.2
AL10B1B	0+38, 9R	5-15	6.4	
AL10B1C	0+38, 9R	10-18	1.1	0.58 ± 0.09
AL10B2A	0+19, 10.4R	0-5	46	0.57 ± 0.05
AL10B2B	0+19, 10.4R	5-15	5.9	

Table 3 (continued)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{238}U[b]	^{226}Ra[c]
AL1083	0+68, 10R	0-3	370	0.65 ± 0.05
AL1084A	0+80, 8R	0-5	160	0.47 ± 0.03
AL1084B	0+80, 8R	5-15	13	
AL1084C	0+80, 8R	30-35	4.6	0.41 ± 0.09
AL1085A	0+52, 8R	0-5	96	0.86 ± 0.07
AL1085B	0+52, 8R	5-15	2.0	
AL1085C	0+52, 8R	15-25	2.3	
AL1085D	0+52, 8R	25-30	1.8	1.6 ± 0.3
AL1086A	0+97, 5R	0-5	150	
AL1086B	0+97, 5R	5-15	56	
AL1087A	1+17, 2R	0-5	740	<0.23
AL1087B	1+17, 2R	5-15	10	
AL1088A	1+16.5, 9.5R	0-5	260	<0.56
AL1088B	1+16.5, 9.5R	5-15	7.0	
AL1088C	1+16.5, 9.5R	40-45	2.9	0.51 ± 0.2

[a]Location indicated in Fig. 5.

[b]Total analytical error of results is less than ±3% (95% confidence level).

[c]Indicated counting error is at 95% confidence level (±2σ).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Summary of outdoor measurements and sample results on property at 1144 Central Avenue, Colonie, New York (AL010)

Measurement or sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	54	7-23	13
Gamma exposure rate at surface (μR/h)[a]	54	7-29	15
Scan, gamma exposure rate near surface (μR/h)[b]	—	7-31	-
Concentration of ^{238}U in soil (pCi/g), systematic locations[c]	31	0.56-310	38
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	20	1.1-740	97
Direct alpha activity on surface (dpm/100 cm^2), selected roof locations	3	14-63	35

[a]At grid points.

[b]Scan of entire property.

[c]Systematic samples, Table 3.

[d]Biased samples, Table 3.

Contract No. W-7405-eng-26

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 1144A CENTRAL AVENUE, COLONIE, NEW YORK (AL011)

March 1984

Work performed as part of the
RADIOLOGICAL SURVEY ACTIVITIES PROGRAM

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831
operated by
UNION CARBIDE CORPORATION
for the
U.S. DEPARTMENT OF ENERGY

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1144A CENTRAL AVENUE, COLONIE, NEW YORK (AL011)*

INTRODUCTION

In 1958, work with depleted uranium began at the National Lead Company's plant in Colonie, New York.[1] Beginning in 1961, the Atomic Energy Commission (AEC), its present successor, the Department of Energy (DOE), and other federal agencies have engaged in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contract, the work at the plant has been devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity since February 1980.

A number of properties in the Colonie/Albany area have been identified as being potentially contaminated with uranium originating from the National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 12 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period October 20-27, 1983. The property at 1144A Central Avenue in Colonie, New York (AL011) was the subject of a radiological investigation on October 26 and 27, 1983.

This property consisted of a two-story concrete block and wood-frame house with an asphalt pad adjacent to the east side of the house. The rear of the lot was fenced; a small area was partially covered with plastic panels. A diagram of the property showing the approximate property boundaries and grid network established for measurements outside the house is shown in Fig. 1. The rectangularly shaped lot included in the radiological survey was approximately 65 m deep by 17 m wide. The house on the north end of the lot was the only onsite structure. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

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*This 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 W-7405-eng-26.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Reference 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha activity measurements on the building roof. A comprehensive description of the survey methods and instrumentation have been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. This data is 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 substracted from radionuclide concentrations in soil samples.

Gamma Measurements

Results of grid point/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 10 to 19 μR/h and averaged 14 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 11 to 21 μR/h and averaged 15 μR/h. For comparison, typical background radiation levels at 1 m above ground surface in the Albany area range from 8 to 10 μR/h and average 9 μR/h.

As can be observed in Fig. 4, gamma radiation levels were generally elevated throughout the property. The highest radiation levels were measured in those areas on the south and west sides of the house, and along the southern and western boundaries of the property. The maximum exposure rate observed during scanning the ground surface was 44 μR/h (grid block

0+08, 8R). The elevated radiation levels measured in areas adjacent to the house appeared to be associated with the drip lines from the roof of the structure.

Soil Sampling

Twenty-seven soil samples were taken on this property. Eighteen of these soil samples were taken at eight locations that were chosen irrespective of gamma radiation levels (denoted systematic soil samples – AL11S); nine soil samples were taken at four locations biased with respect to elevated gamma radiation measurements (denoted biased soil samples – AL11B). The sample locations are shown in Fig. 5, and the results of radionuclide analyses are given in Table 3. A concentration of ^{238}U is provided for each soil sample. Concentrations of ^{226}Ra were measured in several selected soil samples to confirm that ^{226}Ra concentrations were within typical background levels.

Concentrations of ^{238}U in systematic soil samples ranged from 0.50 to 110 pCi/g. At each location, samples were taken from 0 to 5 cm in depth and 5 to 15 cm in depth. Concentrations of ^{238}U were approximately three to ninety times higher in soil samples collected in the top 5 cm. The maximum concentration of ^{238}U in systematic soil samples (150 pCi/g) was measured in two samples taken from a depth of 0-5 cm (AL11S2A and AL11S3A). In the soil samples taken below those samples, from 5-15 cm, the ^{238}U concentration dropped to an average of 2.8 pCi/g.

The highest concentration of ^{238}U in soil, 850 pCi/g, was measured in biased sample AL11B4A. This sample was collected along the drip line of the house roof in the upper 5 cm of soil. The ^{238}U concentration in the sample taken beneath that sample (AL11B4B), at 5 to 15 cm in depth, was 58 pCi/g.

It is evident from the results of the soil sample analyses that ^{238}U concentrations in the top few centimeters of soil are substantially elevated above the average background level (0.96 pCi/g). These elevated ^{238}U concentrations quickly decrease with increasing depth in soil. The highest concentrations of ^{238}U were observed along the western drip line of the house roof and in the extreme southwest portion of the property.

Alpha Measurements

Direct alpha activity measurements were taken on selected areas of the roof on the house. The activities ranged from 130 to 880 dpm/100 cm^2 and averaged 170 dpm/100 cm^2. These levels are all above the typical background level for roofs of that type (30 dpm/100 cm^2).

SIGNIFICANCE OF FINDINGS

A summary of the outdoor measurement results of the radiological survey conducted on this property is provided in Table 4. These results establish that elevated concentrations of ^{238}U are present on the property. Gamma exposure rates were generally elevated throughout the lot. Concentrations of ^{238}U in all surface soil samples (0-5 cm) substantially exceeded the average background level. Direct alpha activity measurements taken on the roof were all above typical background and indicated the presence of ^{238}U surface contamination.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).
2. *A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program*, DOE/EV-0097A (September 1980).
3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).
4. H. W. Jeter and D. M. Eagleson, *A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes*, IWL-9488-461 (October 31, 1980).
5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).
6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, *Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program*, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).
7. T. E. Myrick, B. A. Berven, and F. F. Haywood, *State Background Radiation Levels: Results of Measurements Taken During 1975-1979*, ORNL/TM-7343 (November 1981).

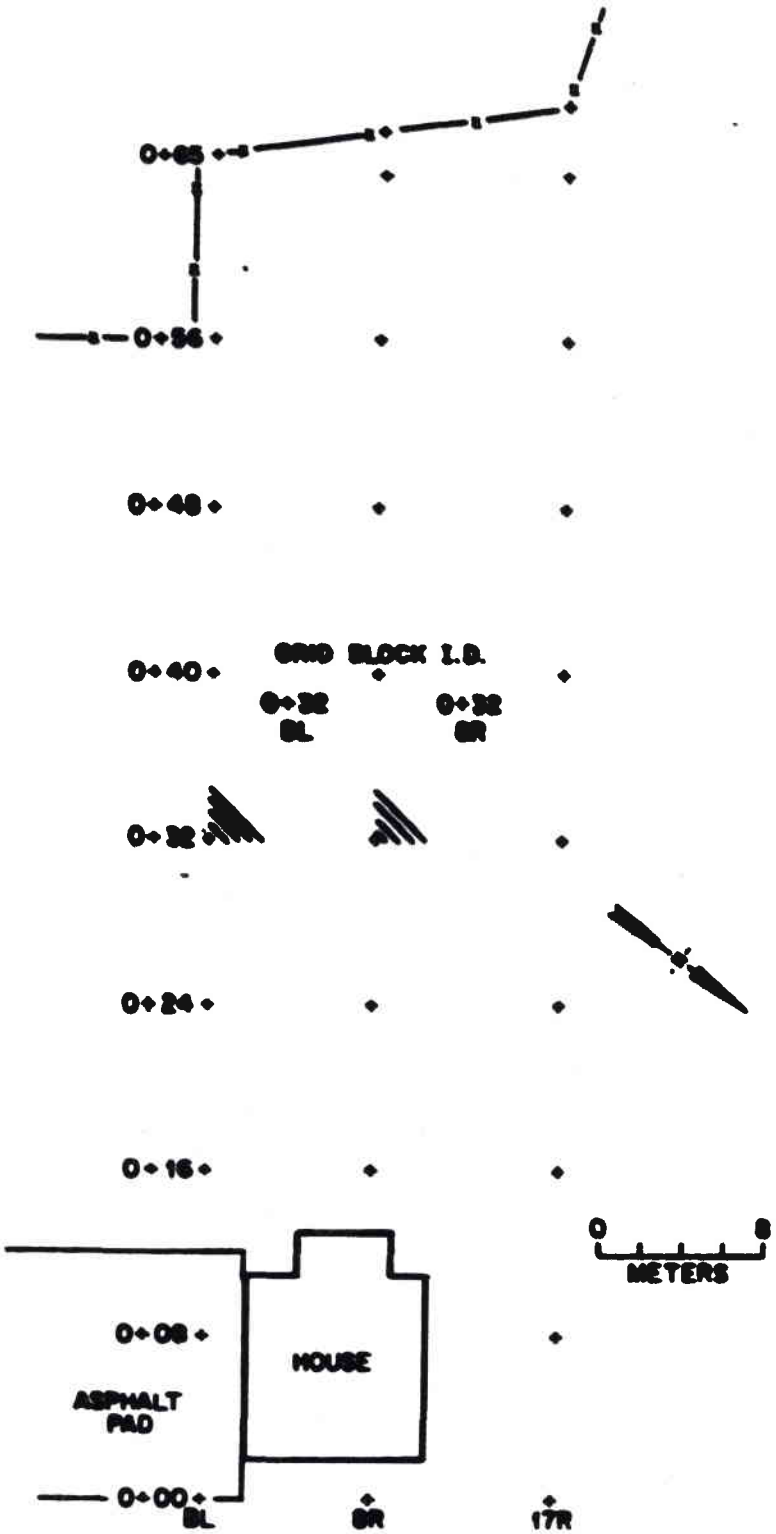

Fig. 1. Diagram showing grid point and grid block locations outdoors on property at 1144A Central Avenue, Colonie, New York (AL011).

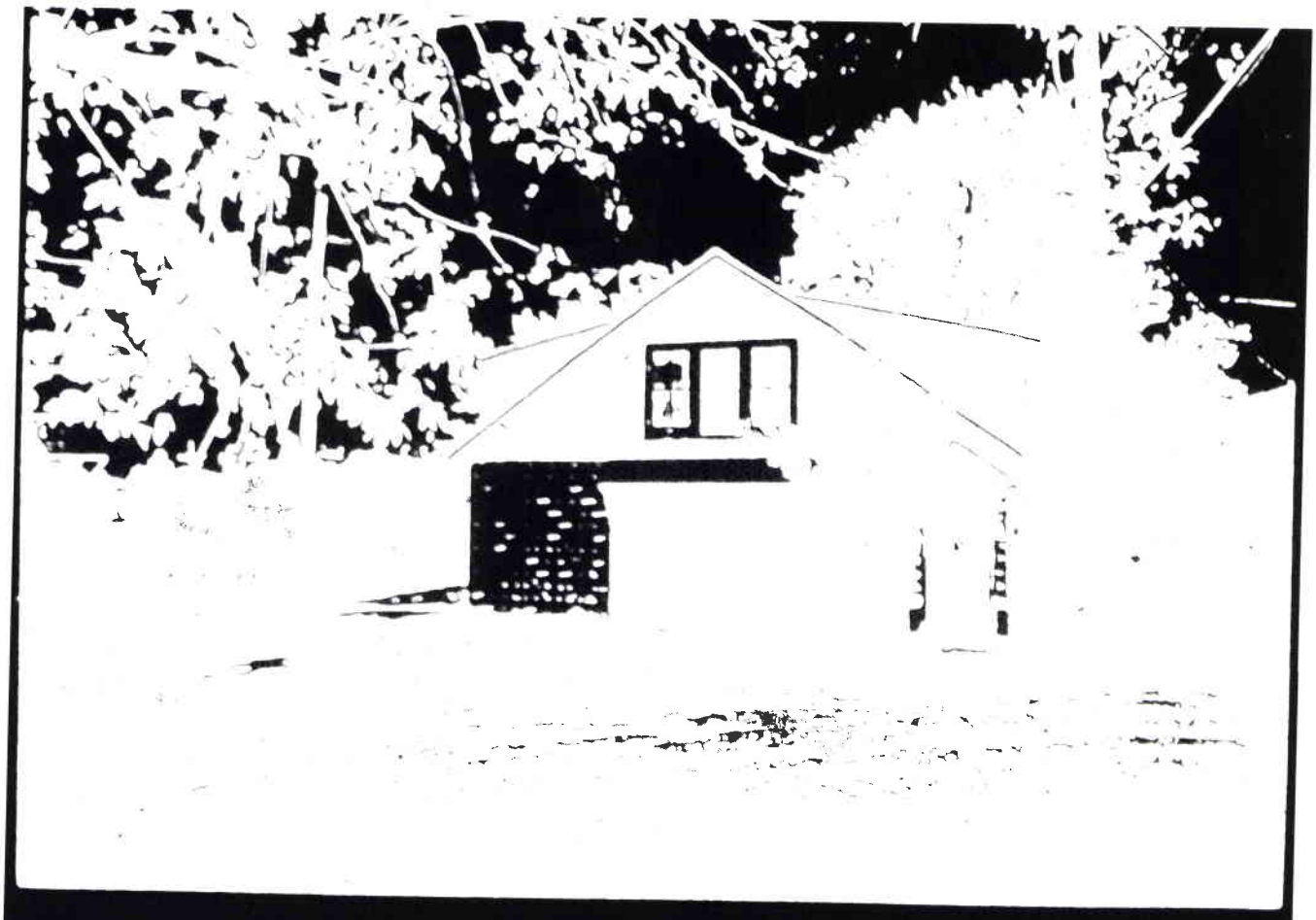

Fig. 2. Front view of property at 1144A Central Avenue, Colonie, New York (AL011) looking southwest.

Fig. 3. Rear view of property at 1144A Central Avenue, Colonie, New York (AL011) looking northeast.

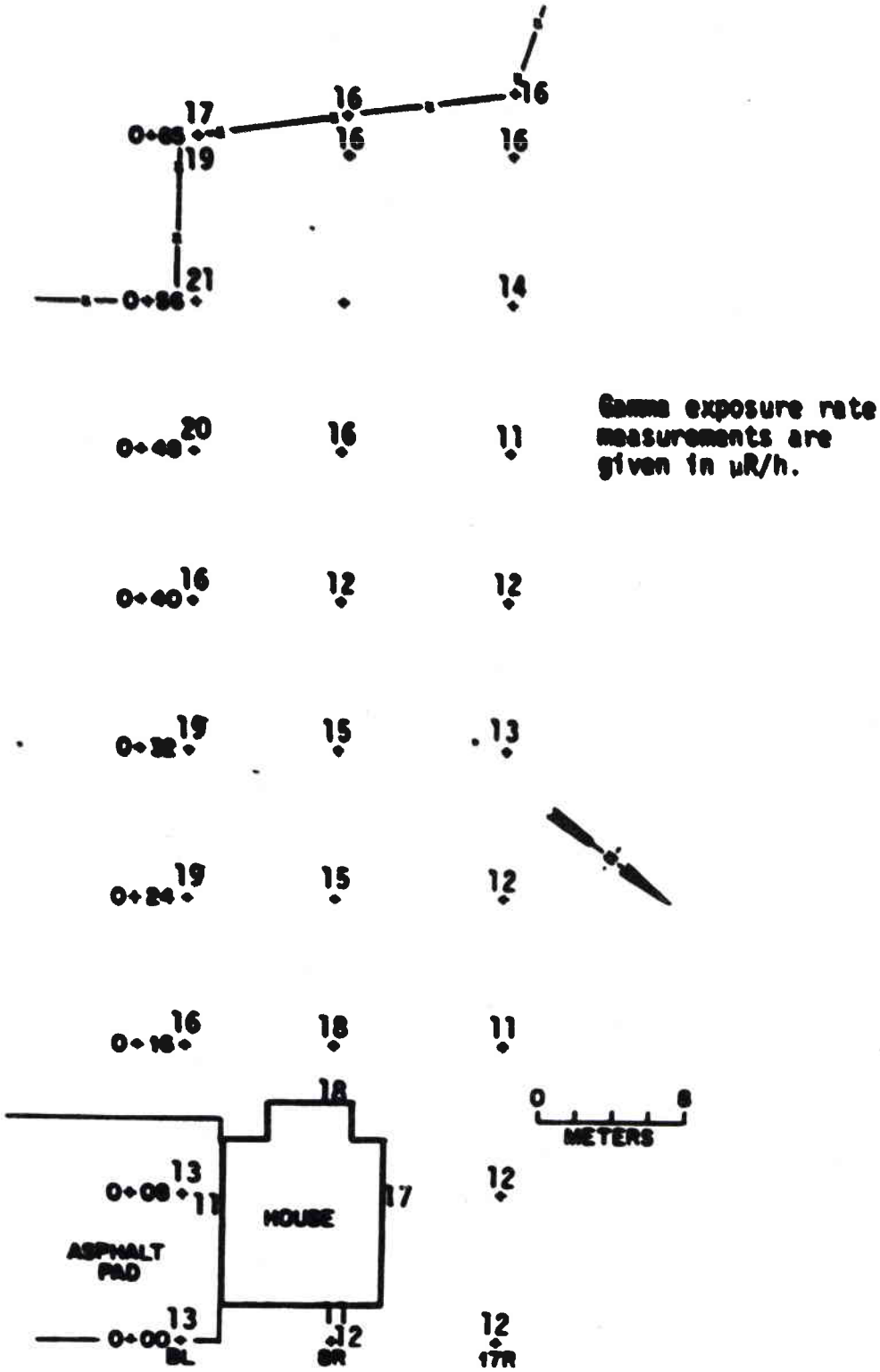

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on property at 1144A Central Avenue, Colonie, New York (AL011).

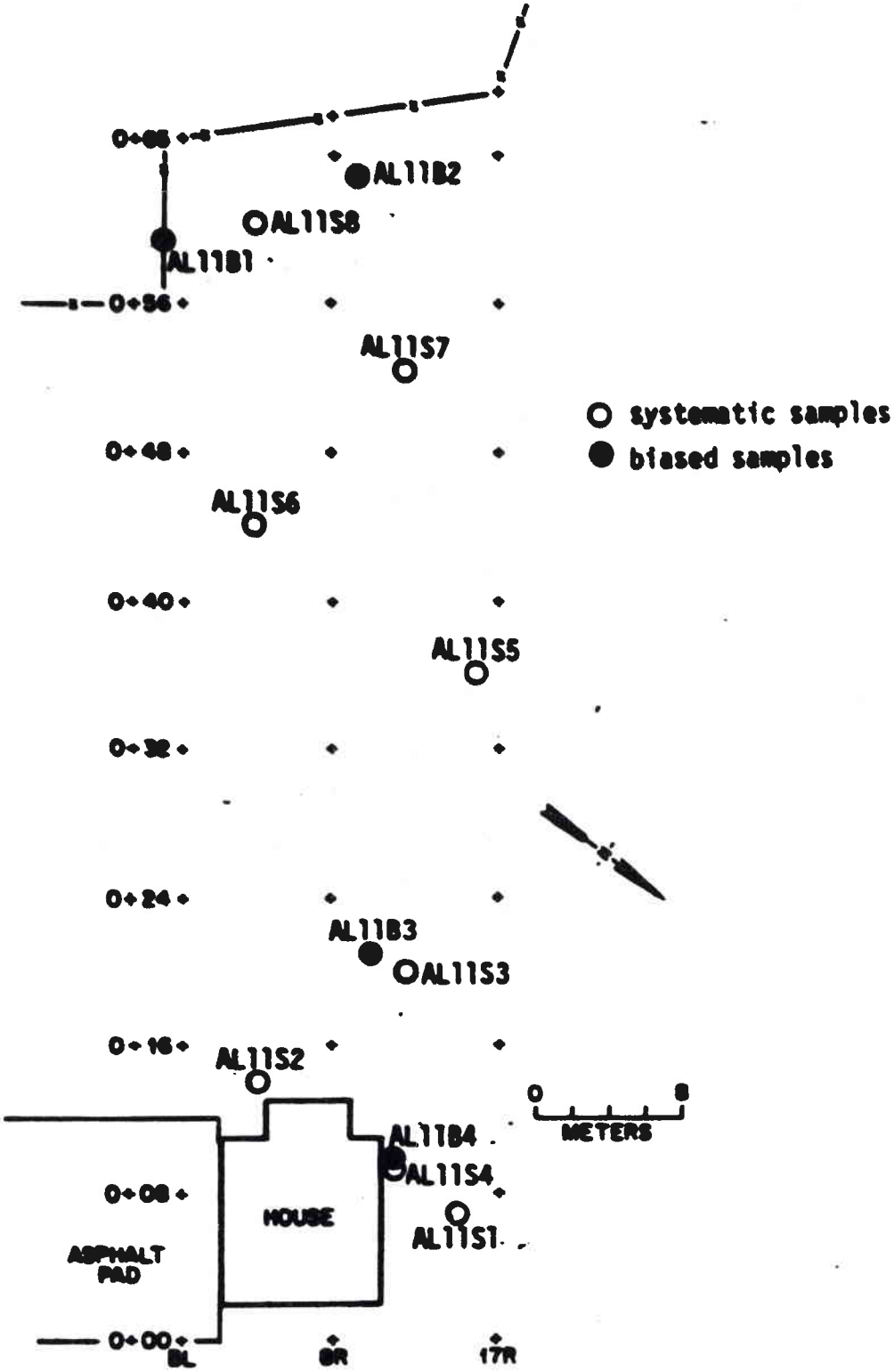

Fig. 5. Location of soil samples on property at 1144A Central Avenue, Colonie, New York (AL011).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.

[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.

Table 2. Outdoor measurement results on property at 1144A Central Avenue, Colonie, New York (AL011)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rates during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, 8L	12	13	10-16
0+08, 8L	12	13	12-26
0+16, 8L	16	16	14-21
0+24, 8L	18	19	14-21
0+32, 8L	16	19	10-19
0+40, 8L	16	16	14-21
0+48, 8L	19	20	14-20
0+56, 8L	18	21	16-31
0+64, 8L	16	19	16-26
0+65, 8L	16	17	—
0+08, 2R	11	11	—
0+00, 8R	11	12	10-31
0+02, 8R	10	11	—
0+08, 8R	e	e	10-44
0+13, 8R	14	18	—
0+16, 8R	16	18	10-26
0+24, 8R	15	15	12-21
0+32, 8R	13	15	10-17
0+40, 8R	13	12	11-18
0+48, 8R	15	16	13-21
0+56, 8R	e	e	14-31
0+64, 8R	16	16	14-31
0+65, 8R	16	16	—
0+08, 10.7R	16	17	—
0+00, 17R	12	12	—
0+08, 17R	12	12	—
0+16, 17R	12	11	—
0+24, 17R	13	12	—
0+32, 17R	13	13	—
0+40, 17R	12	12	—
0+48, 17R	12	11	—
0+56, 17R	14	14	—
0+64, 17R	14	16	—
0+67.5, 17R	15	16	—

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analyses on property at 1144A Central Avenue, Colonie, New York (AL011)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{238}U[b]	^{226}Ra[c]
		Systematic Samples[d]		
AL11S1A	0+07, 15R	0-5	58	0.54 ± 0.08
AL11S1B	0+07, 15R	5-15	23	
AL11S1C	0+07, 15R	15-25	13	2.5 ± 0.4
AL11S2A	0+14, 4R	0-5	150	0.92 ± 0.4
AL11S2B	0+14, 4R	5-15	4.0	
AL11S3A	0+20, 12R	0-5	150	0.52 ± 0.09
AL11S3B	0+20, 12R	5-15	1.6	
AL11S4A	0+09, 11R	0-5	100	0.53 ± 0.04
AL11S4B	0+09, 11R	5-15	6.1	
AL11S4C	0+09, 11R	60-70	0.50	0.57 ± 0.03
AL11S5A	0+36, 16R	0-5	40	
AL11S5B	0+36, 16R	5-15	2.7	
AL11S6A	0+44, 4R	0-5	130	
AL11S6B	0+44, 4R	5-15	4.5	0.45 ± 0.07
AL11S7A	0+52, 12R	0-5	130	0.49 ± 0.03
AL11S7B	0+52, 12R	5-15	2.9	
AL11S8A	0+60, 4R	0-5	82	0.59 ± 0.2
AL11S8B	0+60, 4R	5-15	1.8	
		Biased Samples[e]		
AL11B1A	0+59, BL	0-5	460	1.5 ± 0.2
AL11B1B	0+59, BL	5-15	9.0	
AL11B1C	0+59, BL	15-20	11	1.3 ± 0.2
AL11B2A	0+63, 9R	0-5	440	0.84 ± 0.1
AL11B2B	0+63, 9R	5-15	58	
AL11B3A	0+21, 10R	0-5	360	
AL11B3B	0+21, 10R	5-15	9.5	
AL11B4A	0+09, 11R	0-5	850	
AL11B4B	0+09, 11R	5-15	58	

[a]Location indicated in Fig. 5.

[b]Total analytical error of results is less than ±3% (95% confidence level).

[c]Indicated counting error is at 95% confidence level (±2σ).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Summary of outdoor measurements and sample results on property at 1144A Central Avenue, Colonie, New York (AL011)

Measurement or sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	32	10-19	14
Gamma exposure rate at surface (μR/h)[a]	32	11-21	16
Scan, gamma exposure rate near surface (μR/h)[b]	–	10-44	–
Concentration of ^{238}U in soil (pCi/g), systematic locations[c]	18	0.80-150	90
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	9	9.0-800	251
Direct alpha activity on surface (dpm/100 cm^2), selected roof locations	4	130-200	170

[a]At grid points.

[b]Scan of entire property.

[c]Systematic samples, Table 3.

[d]Biased samples, Table 3.

Contract No. W-7405-eng-26

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 27/29 YARDBORO AVENUE, ALBANY, NEW YORK (AL012)

March 1984

Work performed as part of the
RADIOLOGICAL SURVEY ACTIVITIES PROGRAM

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831
operated by
UNION CARBIDE CORPORATION
for the
U.S. DEPARTMENT OF ENERGY

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RESULTS OF THE RADIOLOGICAL SURVEY AT 27/29 YARDBORO AVENUE, ALBANY, NEW YORK (AL012)*

INTRODUCTION

In 1958, work with depleted uranium began at the National Lead Company's plant in Colonie, New York.[1] Beginning in 1961, the Atomic Energy Commission (AEC), its present successor, the Department of Energy (DOE), and other federal agencies have engaged in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contract, the work at the plant has been devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity since February 1980.

A number of properties in the Colonie/Albany area have been identified as being potentially contaminated with uranium originating from the National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 12 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period October 20-27, 1983. The property at 27/29 Yardboro Avenue in Albany, New York (AL012) was the subject of a radiological investigation on October 26, 1983.

This property consisted of a one and one-half story house constructed of wood, brick, and stucco. A variety of structures such as sheds and porches have been added to the original structure. The major portion of the lot is used to conduct intensive gardening of vegetables. A diagram of the property showing the approximate property boundaries and grid network established for measurements outside the onsite structures is shown in Fig. 1. The rectangularly shaped lot included in the radiological survey was approximately 27.5 m deep by 37 m wide. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

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*This 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 W-7405-eng-26.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Reference 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct beta-gamma dose rate measurements on the house roof. (Alpha activity measurements were not used to assess roof surface contamination because the roof was wet at the time of the survey.) A comprehensive description of the survey methods and instrumentation have been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. This data is 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 substracted from radionuclide concentrations in soil samples.

Gamma Measurements

Results of grid point/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 9 to 15 μR/h and averaged 10 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 9 to 14 μR/h, also averaging 10 μR/h. For comparison, typical background radiation levels at 1 m above ground surface in the Albany area range from 8 to 10 μR/h and average 9 μR/h.

As can be observed in Fig. 4, gamma radiation levels were within the range of background with the exception of several measurements adjacent to or behind the house. Further gamma scanning revealed elevated levels which

coincided with the drip lines from the roof of the structure, particularly along the east side of the house. The maximum exposure rate observed during scanning the ground surface was 27 μR/h (grid block 0+16, BL).

Soil Sampling

Twenty-four soil samples were taken on this property. Eighteen of these soil samples were taken at nine locations that were chosen irrespective of gamma radiation levels (denoted systematic soil samples – AL12S); and six soil samples were taken at two locations biased with respect to elevated gamma radiation measurements (denoted biased soil samples – AL12B). The sample locations are shown in Fig. 5, and the results of radionuclide analyses are given in Table 3. A concentration of ^{238}U is provided for each soil sample. Concentrations of ^{226}Ra were measured in several selected soil samples to confirm that ^{226}Ra concentrations were within typical background levels.

Concentrations of ^{238}U in systematic soil samples ranged from 2.6 to 35 pCi/g. With two exceptions, samples at each location were taken from 0 to 15 cm in depth and 15 to 30 cm in depth. Concentrations of ^{238}U were approximately two to four times higher in soil samples collected in the top 15 cm. The maximum concentration of ^{238}U in a systematic soil sample (35 pCi/g) was measured in a sample taken from a depth of 0-5 cm (AL12S2A). In the soil sample taken below sample AL12S2A (AL12S2B), from 5-15 cm, the ^{238}U concentration dropped to 9.3 pCi/g.

The two highest concentrations of ^{238}U in soil, 38 and 39 pCi/g, were measured in biased samples AL12B1A and AL12B2A, respectively. These samples were collected along the drip lines of the house roof in the upper 5 cm of soil. The ^{238}U concentrations in samples taken beneath those samples, at 5 to 15 cm in depth, averaged 13 pCi/g.

It is evident from the results of the soil sample analyses that ^{238}U concentrations in the top few centimeters of soil are elevated above the average background level (0.96 pCi/g). These elevated ^{238}U concentrations quickly decrease with increasing depth in soil. The highest concentrations of ^{238}U were observed along the drip lines of the house roof.

Beta-Gamma Measurements

Direct beta-gamma dose rate measurements were taken on selected areas of the roof on the house. (Direct alpha activity measurements taken on the wet surface of the roof would not have been representative.) The rates ranged from 0.004 to 0.038 mrad/h and averaged 0.013 mrad/h. These levels may be compared with the typical background level for roofs of that type (0.020 mrad/h).

SIGNIFICANCE OF FINDINGS

A summary of the outdoor measurement results of the radiological survey conducted on this property is provided in Table 4. These results establish that elevated concentrations of ^{238}U are present on the property. Gamma exposure rates were notably elevated only in areas adjacent to the house which correspond to the drip lines of the roof. Concentrations of ^{238}U in all surface soil samples (0-15 cm) exceeded the average background level. Direct beta-gamma dose rate measurements taken on the roof were generally equivalent to typical background and indicated the presence of minimal ^{238}U surface contamination.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).
2. *A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program*, DOE/EV-0097A (September 1980).
3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).
4. H. W. Jeter and D. M. Eagleson, *A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes*, IWL-9488-461 (October 31, 1980).
5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).
6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, *Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program*, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).
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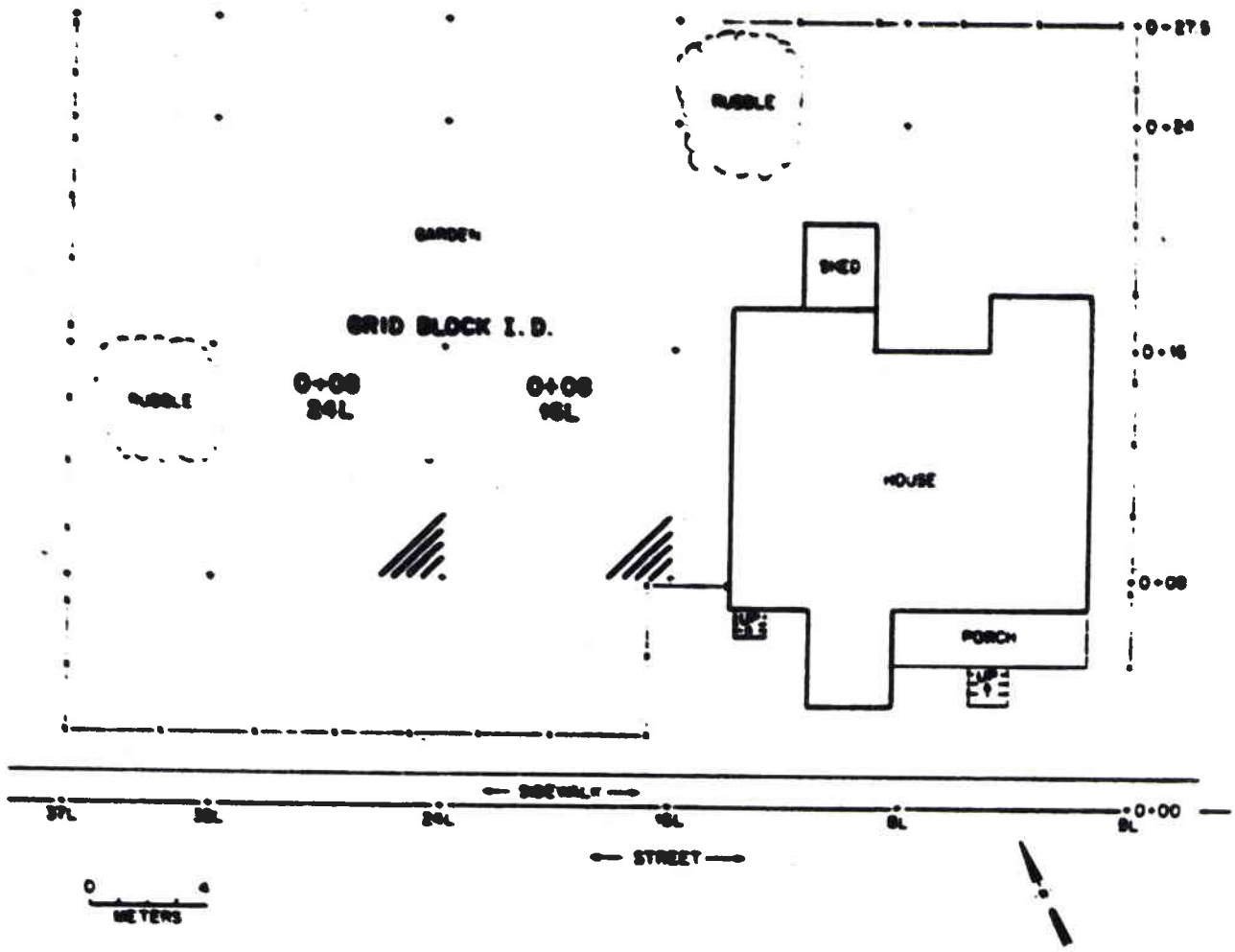

Fig. 1. Diagram showing grid point and grid block locations outdoors on property at 27/29 Yardboro Avenue, Albany, New York (AL012).

Fig. 2. Front view of property at 27/29 Yardboro Avenue, Albany, New York (Albany

Fig. 3. Rear view of property at 27/29 Yardboro Avenue, Albany, New York (AL012) looking southeast.

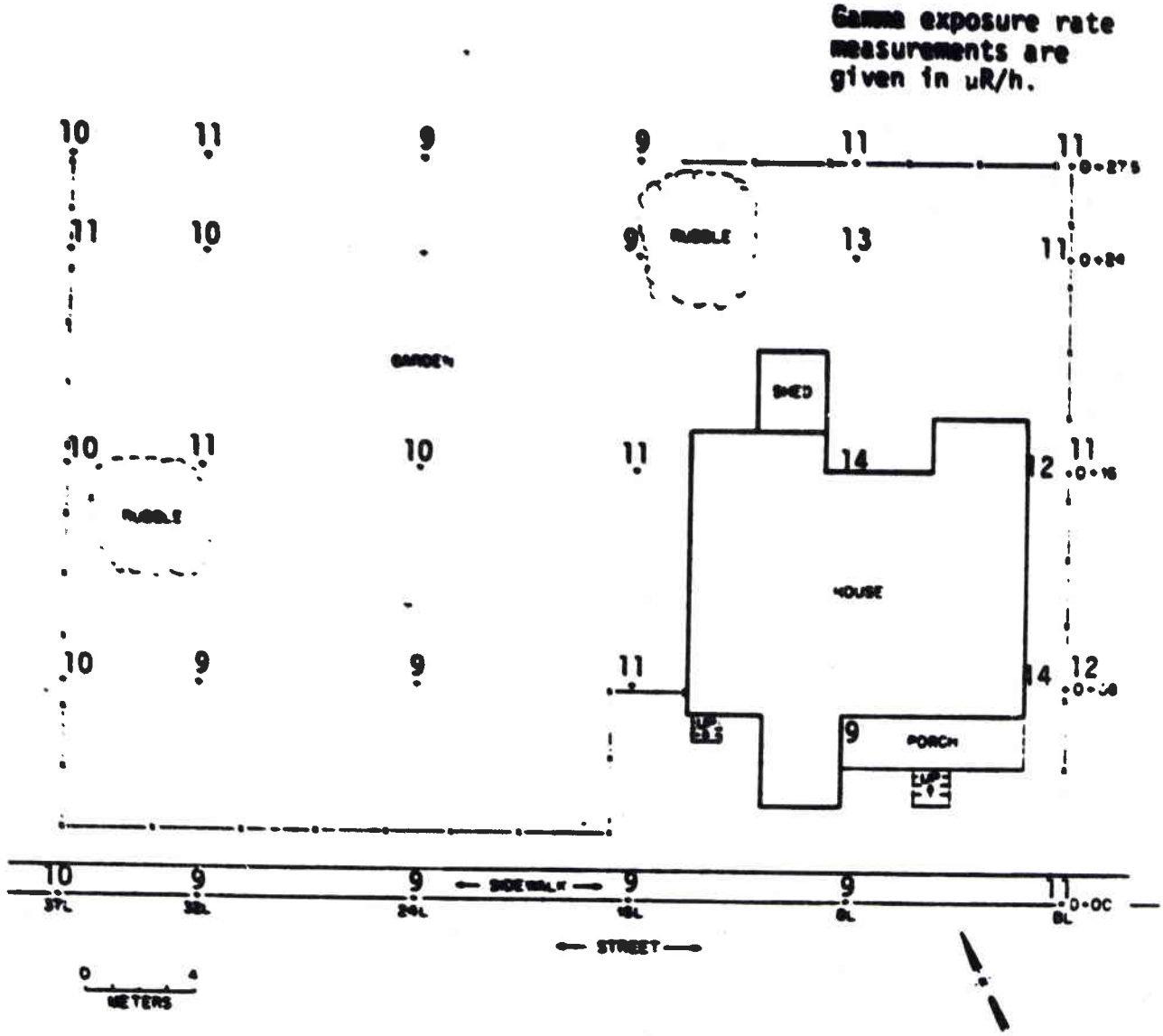

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on property at 27/29 Yardboro Avenue, Albany, New York (AL012).

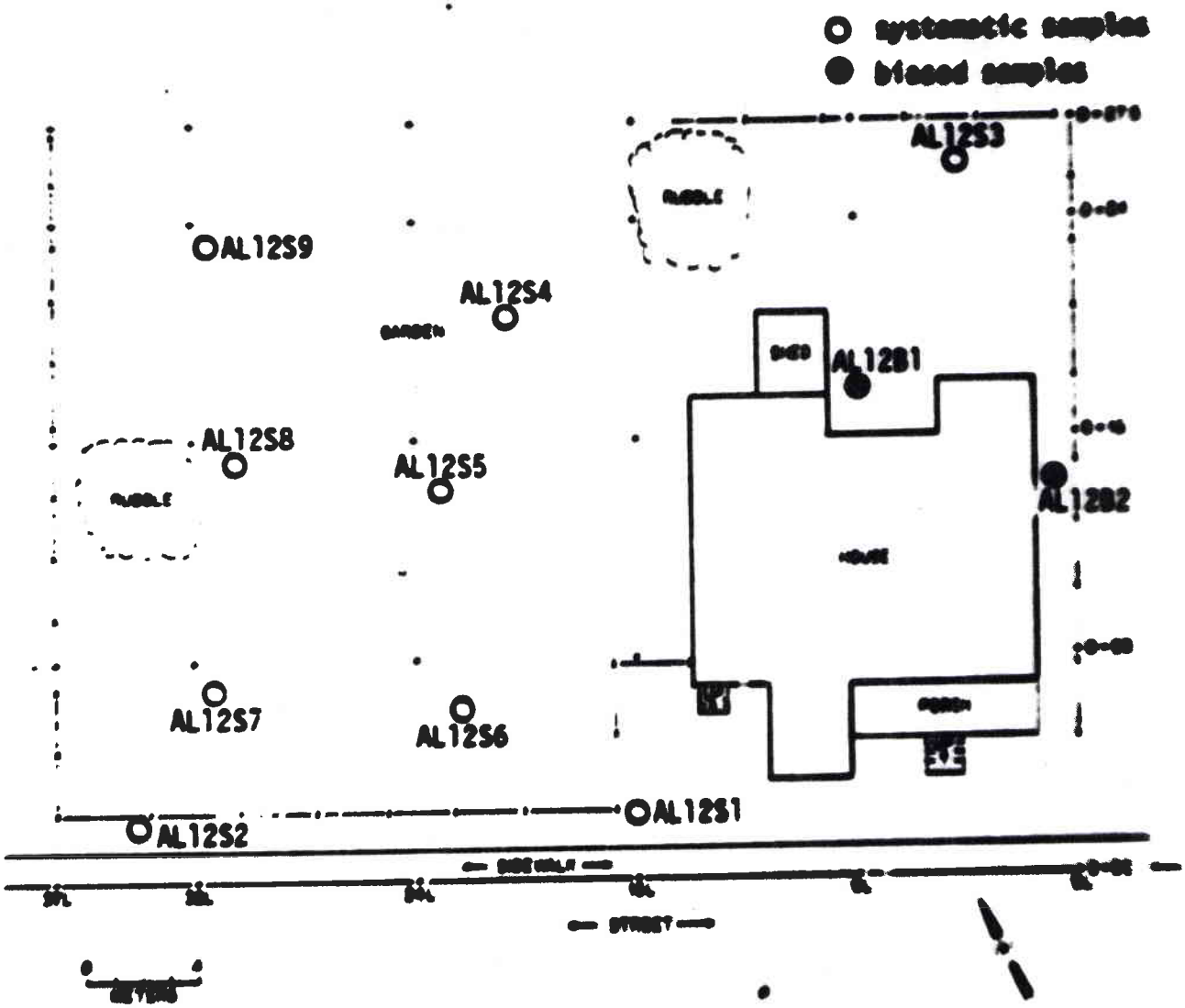

Fig. 5. Location of soil samples on property at 27/29 Yardboro Avenue, Albany, New York (AL012).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.

[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Outdoor measurement results on property at 27/29 Yardboro Avenue, Albany, New York (AL012)

Grid location[a]	Grid point measurements[b] (uR/h)		Range of gamma exposure rates during scan of grid block[d] (uR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	11	11	9-19
0+08, BL	12	12	11-16
0+16, BL	11	11	11-27
0+24, BL	9	11	11-14
0+27.5, BL	11	11	—
0+08, 1.5L	15	14	—
0+16, 1.5L	12	12	—
0+00, 8L	9	9	9-16
0+05, 8L	9	9	—
0+08, 8L	e	e	12-15
0+16, 8L	15	14	9-14
0+24, 8L	11	13	11-13
0+27.5, 8L	11	11	—
0+00, 16L	9	9	9-11
0+08, 16L	11	11	9-12
0+16, 16L	11	11	9-12
0+24, 16L	9	9	9-12
0+27.5, 16L	9	9	—
0+00, 24L	9	9	9-12
0+08, 24L	9	9	9-11
0+16, 24L	10	10	9-11
0+24, 24L	e	e	9-12
0+27.5, 24L	9	9	—
0+00, 32L	9	9	9-11
0+08, 32L	9	9	9-11
0+16, 32L	11	11	9-11
0+24, 32L	10	10	9-11
0+27.5, 32L	11	11	—
0+00, 37L	10	10	—
0+08, 37L	10	10	—
0+16, 37L	10	10	—
0+24, 37L	11	11	—
0+27.5, 37L	10	10	—

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analyses on property at 27/29 Yardboro Avenue, Albany, New York (AL012)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{238}U[b]	^{226}Ra[c]
		Systematic Samples[d]		
AL12S1A	0+02, 16L	0-5	19	0.53 ± 0.05
AL12S1B	0+02, 16L	5-15	11	
AL12S2A	0+02, 34L	0-5	35	
AL12S2B	0+02, 34L	5-15	9.3	0.49 ± 0.05
AL12S3A	0+26, 4L	0-15	16	
AL12S3B	0+26, 4L	15-30	4.5	
AL12S4A	0+21, 21L	0-15	11	
AL12S4B	0+21, 21L	15-30	5.9	0.62 ± 0.06
AL12S5A	0+14, 23L	0-15	10	0.60 ± 0.1
AL12S5B	0+14, 23L	15-30	3.1	
AL12S6A	0+06, 22L	0-15	7.8	
AL12S6B	0+06, 22L	15-30	2.8	0.54 ± 0.1
AL12S7A	0+07, 31L	0-15	9.1	
AL12S7B	0+07, 31L	15-30	2.6	
AL12S8A	0+15, 30L	0-15	10	
AL12S8B	0+15, 30L	15-30	4.0	0.51 ± 0.1
AL12S9A	0+23, 31L	0-15	13	0.64 ± 0.06
AL12S9B	0+23, 31L	15-30	4.0	
		Biased Samples[e]		
AL12B1A	0+18, 8L	0-5	39	0.70 ± 0.1
AL12B1B	0+18, 8L	5-15	16	
AL12B1C	0+18, 8L	30-35	0.67	
AL12B2A	0+14, 1L	0-5	38	0.75 ± 0.1
AL12B2B	0+14, 1L	5-15	9.4	
AL12B2C	0+14, 1L	15-30	2.8	0.65 ± 0.08

[a]Location indicated in Fig. 5.

[b]Total analytical error of results is less than ±3% (95% confidence level).

[c]Indicated counting error is at 95% confidence level (±2σ).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Summary of outdoor measurements and sample results on property at 27/29 Yardboro Avenue, Albany, New York (AL012)

Measurement or sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m. (μR/h)[a]	31	9-15	10
Gamma exposure rate at surface (μR/h)[a]	31	9-14	10
Scan, gamma exposure rate near surface (μR/h)[b]	–	9-27	–
Concentration of ^{238}U in soil (pCi/g), systematic locations[c]	18	2.6-35	9.9
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	6	0.67-39	18

[a]At grid points.

[b]Scan of entire property.

[c]Systematic samples, Table 3.

[d]Biased samples, Table 3.

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(AL013)

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RESULTS OF THE RADIOLOGICAL SURVEY AT 50 YARDBORO AVENUE, ALBANY, NEW YORK (AL013)

OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
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DEPARTMENT OF ENERGY

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ORNL/RASA-84/111
(AL013)

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 50 YARBOROO AVENUE, ALBANY, NEW YORK (AL013)

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RESULTS OF THE RADIOLOGICAL SURVEY AT 50 YARDBORO AVENUE, ALBANY, NEW YORK (AL013)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 16 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period May 29-June 7, 1984. The property at 50 Yardboro Avenue in Albany, New York (AL013) was the subject of a radiological investigation on May 31, 1984.

This commercial property consisted of a one-story concrete block structure used as a garage and repair shop. The building has a concrete floor and a flat, two-level tar roof. The areas to the front and sides are asphalt-covered and partially deteriorated. The surface is a mixture of gravel and asphalt. A diagram of the property showing the approximate property boundaries and the grid network established for measurements outside the building is shown in Fig. 1. The rectangular lot included in the radiological survey was approximately 35 m deep by 55 m wide. A front view of the property from the west side is shown in Fig. 2.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha and beta-gamma activity from surfaces of structures outdoors on the property. A comprehensive description of the survey methods and instrumentation has been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. The data is 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/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 3. Gamma exposure rates at 1 m above the ground surface ranged from 5 to 12 μR/h (microroentgens* per hour) and averaged 8 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 5 to 13 μR/h and averaged 9 μR/h. The maximum gamma exposure rate was 21 μR/h measured at a pit or concrete structure approximately corresponding to 0+34, 5R. A neighborhood resident informed the author that the concrete structure is associated with an underground drain that runs from the former NL Industries structure, ending at the street in the Albany sewage system. An 18 μR/h spot was located on the surface near the concrete at 0+32, 6R. The 18 μR/h level was also measured along the garage wall and in a planter at the front of the building.

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*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.

Soil Sampling

Twenty-five soil samples were taken at this property. Nineteen of these at ten locations [denoted as systematic samples (AL13S)] were taken without regard to gamma exposure levels at the sampling points. Six samples at three locations [denoted biased samples (AL13B)] were selected at positions having elevated gamma exposure levels. The locations of the samples are shown on Fig. 4, and the results of analysis are presented in Table 3.

Samples were taken at 0 to 5 cm and at 5 to 15 cm depths from each location except where restricted by underlying paving. Concentrations of ^{238}U in the systematic soil samples ranged from 0.69 to 55 pCi/g (picocuries* per gram) and averaged 17 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 23 pCi/g and averaged 10 pCi/g in the 5 to 15 cm depth samples. The ratio of (concentration at 0 to 5 cm) to (concentration at 5 to 15 cm) is 2.5, indicating a general higher abundance of ^{238}U near the surface. Four locations having significantly elevated concentrations of ^{238}U in the systematic soil samples were 0+35, 8R; 0+16, 54R; 0+12, 40R; and 0+32, 55R. At these locations the concentration of ^{238}U was 55, 44, 38, and 37 pCi/g, respectively. Concentrations of ^{238}U in biased samples ranged from 13 pCi/g to 550 pCi/g. The maximum concentration of ^{238}U found on the property was in a landscape planting at the front of the building at location 0+12, 33R (sample AL13B1A) as shown in Fig. 4.

The isotopic content of the uranium in the soil was determined by thermal ionization mass spectrometry. The uranium-235 isotope content of the uranium in sample AL13B2B was 0.217%.

Radium was measured in samples AL13S10A and AL13B2B. The concentrations of ^{226}Ra were 0.56 and 0.77 pCi/g, averaging 0.67 pCi/g.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the roof of the building and on asphalt paving. The results of these measurements are listed in Table 4. The alpha activity ranged from <7 to 330 dpm/100 cm^2 and averaged 101 dpm/100 cm^2. Beta-gamma activity ranged from 0.02 to ~~0.05~~ 0.5 mrad/h and averaged 0.15 mrad/h.

A summary of the outdoor measurement results is provided in Table 5.

---

*The curie is a unit used to define the radioactivity in a substance and equals that quantity of any radioactive isotope undergoing 3.7 x 10^{10} disintegrations per minute. The picocurie is one million-millionth of a curie or that amount yielding 2.2 disintegrations per minute.

SIGNIFICANCE OF FINDINGS

Measurements of the gamma exposure levels outdoors on the property determined that the exposure rate at 1 m above the ground surface ranged from 5 to 12 μR/h and averaged 8 μR/h; a level less than the background for the Albany area. For comparison, the typical background for the Albany area is 9 μR/h; and the background for the state of New York[8,9] averages 9.5 μR/h and ranges from 6.8 to 13 μR/h (one standard deviation) based on 51 measurements. Based on this information, there is no indication of risk to health caused by gamma exposure rates outdoors on the property.

The results of ^{238}U analysis establish the presence of uranium at concentrations significantly above background on the property. The average concentration of 17 pCi/g of ^{238}U in the systematic samples is approximately 18 times the normal background of 0.96 pCi/g for the Albany area. Although the average concentration is approximately one-half the DOE guideline[10] of 35 pCi/g, areas around the building and to the rear of the property are significantly higher. The sampling of the location with the highest concentrations, 550 pCi/g (approximately 16 times the guideline), shows that the uranium is now above criteria to 15 cm or more. It is believed that the uranium has migrated primarily as a result of natural processes such as freezing and thawing, melting snow, and washing by rain. Sample AL13B1, from 0+12, 33R, a location below a drainage path from the roof of the building, is probably an excellent example of the effect of rain washing the ^{238}U from the roof to the ground where the uranium was absorbed and retained in the soil. It is also probable that the uranium will be further diffused, become less concentrated with time, as the above processes continue to disperse the uranium. A second area with a high concentration of ^{238}U in the soil sample (480 pCi/g) appears tc be associated with an underground drain purportedly running from the former NL Industries site to the Albany sewage system.

The 0.217 atom percent ^{235}U determined by mass spectrometry establishes that the uranium which contaminated the property is depleted, i.e., it has been treated by a separations process; and a significant fraction of the ^{235}U has been removed. Natural uranium contains 0.7% uranium-235.

The 0.67 pCi/g average for ^{226}Ra measured in the soil compares favorably with the Albany area background of 0.85 pCi/g of radium-226.

The average alpha activity of 170 dpm/100 cm^2 obtained by measurements on the roof of the building and on the asphalt paving are well below the DOE criterion of 5000 dpm/100 cm^2 for alpha activity from natural uranium, uranium-235, or uranium-238.

The average beta-gamma activity of 0.27 mrad/h obtained at measurements on the roof of the building are greater than the DOE criterion of 0.20 mrad/h at 1 cm from the surface. All measurements of beta-gamma at the asphalt surfaces are less than the DOE criterion of 0.20 mrad/h.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindeken, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. Environmental Research Division, Action Description Memorandum. "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

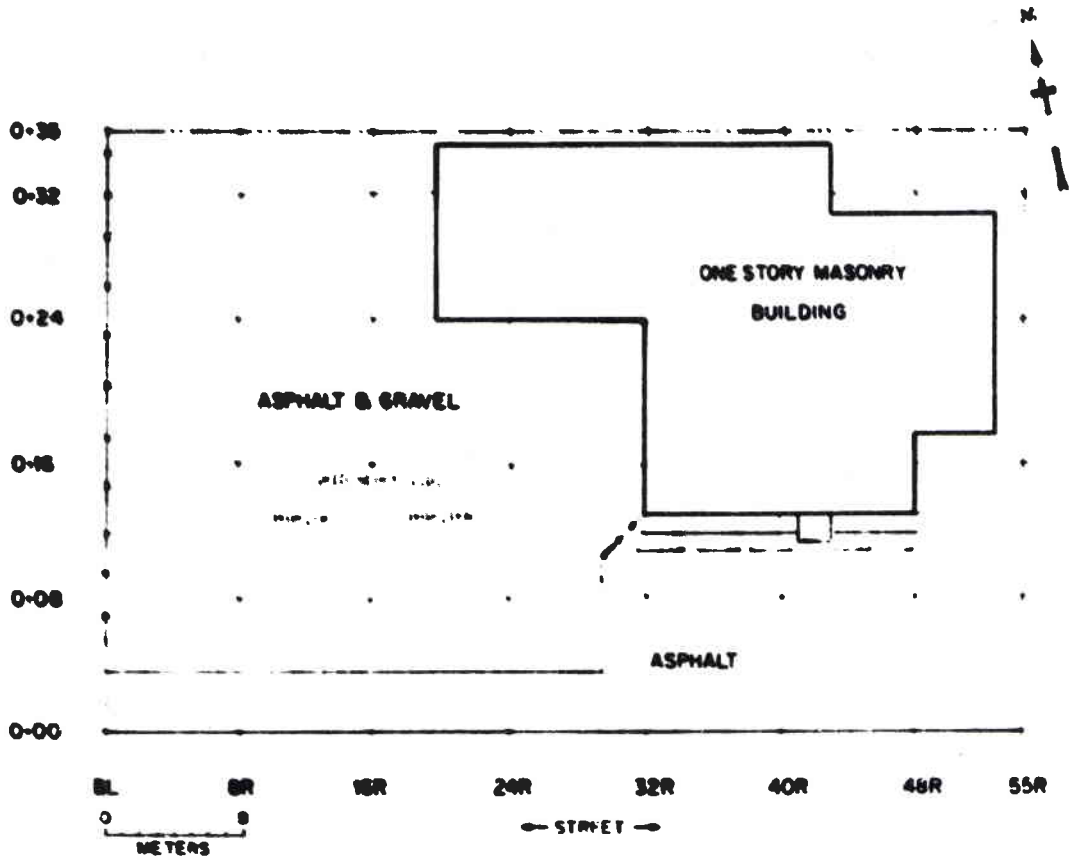

Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 50 Yardboro Avenue, Albany, New York (AL013).

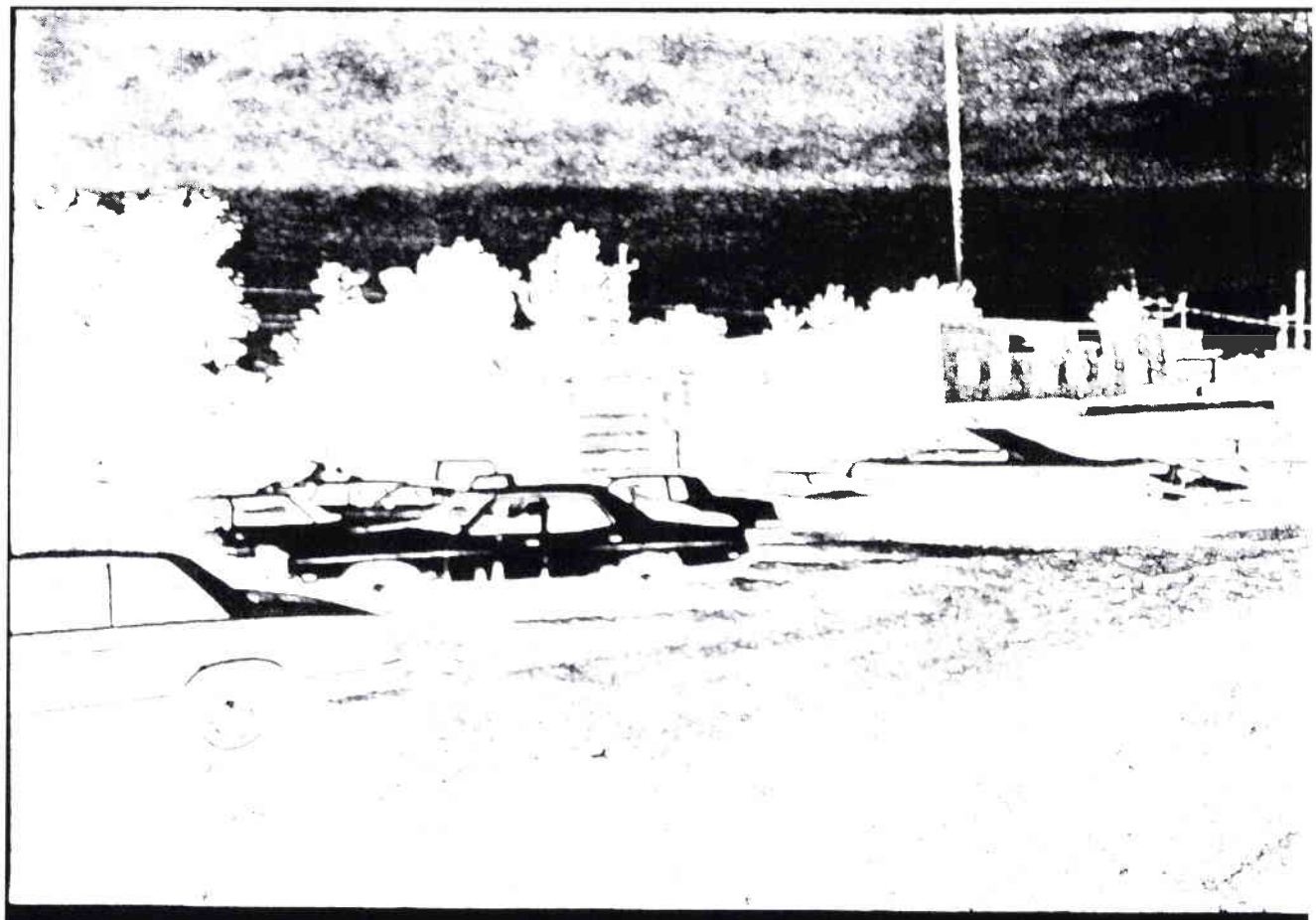

Fig. 2. Front view of the property at 50 Yardboro Avenue, Albany, New York (AL013) looking northeast.

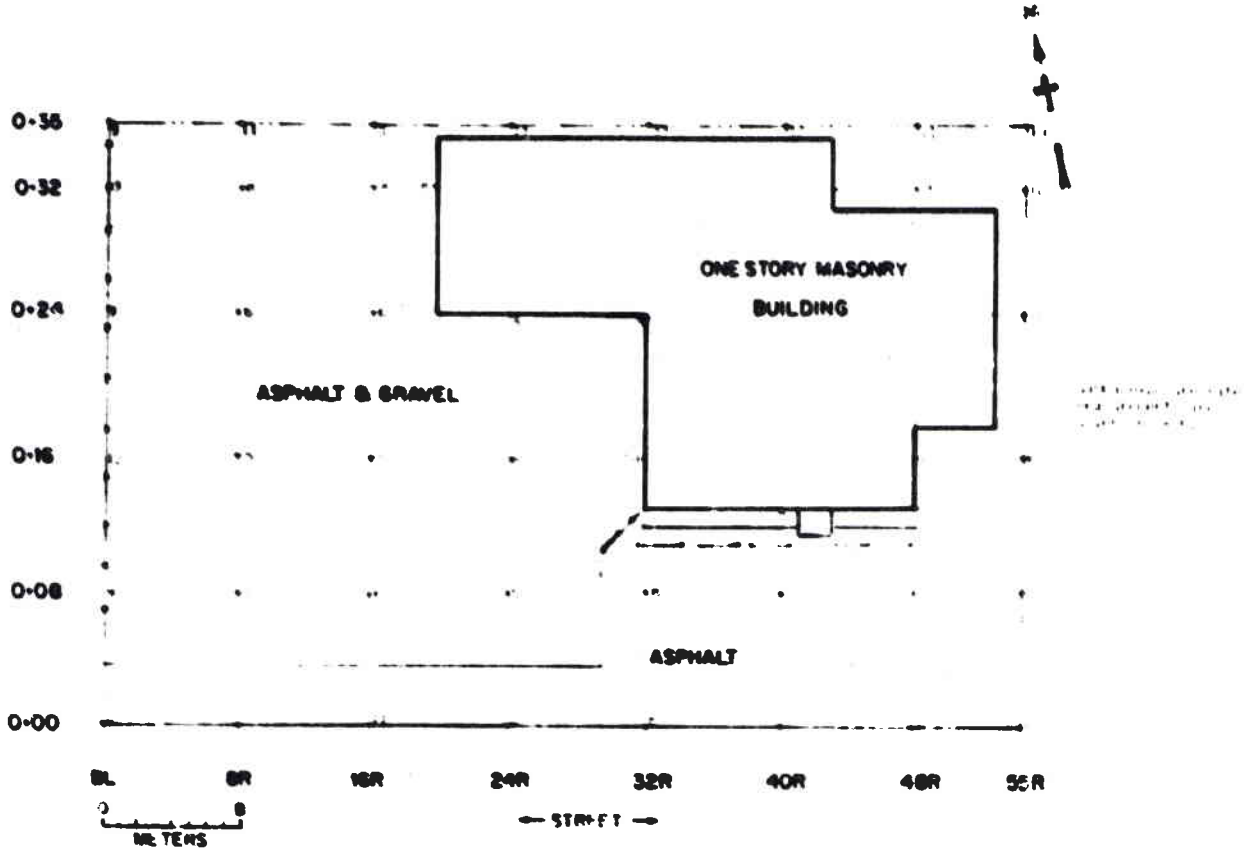

Fig. 3. Surface gamma exposure rates measured at grid points outdoors on the property at 50 Yardboro Avenue, Albany, New York (AL013).

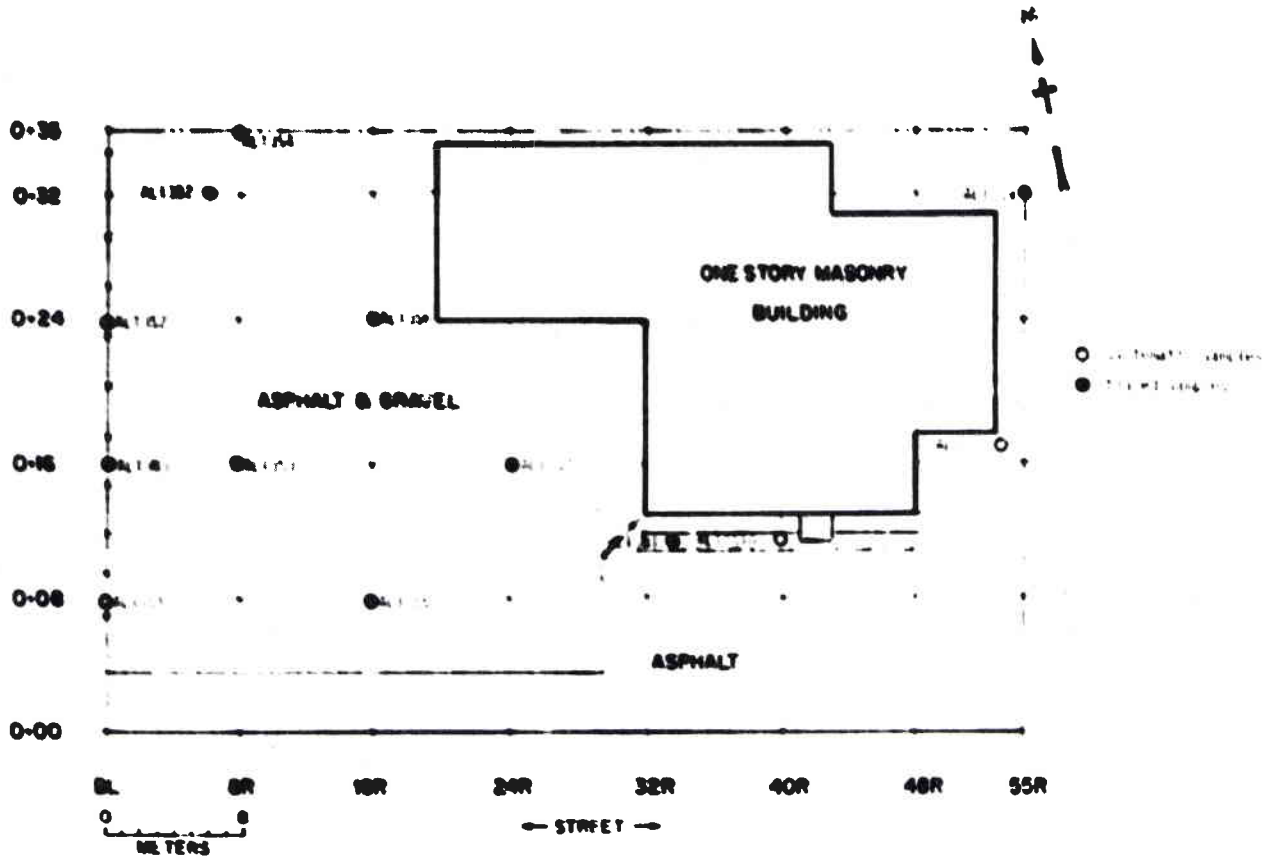

Fig. 4. Locations of soil samples on the property at 50 Yardboro Avenue, Albany, New York (AL013).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 50 Yardboro Avenue, Albany, New York (AL013)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	8	8	6-12
0+08, BL	8	9	5-15
0+16, BL	10	12	5-13
0+24, BL	8	9	5-12
0+32, BL	9	9	5-21
0+35, BL	9	9	5-21
0+00, 8R	8	7	7-9
0+08, 8R	5	5	5-6
0+16, 8R	5	5	5-6
0+24, 8R	6	6	6-9
0+32, 8R	8	8	8-18
0+35, 8R	8	11	-
0+00, 16R	8	11	5-11
0+08, 16R	6	6	5-8
0+16, 16R	5	5	5-8
0+24, 16R	5	6	5-8
0+32, 16R	8	8	5-10
0+35, 16R	7	8	-
0+32, 20.4R	7	8	-
0+00, 24R	8	8	5-8
0+08, 24R	5	5	5-15
0+16, 24R	7	8	6-9
0+24, 24R	7	8	-
0+35, 24R	10	11	-
0+00, 32R	7	8	6-9
0+08, 32R	8	8	8-18
0+16, 32R	10	10	-
0+24, 32R	8	8	-
0+35, 32R	10	11	-
0+00, 40R	8	8	6-10
0+08, 40R	8	8	8-17
0+12, 40R	12	13	-
0+35, 40R	9	10	-
0+00, 48R	8	8	8-12
0+08, 48R	8	8	8-18
0+16, 48R	12	12	-
0+32, 48R	9	9	-
0+35, 48R	9	11	-

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, SSR	7	7	-
0+08, SSR	7	6	-
0+16, SSR	9	10	-
0+24, SSR	9	10	-
0+32, SSR	9	10	-
0+35, SSR	10	10	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 3.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analysis on the property at 50 Yardboro Avenue, Albany, New York (AL013)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
		Systematic samples[d]		
AL13S1A	0+08, BL	0-5	-	5.4
AL13S1B	0+08, BL	5-15	-	5.5
AL13S2A	0+24, BL	0-5	-	28
AL13S2B	0+24, BL	5-15	-	8.0
AL13S3A	0+16, 8R	0-5	-	13
AL13S3B	0+16, 8R	5-15	-	3.3
AL13S4A	0+35, 8R	0-5	-	55
AL13S4B	0+35, 8R	5-15	-	20
AL13S5A	0+08, 16R	0-5	-	2.3
AL13S5B	0+08, 16R	5-15	-	2.7
AL13S6A	0+24, 16R	0-5	-	5.9
AL13S6B	0+24, 16R	5-15	-	6.5
AL13S7A	0+16, 24R	0-5	-	0.69
AL13S8A	0+16, 54R	0-5	-	44
AL13S8B	0+16, 54R	5-15	-	7.8
AL13S9A	0+32, 55R	0-5	-	37
AL13S9B	0+32, 55R	5-15	-	25
AL13S10A	0+12, 40R	0-5	0.56 ± 0.08	38
AL13S10B	0+12, 40R	5-15	-	14
		Biased samples[e]		
AL13B1A	0+12, 33R	0-5	-	550
AL13B1B	0+12, 33R	5-15	-	150
AL13B2A	0+32, 6R	0-5	-	480
AL13B2B	0+32, 6R	5-15	0.77 ± 0.3	230
AL13B2C	0+32, 6R	15-30	-	230
AL13B3A	0+16, BL	0-5	-	13

Table 3 (continued)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]

Isotopic Analysis by Mass Spectrometry

Sample	Atom percent			
	^{235}U	^{234}U	^{236}U	^{238}U
AL13H2B	0.217	0.0009	0.0031	99.779

[a]Locations of soil samples are shown on Fig. 4.

[b]Indicated counting error is at the 95% confidence level (± 2σ).

[c]Analytical error of measurement results is < ± 5% (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Results of surface analysis of structures at 50 Yardboro Avenue, Albany, New York (AL013)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity					
Roof of building	14	150,110,210,110, 210,330,200,230, 200,170,77,150, 98,200	-	170	-
Asphalt paving	13	14,56,29,14,28, 14,<7,28,14,18, 14,14,28	-	22	-
Total	13	7-330	-	101	-
Beta-Gamma					
Roof of building	13	-	0.50,0.31,0.17, 0.22,0.24,0.11,0.32, 0.32,0.33,0.31,0.40, 0.14,0.13	-	0.27
Asphalt paving	13	-	0.02,0.05,0.03,0.05,0.02, 0.12,0.02,0.03,0.02,0.04, 0.04,0.03,0.03	-	0.04
Total	26	-	0.02-0.50	-	0.15

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 erg per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

Table 5. Summary of outdoor measurements and sample results on the property at 50 Yardboro Avenue, Albany, New York (AL013)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	44	5-12	8
Gamma exposure rate at surface (μR/h)[a]	44	5-13	9
Scan, gamma exposure rate near surface (μR/h)[b]	-	5-21	-
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	19	0.69-55	17
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	6	13-550	275
Abundance of isotope ^{235}U in uranium (%)	-	-	0.217
Concentration of ^{226}Ra in surface soil (pCi/g), systematic locations[c]	2	0.56-0.77	0.67
<u>Surface measurements</u>[e]			
Alpha activity (dpm/100 cm^2)	27	<7-330	101
Beta-gamma activity (mrad/h)	26	0.02-0.50	0.15

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Biased samples, Table 3.
[e]Surface measurements, Table 4.

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ORNL/RASA-84/112
(AL016)

OAK RIDGE NATIONAL LABORATORY

MARTIN MARIETTA

RESULTS OF THE RADIOLOGICAL SURVEY AT 25/27 YARDBORO AVENUE, ALBANY, NEW YORK (AL016)

OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
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ORNL/RASA-84/112
(AL016)

Health and Safety Research Division

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RESULTS OF THE RADIOLOGICAL SURVEY AT 25/27 YARDBORO AVENUE, ALBANY, NEW YORK (AL016)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 16 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period May 29-June 7, 1984. The property at 25/27 Yardboro Avenue in Albany, New York (AL016) was the subject of a radiological investigation on May 31, 1984.

This property consisted of a two-story brick house with surrounding lawn and garden areas and an adjoining vacant lot which had been covered with asphalt paving. The house and adjacent area was attractive and appeared well maintained. The paving was in poor condition (i.e., mostly dirt covered and with holes and broken areas). A diagram of the property showing the approximate property boundaries and grid network established for measurements outside the house is shown in Fig. 1. The rectangular lot included in the radiological survey was ~29.5 m deep by 41.5 m wide. The house and attached storage shed are the only onsite structures. Front and side views of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

Soil Sampling

Forty-four systematic soil samples were taken at 24 locations on the property. Systematic denotes samples that were taken at grid locations irrespective of the gamma exposure level at the point of sampling. The locations of the samples are shown in Fig. 5, and the results of analysis are presented in Table 3.

Samples were taken at 0 to 5 cm and at 5 to 15 cm from each location except where prevented by obstructions such as underlying paving. Concentrations of ^{238}U in the soil samples ranged from 0.43 to 44 pCi/g (picocuries* per gram) and averaged 9.8 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 12 pCi/g and averaged 7.4 pCi/g for the 5 to 15 cm depth samples. The ratio of concentration at 0 to 5 cm to concentration at 5 to 15 cm is 1.65, indicating that the higher concentrations are located near the surface. The sample from grid location 0+00, 29.5R having the maximum concentration found on the property (44 pCi/g) and was from depths of 0 to 5 cm.

The isotopic content of the uranium in the soil was determined by thermal ionization mass spectrometry. The uranium-235 isotope content of the uranium in sample AL1685A was 0.208%.

Radium was measured in samples AL1684B, AL1685A, and AL1688A. The concentration average for ^{226}Ra was 0.83 pCi/g.

Surface Measurements

Alpha activity and beta-gamma activity was measured at selected locations on the roof of the house and on the front walkways. The results of these measurements are listed in Table 4. The alpha activity ranged from <7 to 49 dpm/100 cm^2 and averaged 24 dpm/100 cm^2. Beta-gamma activity ranged from 0.02 to 0.04 mrad/h and averaged 0.03 mrad/h.

A summary of the outdoor measurement results is provided in Table 5.

---

*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.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).

6. T. R. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. R. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, H. Enerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindekin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. Environmental Research Division, Action Description Memorandum, "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

Fig. 2. Front view of the property at 25/27 Yardboro Avenue, Albany, New York (AL016) looking west.

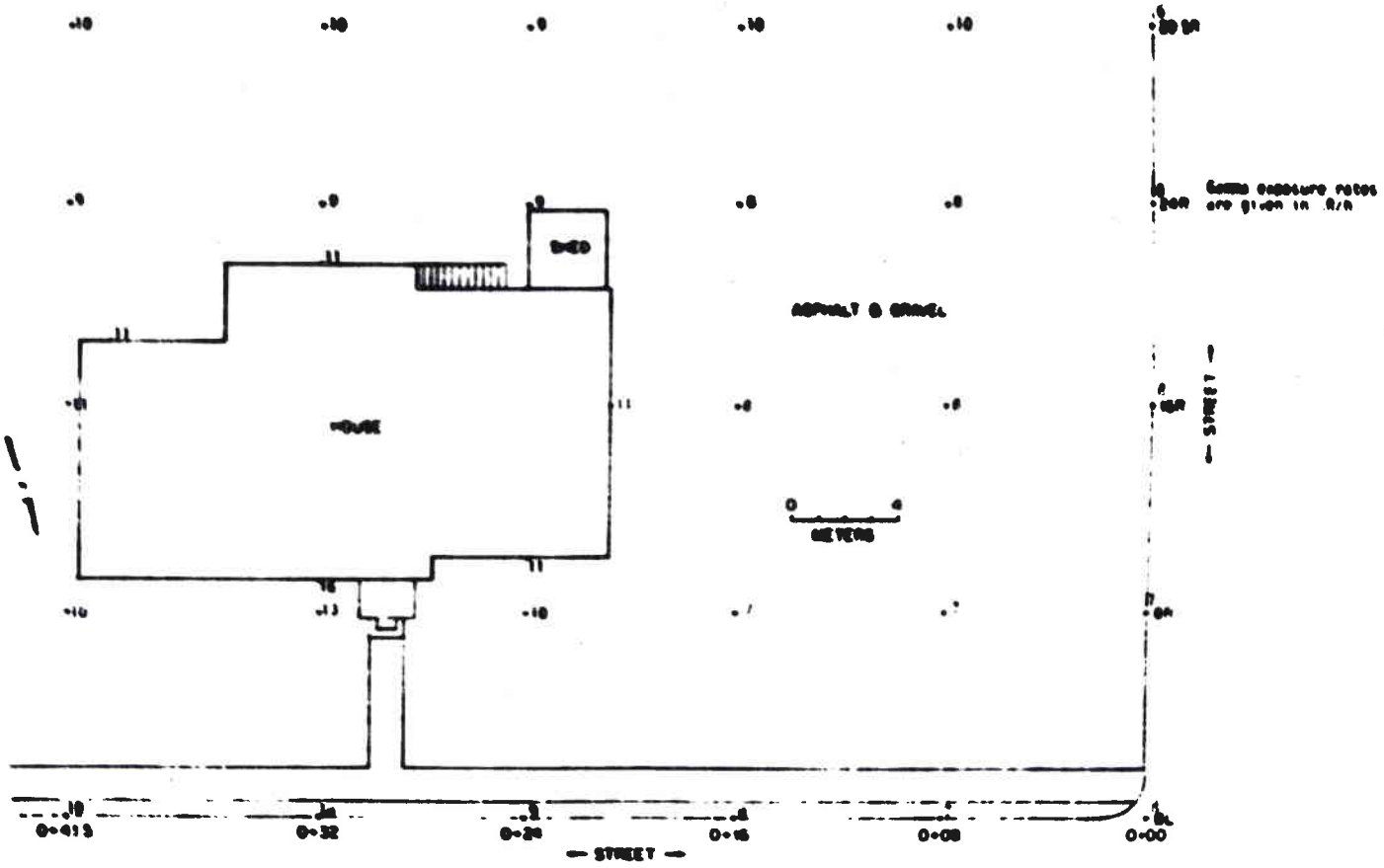

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 25/27 Yardboro Avenue, Albany, New York (AL016).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 3. Results of soil sample analysis on the property at 25/27 Yardboro Avenue, Albany, New York (AL016)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
			Systematic samples[d]	
AL16S1A	0+00, 2R	0-5	-	19
AL16S1B	0+00, 2R	5-15	-	6.6
AL16S2A	0+08, 8R	0-5	-	5.9
AL16S3A	0+15, 2R	0-5	-	15
AL16S3B	0+15, 2R	5-15	-	18
AL16S4A	0+20, 10R	0-5	-	4.3
AL16S4B	0+20, 10R	5-15	1.1 ± 0.1	2.0
AL16S5A	0+32, 8R	0-5	0.74 ± 0.1	20
AL16S5B	0+32, 8R	5-15	-	11
AL16S6A	0+39, 8.5R	0-5	-	22
AL16S6B	0+39, 8.5R	5-15	-	11
AL16S7A	0+40, 2R	0-5	-	18
AL16S7B	0+40, 2R	5-15	-	12
AL16S8A	0+39, 16R	0-5	0.66 ± 0.09	13
AL16S8B	0+39, 16R	5-15	-	8.9
AL16S9A	0+32, 18.5R	0-5	-	10
AL16S9B	0+32, 18.5R	5-15	-	7.0
AL16S10A	0+41.5, 29R	0-5	-	8.6
AL16S10B	0+41.5, 29R	5-15	-	7.0
AL16S11A	0+32, 29.5R	0-5	-	5.0
AL16S11B	0+32, 29.5R	5-15	-	4.6
AL16S12A	0+32, 24R	0-5	-	4.6
AL16S12B	0+32, 24R	5-15	-	4.8
AL16S13A	0+24, 20.5R	0-5	-	0.43
AL16S13B	0+24, 20.5R	5-15	-	4.6
AL16S14A	0+24, 29.5R	0-5	-	4.5
AL16S14B	0+24, 29.5R	5-15	-	4.2
AL16S15A	0+20, 26R	0-5	-	4.7
AL16S15B	0+20, 26R	5-15	-	3.9
AL16S16A	0+16, 29.5R	0-5	-	13
AL16S16B	0+16, 29.5R	5-15	-	5.4
AL16S17A	0+16, 24R	0-5	-	7.9
AL16S18A	0+08, 29.5R	0-5	-	15
AL16S18B	0+08, 29.5R	5-15	-	6.1
AL16S19A	0+00, 29.5R	0-5	-	44
AL16S19B	0+00, 29.5R	5-15	-	17
AL16S20A	0+00, 24R	0-5	-	13
AL16S20B	0+00, 24R	5-15	-	3.1

Table 4. Results of surface analysis of structures at 25/27 Yardboro Avenue, Albany, New York (AL016)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity					
Roof of house	5	28,42,7,49,28	-	31	-
Walkways	6	14,14,14,<7,42,14	-	18	-
Total	11	<7-49	-	24	-
Beta-Gamma					
Roof of house	5	-	0.03,0.03,0.02,0.04,0.04	-	0.03
Walkways	6	-	0.04,0.04,0.03,0.02,0.03,0.02	-	0.03
Total	11	-	0.02-0.04	-	0.03

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 erg per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

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INTRODUCTION

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A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 16 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period May 29-June 7, 1984. The property at 7 Palmer Avenue in Albany, New York (AL017) was the subject of a radiological investigation on June 1, 1984.

This private property consisted of a house with a lawn and garden area. A diagram of the property showing the approximate property boundaries and the grid network established for measurements outside the house is shown in Fig. 1. The rectangular lot included in the radiological survey was approximately 40 m deep by 10 m wide. A small storage shed was located about 4 m from the rear fence. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha and beta-gamma activity from surfaces of structures outdoors on the property. A comprehensive description of the survey methods and instrumentation has been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. The data is 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/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 8 to 13 μR/h (microroentgens* per hour) and averaged 10 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 8 to 15 μR/h and averaged 11 μR/h. The maximum gamma exposure rate measured at the property was 20 μR/h at two locations (0+11, 9.5L, and 0+04, 5.5L) which were along the driplines of the house.

Soil Sampling

Thirty-six soil samples were taken at this property. Twenty-six of these at thirteen locations [denoted as systematic samples (AL17S)] were taken without regard to gamma exposure rates at the sampling points. Ten samples at four locations [denoted biased samples (AL17B)] were selected at positions having elevated gamma exposure levels. The locations of samples are shown on Fig. 5, and the results of analysis are presented in Table 3.

---

*The roentgen (R) is a unit which was defined for radiation protection purposes for people exposed to penetrating x-ray 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.

Samples were taken at 0 to 5 cm and at 5 to 15 cm depths from each location. Concentrations of ^{238}U in the systematic soil samples ranged from 3.2 to 44 pCi/g (picocuries* per gram) and averaged 9.3 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 12 pCi/g and averaged 6.6 pCi/g in the 5 to 15 cm depth samples. The ratio of concentration at 0 to 5 cm to concentration at 5 to 15 cm depths was 1.75, indicating that the higher concentrations are located near the surface. The sample from grid location 0+11, 9.5L (AL17B2B) having the maximum concentration found on the property (110 pCi/g) was from depths of 0 to 5 cm.

The isotopic content of the uranium in the soil was determined by thermal ionization mass spectrometry. The uranium-235 isotope content of the uranium in sample AL17B2A was 0.207%.

Radium was measured in samples AL17S3A and AL17B2A. The average concentration of ^{226}Ra was 1.4 pCi/g.

Surface Measurements

Alpha activity and beta-gamma activity was measured at selected locations on the roof of the house and on the walkways. The results of these measurements are listed in Table 4. The alpha activity ranged from 16 to 70 dpm/100 cm^2 and averaged 45 dpm/100 cm^2. Beta-gamma activity ranged from 0.03 to 0.05 mrad/h and averaged 0.04 mrad/h.

A summary of the outdoor measurement results is provided in Table 5.

SIGNIFICANCE OF FINDINGS

Measurements of the gamma exposure levels outdoors on the property determined that the exposure rate at 1 m above the ground surface ranged from 8 to 13 μR/h and averaged 10 μR/h, a level slightly greater than the background for the Albany area. For comparison, the typical background for the Albany area is 9 μR/h; and the background for the state of New York[8,9] averages 9.5 μR/h and ranges from 6.8 to 13 μR/h (one standard deviation) based on 51 measurements. Based on this information, there is no indication of significant risk to health caused by gamma exposure rates outdoors on the property.

---

*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.

The results of ^{238}U analysis establish the presence at concentrations significantly above background on the property. The average concentration of 9.4 pCi/g of ^{238}U in the systematic samples is approximately 10 times the normal background of 0.96 pCi/g for the Albany area. However, it is well below the DOE guideline[10] of 35 pCi/g ^{238}U. The maximum concentration of ^{238}U measured, 110 pCi/g, was approximately 3 times the DOE guideline.

The 0.207 atom percent ^{235}U determined by mass spectrometry establishes that the uranium which contaminated the property is depleted, i.e., it has been treated by a separations process; and a significant fraction of the ^{235}U has been removed. Natural uranium contains 0.7% uranium-235.

The 1.4 pCi/g of ^{226}Ra measured in the soil compares favorably with the Albany area background of 0.85 pCi/g of radium-226.

The average alpha activity of 45 dpm/100 cm^2 obtained by measurements on the roof of the house is well below the DOE criterion of 5000 dpm/100 cm^2 for alpha activity from natural uranium, uranium-235, or uranium-238.

The average and maximum beta-gamma activities of 0.04 and 0.05 mrad/h are less than the DOE criteria of 0.20 and 1.0 mrad/h at 1 cm, respectively.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

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5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/ID (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindeken, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

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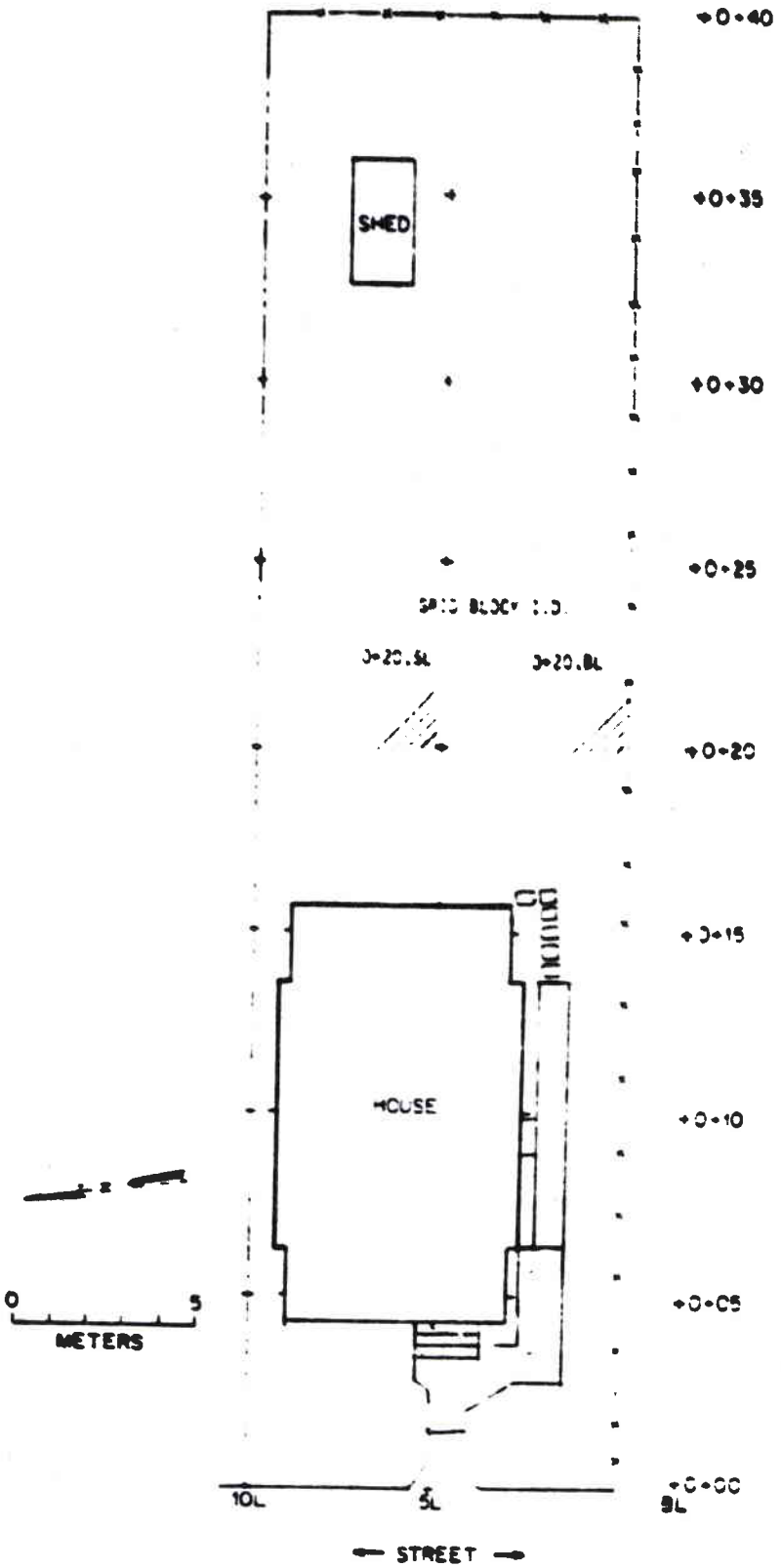

Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 7 Palmer Avenue, Albany, New York (AL017).

Fig. 2. Front view of the property at 7 Palmer Avenue, Albany, New York (AL017) looking southeast.

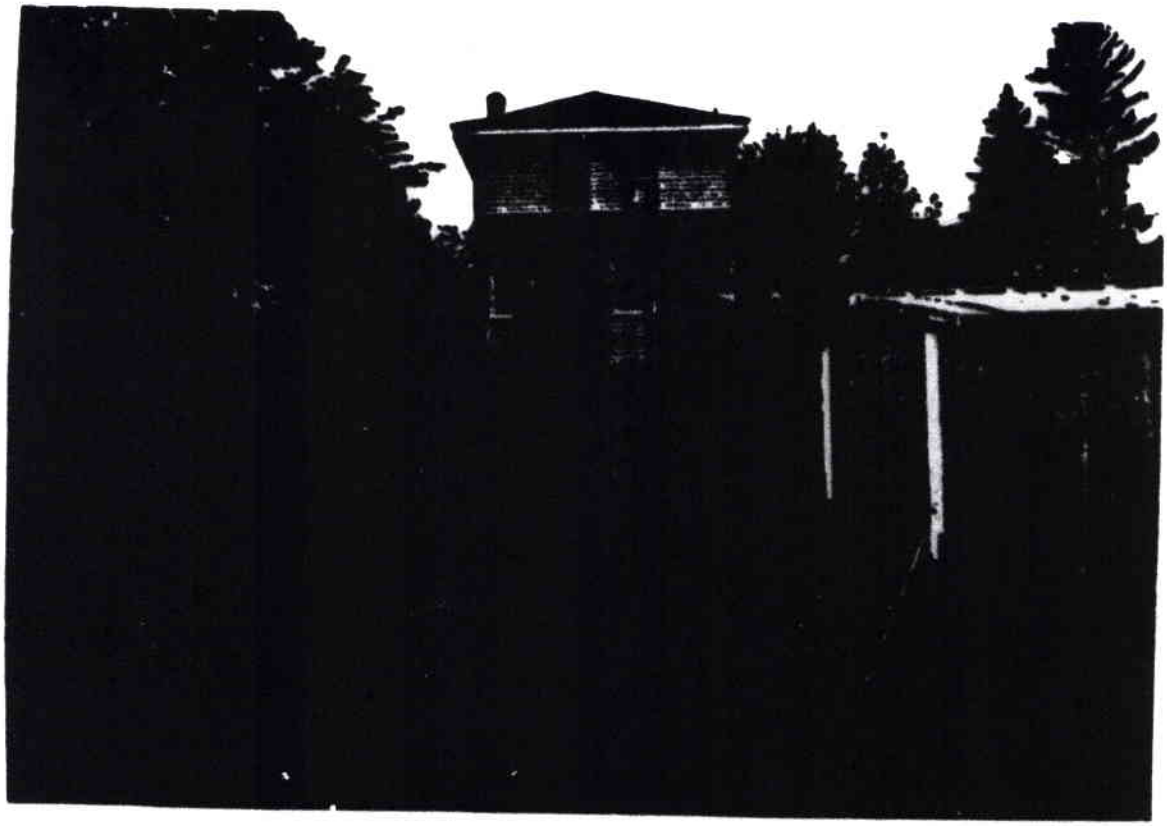

Fig. 3. Rear view of the property at 7 Palmer Avenue, Albany, New York (AL017) looking northwest.

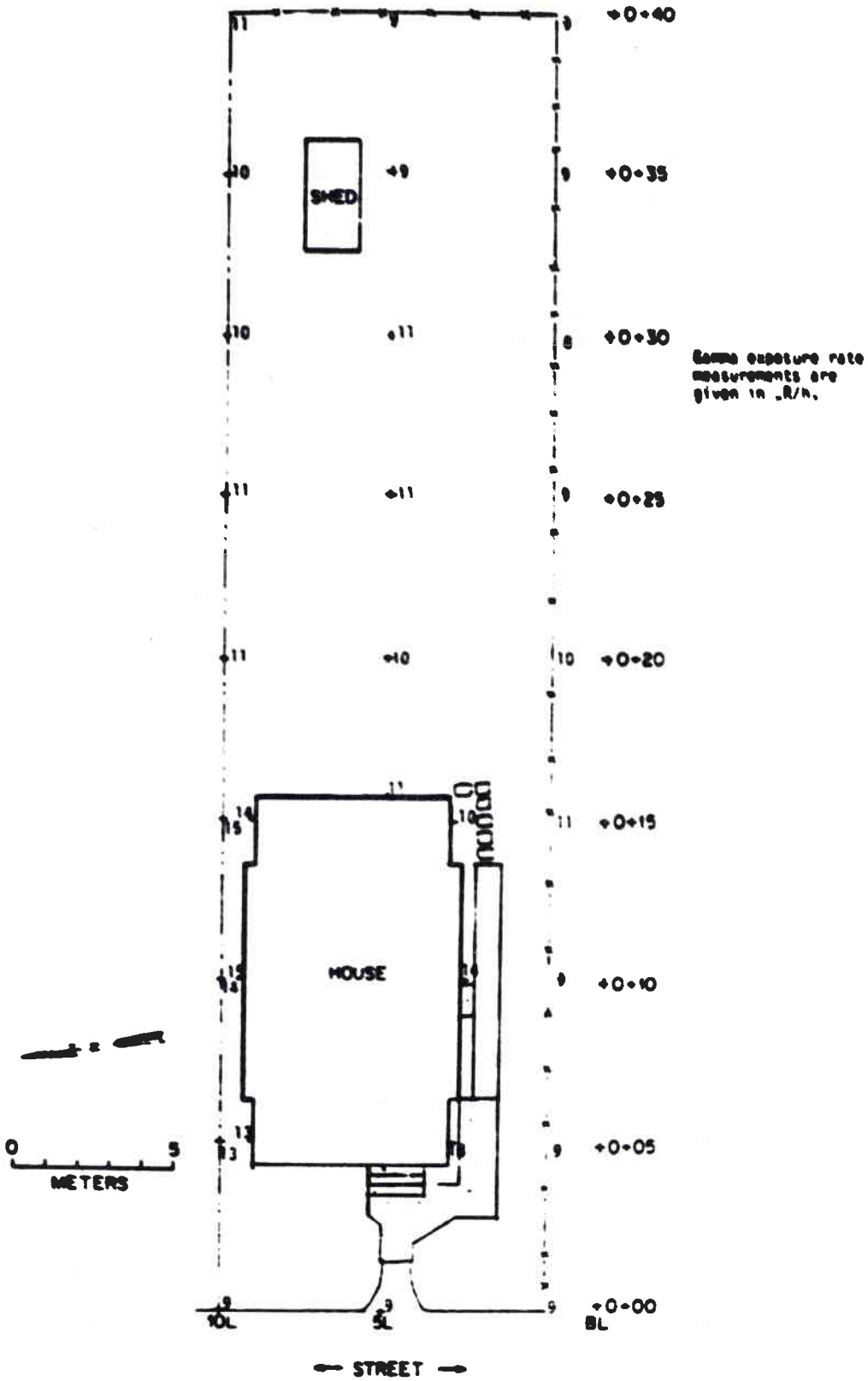

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 7 Palmer Avenue, Albany, New York (AL017).

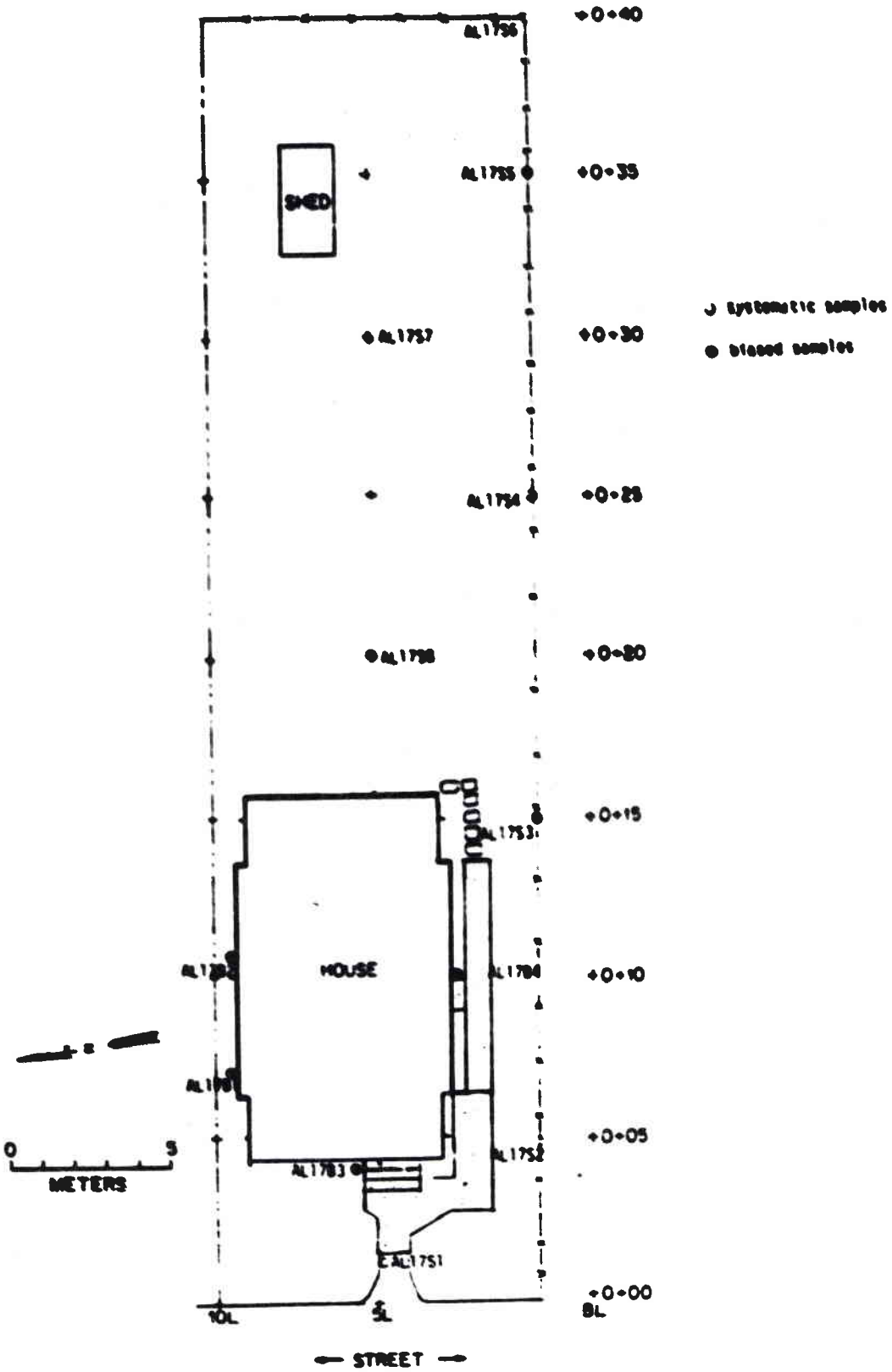

Fig. 5. Locations of soil samples on the property at 7 Palmer Avenue, Albany, New York (AL017).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 7 Palmer Avenue, Albany, New York (AL017)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	9	9	7-14
0+05, BL	9	9	9-16
0+10, BL	9	9	10-16
0+15, BL	11	11	10-14
0+20, BL	10	10	10-13
0+25, BL	9	9	9-11
0+30, BL	8	8	8-11
0+35, BL	9	9	9-11
0+40, BL	9	9	-
0+10, 2.8L	11	14	-
0+15, 03L	9	10	-
0+05, 3.2L	9	13	-
0+00, 05L	9	9	9-19
0+04.3, 05L	e	e	-
0+05, 05L	e	e	13-20
0+10, 05L	e	e	13-20
0+15, 05L	e	e	10-14
0+16.7, 05L	10	11	-
0+20, 05L	10	10	9-13
0+25, 05L	10	11	9-13
0+30, 05L	9	11	9-11
0+35, 05L	9	9	9-11
0+40, 05L	9	9	-
0+15, 9.3L	11	14	-
0+05, 9.5L	10	13	-
0+10, 9.5L	10	15	-
0+00, 10L	9	9	-
0+05, 10L	10	13	-
0+10, 10L	11	14	-
0+15, 10L	13	15	-
0+20, 10L	10	11	-
0+25, 10L	11	11	-
0+30, 10L	9	10	-
0+35, 10L	10	10	-
0+40, 10L	11	11	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analysis on the property at 7 Palmer Avenue, Albany, New York (AL017)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
		Systematic samples[d]		
AL017S1A	0+01, 5L	0-5	-	11
AL017S1B	0+01, 5L	5-15	-	3.2
AL017S2A	0+05, 5L	0-5	-	9.0
AL017S2B	0+05, 5L	5-15	-	7.8
AL017S3A	0+15, 5L	0-5	1.5 ± 0.1	13
AL017S3B	0+15, 5L	5-15	-	9.6
AL017S4A	0+25, 5L	0-5	-	9.6
AL017S4B	0+25, 5L	5-15	-	5.9
AL017S5A	0+35, 5L	0-5	-	8.4
AL017S5B	0+35, 5L	5-15	-	6.1
AL017S6A	0+40, 5L	0-5	-	12
AL017S6B	0+40, 5L	5-15	-	6.4
AL017S7A	0+30, 5L	0-5	-	3.2
AL017S7B	0+30, 5L	5-15	-	3.7
AL017S8A	0+20, 5L	0-5	-	9.1
AL017S8B	0+20, 5L	5-15	-	6.4
AL017S9A	0+12, 10L	0-5	-	5.0
AL017S9B	0+12, 10L	5-15	-	4.6
AL017S10A	0+24, 10L	0-5	-	4.5
AL017S10B	0+24, 10L	5-15	-	4.2
AL017S11A	0+16, 10L	0-5	-	13
AL017S11B	0+16, 10L	5-15	-	5.4
AL017S12A	0+08, 10L	0-5	-	15
AL017S12B	0+08, 10L	5-15	-	6.1
AL017S13A	0+00, 10L	0-5	-	44
AL017S13B	0+00, 10L	5-15	-	17
		Biased samples[e]		
AL017B1A	0+08, 9.5L	0-5	±	60
AL017B1B	0+08, 9.5L	5-15	±	7.9
AL017B2A	0+11, 9.5L	0-5	1.2 ± 0.2	110
AL017B2B	0+11, 9.5L	5-15	±	6.2
AL017B2C	0+11, 9.5L	15-30	±	[illegible].3
AL017B3A	0+04, 5.5L	0-5	±	42
AL017B3B	0+04, 5.5L	5-15	±	1.7
AL017B4A	0+10, 2.8L	0-5	±	18
AL017B4B	0+10, 2.8L	5-15	±	12
AL017B4C	0+10, 2.8L	15-30	±	7.1

Table 3 (continued)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]

Isotopic Analysis by Mass Spectrometry

Sample	Atom percent			
	^{235}U	^{234}U	^{236}U	^{238}U
AL17H2A	0.207	0.0005	0.0027	99.789

[a]Locations of soil samples are shown on Fig. 5.

[b]Indicated counting error is at the 95% confidence level (± 2σ).

[c]Total analytical error of measurement results is < ± 5% (95 % confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Results of surface analysis of structures at 7 Palmer Avenue, Albany, New York (AL017)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity					
Roof of house	4	35,28,70,56	-	47	-
Walkways	3	16,42,70	-	43	-
Total	7	16-70	-	45	-
Beta-Gamma					
Roof of house	4	-	0.03,0.03,0.05,0.04	-	0.04
Walkways	3	-	0.03,0.03,0.04	-	0.03
Total	7	-	0.03-0.05	-	0.04

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 erg per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

Table 5. Summary of outdoor measurements and sample results on the property at 7 Palmer Avenue, Albany, New York (AL017)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	31	8-13	10
Gamma exposure rate at surface (μR/h)[a]	31	8-15	11
Scan, gamma exposure rate near surface (μR/h)[b]	-	7-20	-
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	26	3.2-44	9.4
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	10	1.7-110	27
Abundance of isotope ^{235}U in uranium (%)	1	-	0.207
Concentration of ^{226}Ra in surface soil (pCi/g)[c,d]	2	1.2-1.5	1.4
<u>Surface measurements</u>[e]			
Alpha activity (dpm/100 cm^2)	7	16-70	45
Beta-gamma activity (mrad/h)	7	0.03-0.05	0.04

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Biased samples, Table 3.
[e]Surface measurements, Table 4.

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RESULTS OF THE RADIOLOGICAL SURVEY AT 24 YARDBORO AVENUE, ALBANY, NEW YORK (AL019)

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Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 24 YARBORO AVENUE, ALBANY, NEW YORK (ALB19)

J. L. Marley, B. A. Berven, and W. D. Cottrell

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RADIOLOGICAL SURVEY ACTIVITIES PROGRAM

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RESULTS OF THE RADIOLOGICAL SURVEY AT 24 YARDBORO AVENUE, ALBANY, NEW YORK (AL019)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 16 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period May 29-June 7, 1984. The property at 24 Yardboro Avenue in Albany, New York (AL019) was the subject of a radiological investigation on June 2, 1984.

This private property consisted of a three-story residence surrounded by asphalt areas at the front and two sides. A garden is located to the rear. A diagram of the property showing the approximate property boundaries and the grid network established for measurements outside the house is shown in Fig. 1. The rectangular lot included in the radiological survey was approximately 34 m deep by 9 m wide. The house was the only on-site structure. A front view of the property is shown in Fig. 2.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

understand the cause of gamma exposure rates beside the house. The beta-gamma at the surface was 0.12 mrad/h at 0+15, BL; and after removal of the surface, it measured 0.05 mrad/h. It was calculated that most of the activity originates nor the surface or in the sealing coat. It was also observed that the gamma level along the east side of the house, approximately 2/3 m from the asphalt surface, measured 12-17 μR/h. It is, therefore, probable that the elevated gamma rate is caused by radiation from construction materials and from traces of contamination that has adhered to the sealing coat.

Soil Sampling

Twenty-two systematic soil samples were taken at eleven locations on the property. Systematic denotes samples that were taken at grid locations irrespective of the gamma exposure exposure level at the point of sampling. The locations of the samples are shown in Fig. 4, and the results of analysis are presented in Table 3.

At each location samples were taken at 0 to 5 cm and at 5 to 15 cm depths. Concentrations of ^{238}U in the soil samples ranged from 0.43 to 83 pCi/g (picocuries* per gram) and averaged 20 pCi/g. The concentration of ^{238}U in the 0 to 5 cm samples averaged 21 pCi/g and averaged 19 pCi/g in the 5 to 15 cm depth samples. Although the ratio of concentration at 0 to 5 cm to concentration at 5 to 15 cm depths was 2.31, in line with that found at most locations, it is noteworthy that the ^{238}U in the samples representing the highest concentrations found on the property, 83 and 48 pCi/g (samples AL19S1B and AL19S11B, respectively), did not show a decrease in concentration with depth. Further sampling to determine the depths of migration of uranium into the soil at these locations may be necessary. It is believed that the uranium has migrated into the soil primarily as a result of natural processes such as freezing and thawing, melting snow, and washing by rain. Sample AL19S1 from 0+19, 1R, a location below a drainage path fromthe roof of the house, is probably an excellent example of the effect of rain washing the ^{238}U from the roof to the ground where the uranium is absorbed and retained in the soil. It is also probable that the uranium will be further diffused, become less concentrated with time, as the above processes continue to disperse the uranium.

The isotopic content of the uranium in the soil was determined by thermal ionization mass spectrometry. The uranium-235 isotope content of the uranium in sample AL19S1A was 0.205%.

Radium was measured in sample AL19S1A. The concentration of ^{226}Ra was 0.65 pCi/g.

---

*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.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

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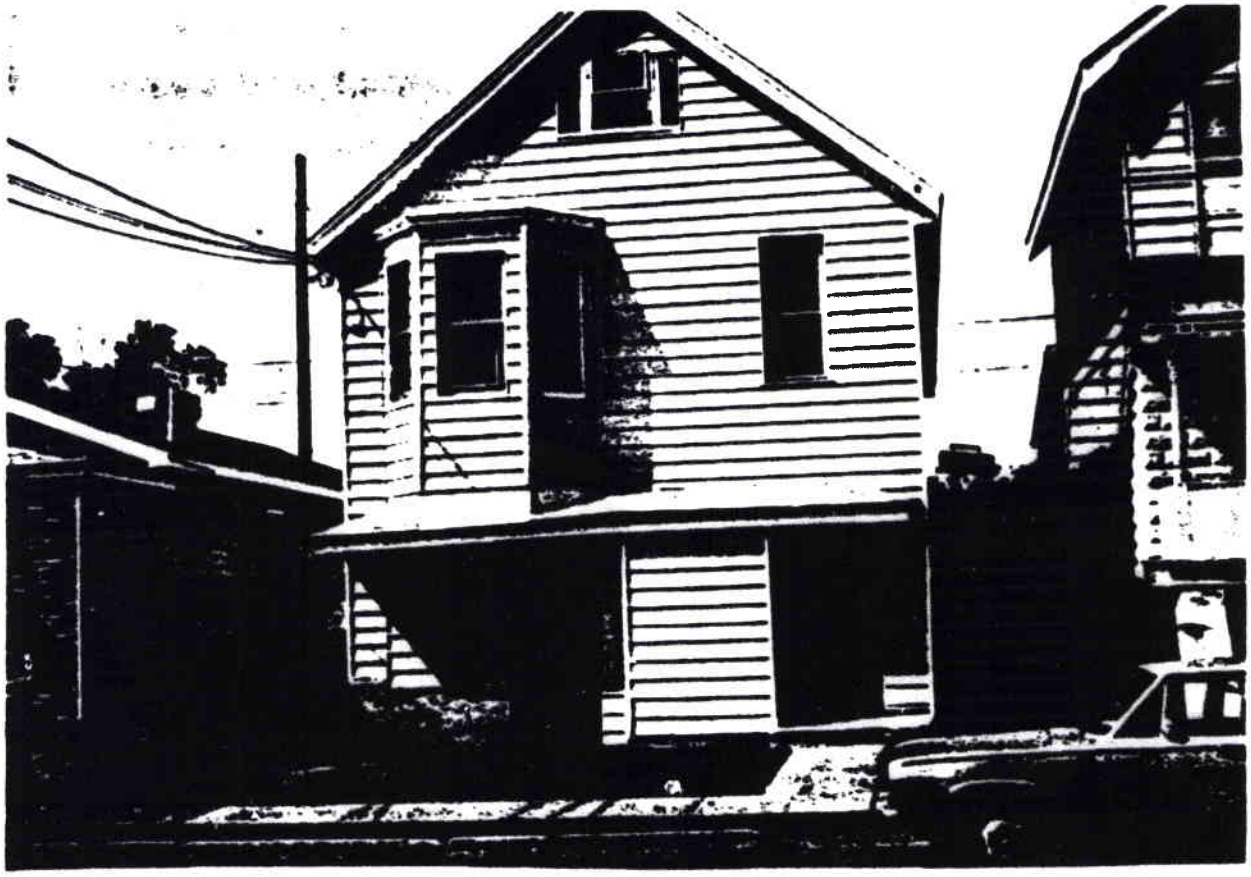

Fig. 2. Front view of the property at 24 Yardboro Avenue, Albany, New York (AL019) looking northwest.

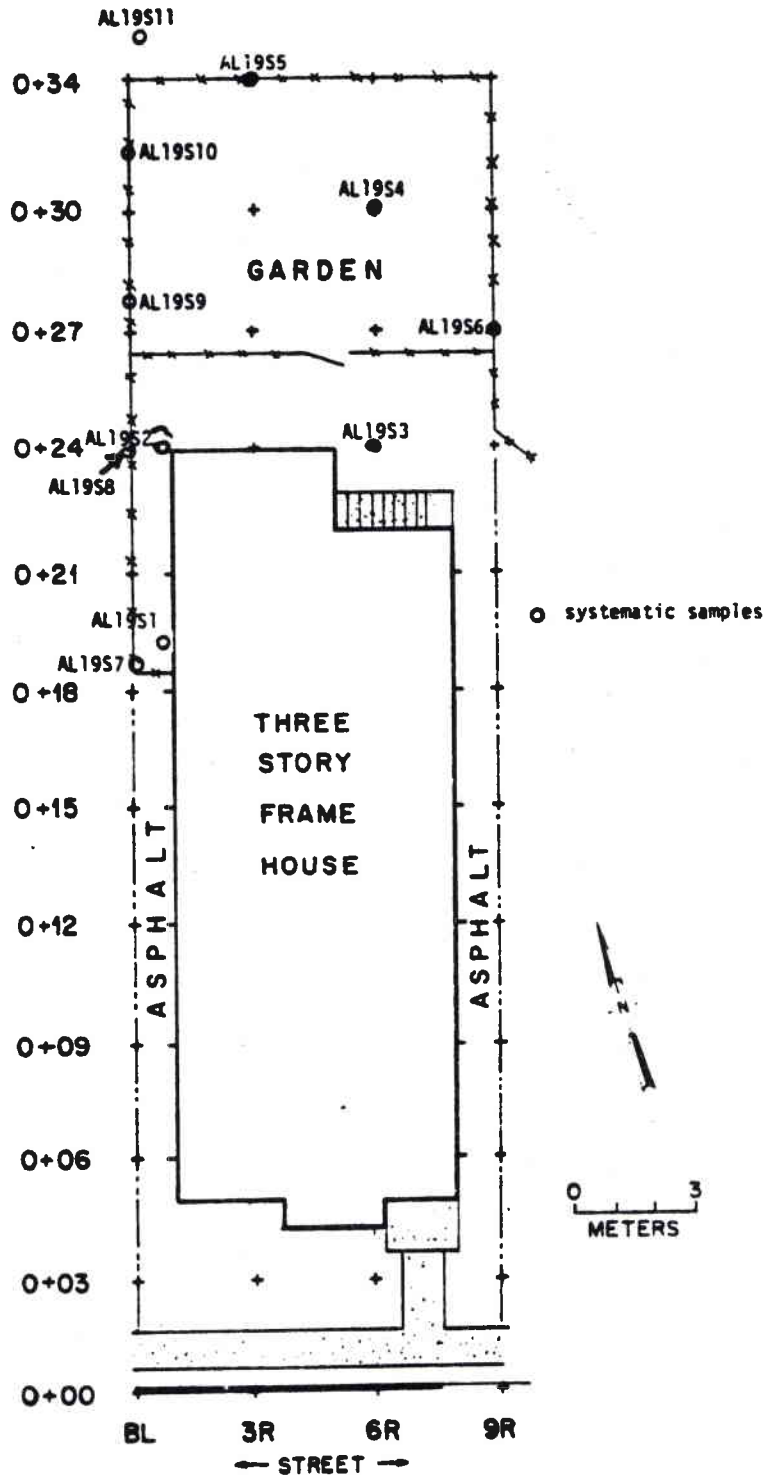

Fig. 4. Locations of soil samples on the property at 24 Yardboro Avenue, Albany, New York (AL019).

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Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	11	19	8-19
0+03, BL	11	11	8-17
0+06, BL	11	12	11-14
0+09, BL	12	14	11-15
0+12, BL	12	14	11-14
0+15, BL	12	14	11-16
0+18, BL	12	12	11-14
0+21, BL	10	10	10-14
0+24, BL	10	10	8-11
0+27, BL	8	10	8-11
0+30, BL	8	10	-
0+34, BL	8	10	-
0+09, 1R	12	14	-
0+12, 1R	14	14	-
0+15, 1R	12	12	-
0+18, 1R	12	15	-
0+21, 1R	8	11	-
0+00, 3R	12	19	8-19
0+03, 3R	11	12	8-12
0+05, 3R	11	14	8-14
0+24, 3R	14	11	10-12
0+27, 3R	10	10	-
0+30, 3R	8	10	-
0+34, 3R	8	10	-
0+00, 6R	11	19	8-19
0+03, 6R	10	11	8-12
0+06, 6R	12	12	8-14
0+09, 6R	e	e	11-14
0+12, 6R	e	e	11-17
0+15, 6R	e	e	12-15
0+18, 6R	e	e	10-12
0+21, 6R	e	e	10-12
0+24, 6R	11	12	10-12
0+25, 6R	12	12	-
0+27, 6R	10	10	8-14
0+30, 6R	8	10	10-12
0+34, 6R	8	10	-
0+09, 8R	12	14	-
0+12, 8R	12	14	-
0+15, 8R	15	14	-
0+18, 8R	15	15	-
0+21, 8R	12	14	-

Table 3. Results of soil sample analysis on the property at 24 Yardboro Avenue, Albany, New York (AL019)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
		Systematic samples[d]		
AL19S1A	0+19, 1R	0-5	0.65 ± 0.09	82
AL19S1B	0+19, 1R	5-15	-	83
AL19S2A	0+24, 1R	0-5	-	17
AL19S2B	0+24, 1R	5-15	-	4.0
AL19S3A	0+24, 6R	0-5	-	31
AL19S3B	0+24, 6R	5-15	-	8.3
AL19S4A	0+30, 6R	0-5	-	12
AL19S4B	0+30, 6R	5-15	-	11
AL19S5A	0+34, 3R	0-5	-	12
AL19S5B	0+34, 3R	5-15	-	13
AL19S6A	0+27, 9R	0-5	-	17
AL19S6B	0+27, 9R	5-15	-	17
AL19S7A	0+18.5, BL	0-5	-	32
AL19S7B	0+18.5, BL	5-15	-	16
AL19S8A	0+24, BL	0-5	-	0.63
AL19S8B	0+24, BL	5-15	-	0.48
AL19S9A	0+28, BL	0-5	-	5.2
AL19S9B	0+28, BL	5-15	-	0.64
AL19S10A	0+32, BL	0-5	-	5.1
AL19S10B	0+32, BL	5-15	-	2.9
AL19S11A	0+35, 0.2R	0-5	-	14
AL19S11B	0+35, 0.2R	5-15	-	48

Isotopic Analysis by Mass Spectrometry

Sample	Atom percent			
	^{235}U	^{234}U	^{236}U	^{238}U
AL19S1A	0.205	0.0008	0.0028	99.791

[a]Locations of soil samples are shown on Fig. 4.

[b]Indicated counting error is at the 95% confidence level ($\pm 2\sigma$).

[c]Analytical error of measurement results is $< \pm 5\%$ (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

Table 5. Summary of outdoor measurements and sample results on the property at 24 Yardboro Avenue, Albany, New York (AL019)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	49	8-15	11
Gamma exposure rate at surface (μR/h)[a]	49	10-19	12
Scan, gamma exposure rate near surface (μR/h)[b]	-	8-19	-
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	22	0.48-83	20
Abundance of isotope ^{235}U in uranium (%)	1	-	0.205
Concentration of ^{226}Ra in surface soil (pCi/g) systematic locations[c]	1	-	0.65
<u>Surface measurements</u>[d]			
Alpha activity (dpm/100 cm^2)	11	<7-	58
Beta-gamma activity (mrad/h)	11	0.03-0.04	0.06

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Surface measurements, Table 4.

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1160/1162 CENTRAL AVENUE, COLONIE, NEW YORK (AL020)

OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
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ORNL/RASA-84/223
(AL020)

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 1160/1162 CENTRAL AVENUE, COLONIE, NEW YORK (AL020)

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1160/1162 CENTRAL AVENUE, COLONIE, NEW YORK (AL020)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 16 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period May 29–June 7, 1984. The property at 1160/1162 Central Avenue in Colonie, New York (AL020) was the subject of a radiological investigation on June 2, 1984.

This commercial property consisted of a single-story concrete block, brick-faced building housing a bowling alley and retail shops, also with a concrete block storage or garage structure to the rear. The outside areas were covered with asphalt paving except for narrow strips (about 2 m wide) along two sides. A diagram of the property showing the approximate property boundaries and the grid network established for measurements outside the structures is shown in Fig. 1. The irregular shaped area included in the radiological survey was approximately 90 m wide at the front, 137 m wide at the rear, and 121 m deep. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha and beta-gamma activity from surfaces of structures outdoors on the property. A comprehensive description of the survey methods and instrumentation has been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. The data is 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/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 7 to 14 μR/h (microroentgens* per hour) and averaged 9 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 7 to 14 μR/h and averaged 9 μR/h. The maximum gamma exposure rates, 18 to 19μR/h, were measured along a rock wall at the edge of the asphalt, approximately 0+20 to 0+40, 90R. Finding elevated gamma exposure rates at the rock wall was not an unusual occurrence and should not become an item of personal concern because most brick and many naturally occurring stones used as construction materials exhibit an increase in gamma exposure rates when compared to surrounding soils. The increases are caused by the presence of trace amounts of naturally occurring radioactive elements such as potassium, radium, thorium, and uranium, which are present in these materials. All of these minute sources together make up the natural background from the radioactivity that is a part of our environment.

---

*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.

Soil Sampling

Twenty-two soil samples were taken at this property. Twenty of these at ten locations [denoted as systematic samples (AL20S)] were taken without regard to gamma exposure rates at the sampling points. Two samples at one location [denoted as a biased sample (AL20B1)] were taken in a grassy area having an elevated gamma rate. The locations of samples are shown on Fig. 5 and the results of analysis are presented in Table 3.

Samples were taken at 0 to 5 cm and at 5 to 15 cm depths. The concentrations of ^{238}U in the systematic soil samples ranged from 1.6 to 81 pCi/g (picocuries* per gram) and averaged 23 pCi/g. The concentration of ^{238}U in the 0 to 5 cm depth samples averaged 32 pCi/g and averaged 13 pCi/g for the 5 to 15 cm depth samples. Also, the ratio of concentration at 0 to 5 cm to concentration at 5 to 15 cm depths is 3.06, showing that the ^{238}U is generally more concentrated in the 0 to 5 cm depths. The highest concentration of ^{238}U found on the property, 81 pCi/g, was in a strip of shrubbery and weeds at the edge of the paving in sample AL20S3A, at location 0+70, BL.

The isotopic content of the uranium in the soil was determined by thermal ionization mass spectrometry. The uranium-235 isotope content of the uranium in sample AL20B1A was 0.208%.

Radium concentrations of 0.71 to 0.78 pCi/g, averaging 0.75 pCi/g, were measured in samples AL20S2A and AL20B1A.

Surface Measurements

Alpha and beta-gamma activity were measured at selected locations on the flat roofs of the two buildings on the property. The results of the measurements are presented in Table 4. The alpha activity ranged from <7 to 42 dpm/100 cm^2. The beta-gamma activity ranged from 0.02 to 0.05 mrad/h and averaged 0.03 mrad/h.

The alpha and beta-gamma measurements were then performed over the asphalt paving of the parking areas and over the walkways on the property. The frequency of analysis approximated 20 m spacing, consistant with the grid system which was established earlier with an important exception. Measurements started at approximately 0+00, 2R, the line on the parking lot about 15 cm (6") to the right of an asphalt curb that provides a barrier and an apparent drainage route for rain or melting snow. The alpha activity ranged from <7 to 210 dpm/100 cm^2 and averaged 79 dpm/100 cm^2. The beta-gamma ranged from 0.02 to 0.31 mrad/h, averaging 0.10 mrad/h. The results are presented in Table 5. In order to determine the areal extent of contamination, a set of measurements was completed based on 1 m grid spacing, beginning from 0+80, 2R, the location having a beta-gamma rate of 0.31 mrad/h. Measurements were made toward the front of the property to 0+71, 2R, to the rear to 1+19, 3R, and to the right until as necessary to assure that the boundary of significant contamination was reached. Beta-gamma was determined at 42

grid locations. The values ranged from 0.04 (0+88, 3R) to 0.61 mrad/h (0+85, 2R). The locations of measurements and the beta-gamma levels are shown on Fig. 6. All results greater than 0.20 mrad/h are underlined for emphasis and show contiguous grids >0.20 mrad/h, and the band of elevated beta-gamma following the course for water flow to the storm drain at 0+116, 7R. The offset at 0+10 to 3R is consistent with the change in the drainage course toward the storm drain. Figure 7 shows the estimated area of contamination (~141 m^2).

Location 0+85, 2R with 0.61 mrad/h was selected after an evaluation of the position of the source of the beta-gamma, i.e., the contamination may be surface (in the seal coat), from the asphalt matrix, or from the ground under the paving. The position reading 0.61 mrad/h was confirmed; then 6 to 9 mm (1/4"-3/8") of surface was removed by chipping; then the measurement was repeated. The beta-gamma activity was reduced to 0.08 mrad/h, demonstrating that the source of the radioactivity was from material in the seal coat. The test was repeated at 1+11, 4R. Chipping 6 to 9 mm of surface reduced the beta-gamma from 0.26 to 0.09 mrad/h.

Two other locations having beta-gamma activity greater than 0.20 mrad/h were evaluated. The beta-gamma from the asphalt near the building (0+60, 34R) measured 0.21 mrad/h. Determinations at adjacent areas (0+60, 33R; 0+59, 34R; 0+61, 34R, with 0.07, 0.10, and 0.11 mrad/h, respectively (Table 5) show that the 0+60, 34R spot is not part of an extended area and should be disregarded.

Beta-gamma from location 1+05, 34R was 0.23 mrad/h; beta-gamma from 1+05, 33R was 0.23 mrad/h. Ten additional measurements including 1+10, 34R were 0.20 mrad/h or less (see Table 5). It is recommended that this small area be disregarded. Based on the gamma exposure in this area there is no risk to health. The gamma scan of the surface of the 1+00, 20R grid block ranged from 7 to 12 μR/h (see Table 2), levels within the range of the background for New York state.

A summary of the outdoor measurement results is provided in Table 5.

---

*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.

SIGNIFICANCE OF FINDINGS

Measurements of the gamma exposure levels outdoors on the property determined that the exposure rate at 1 m above the ground surface ranged from 7 to 14 μR/h and averaged 9 μR/h, the same as the background for the Albany area. For comparison, the typical background for the state of New York[8,9] averages 9.5 μR/h and ranges from 6.8 to 13 μR/h (one standard deviation) determined by 51 measurements. Based on this information, there is no indication of risk to health caused by gamma exposure rates outdoors on the property.

The results of ^{238}U analysis establish the presence of uranium at concentrations significantly above background on the property. The average concentration of 23 pCi/g of ^{238}U in the systematic samples is approximately 24 times the normal background of 0.96 pCi/g for the Albany area. However, the average is below the DOE guideline[10] of 35 pCi/g ^{238}U. The maximum concentration of ^{238}U measured, 81 pCi/g in sample AL2083A, was approximately 2.3 times the DOE guideline.

The 0.208 atom percent ^{238}U determined by mass spectrometry establishes that the uranium which contaminated the property is depleted, i.e., it has been treated by a separations process; and a significant fraction of the ^{235}U has been removed. Natural uranium contains 0.7% uranium-235.

The average alpha activity of 23 dpm/100 cm^2 obtained by measurements on the roof of the buildings is well below the DOE criterion of 5000 dpm/100 cm^2 for alpha activity from natural uranium, uranium-235, or uranium-238. The average and maximum beta-gamma activities of 0.03 and 0.05 mrad/h measured on the roofs are less than the DOE criteria of 0.20 and 1.0 mrad/h at 1 cm, respectively.

The average alpha activity of 79 dpm/100 cm^2 obtained by measurement of the asphalt surfaces is well below the DOE criterion of 5000 dpm/100 cm^2 for alpha activity, natural uranium, uranium-235, or uranium-238. All asphalt surfaces measured less than the 1.0 mrad/h maximum; however, a number of areas greater than 1 m^2 have beta-gamma activity greater than 0.2 mrad/h.

The estimated asphalt surface exceeding the DOE criterion is 241 m^2.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/RQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindokin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. Environmental Research Division, Action Description Memorandum. "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

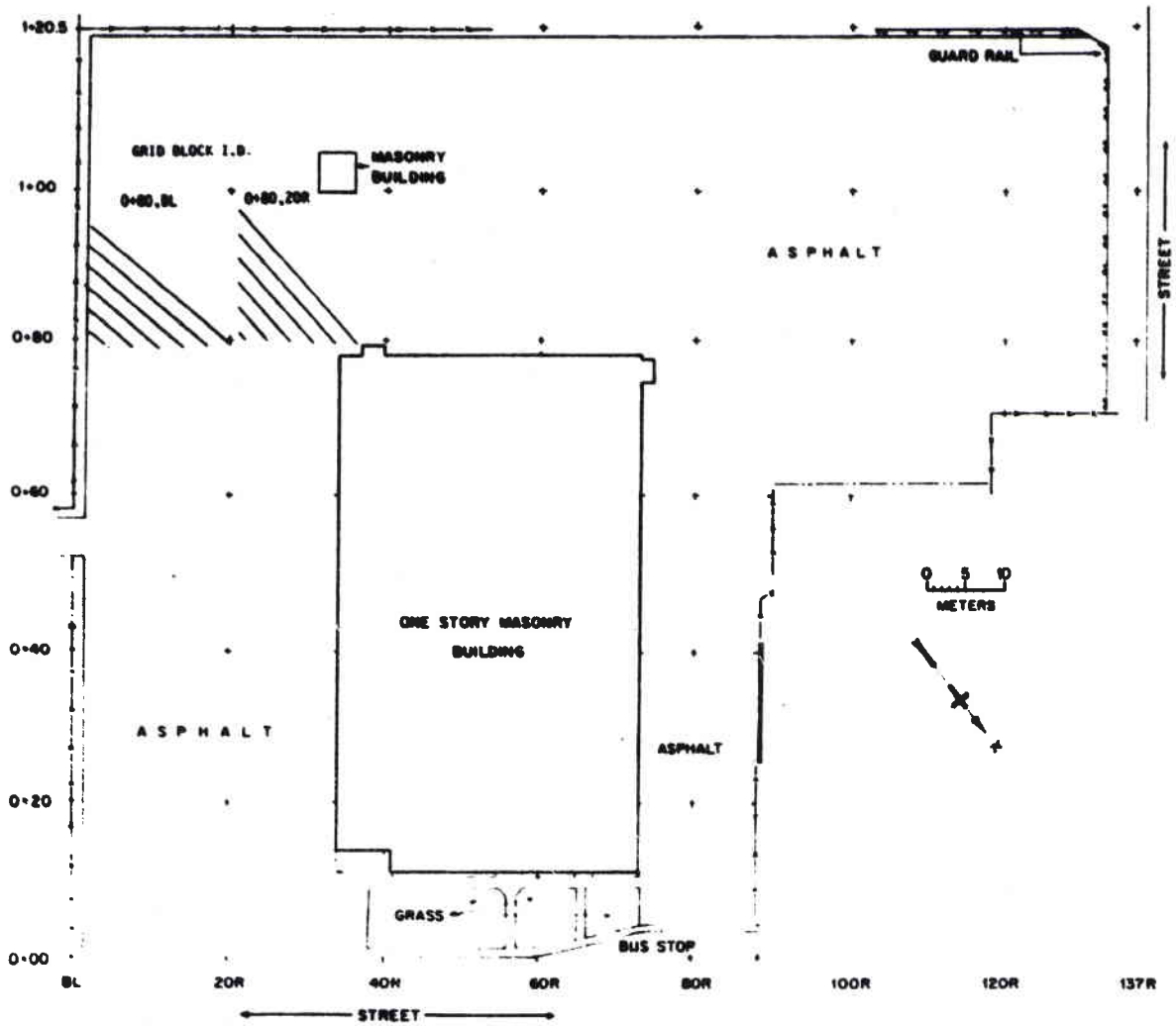

Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 1160/1162 Central Avenue, Colonie, New York (AL020).

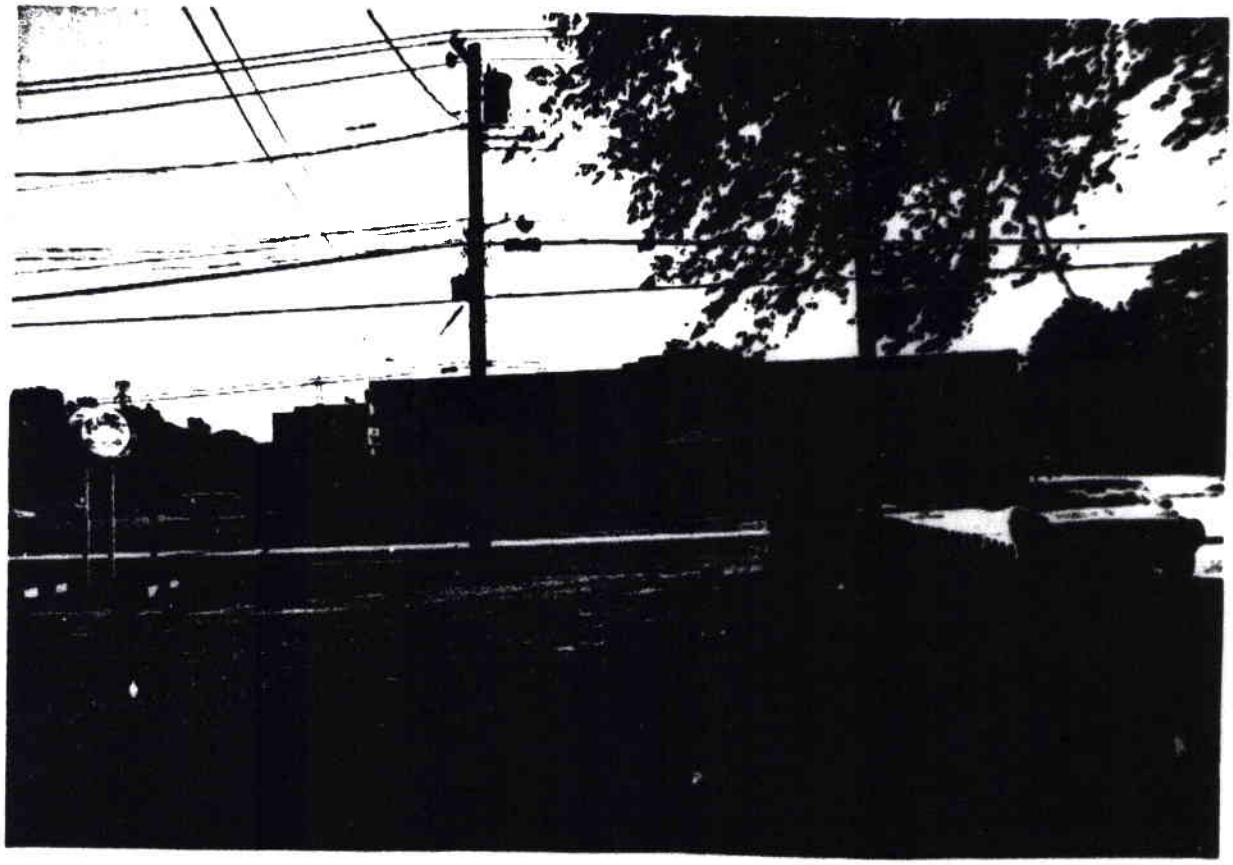

Fig. 2. Front view of the property at 1160/1162 Central Avenue, Colonie, New York (AL020) looking southwest.

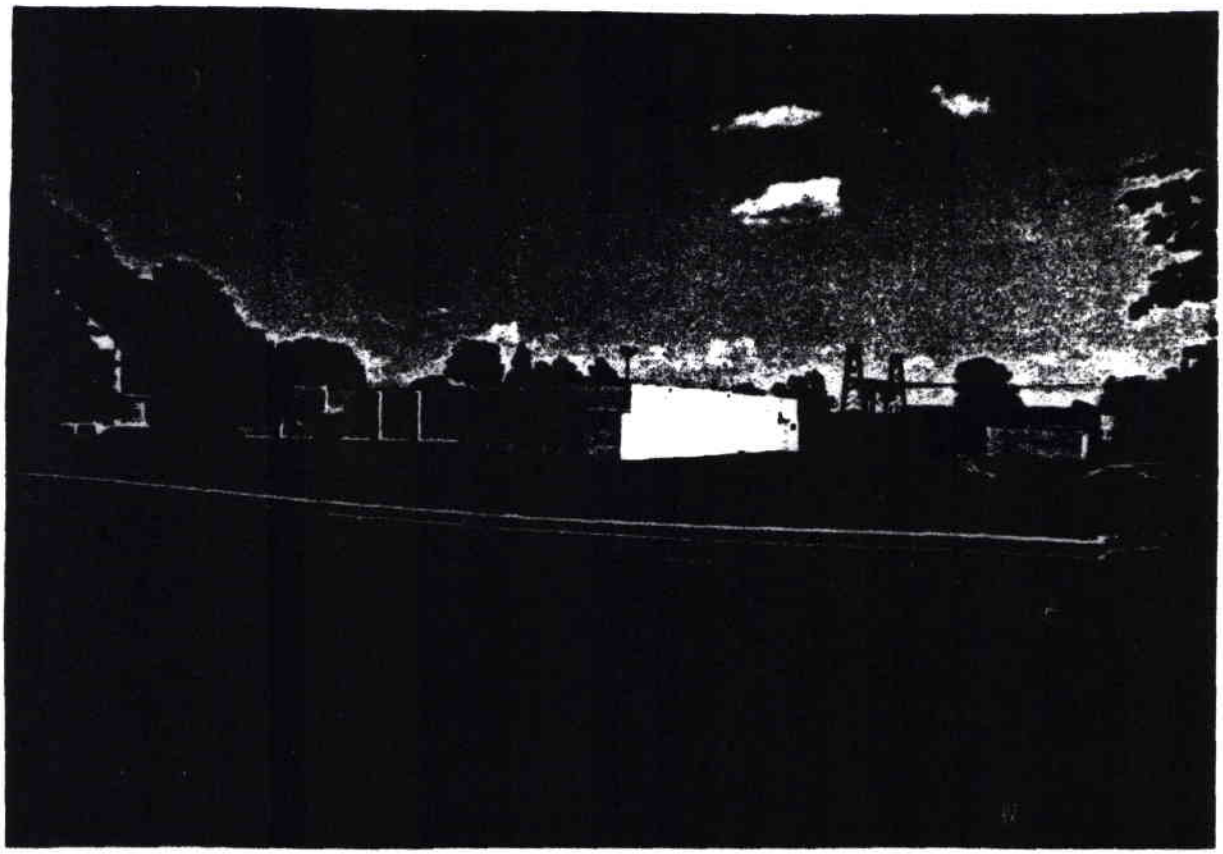

Fig. 3. Rear view of the property at 1160/1162 Central Avenue, Colonie, New York (AL020) looking east.

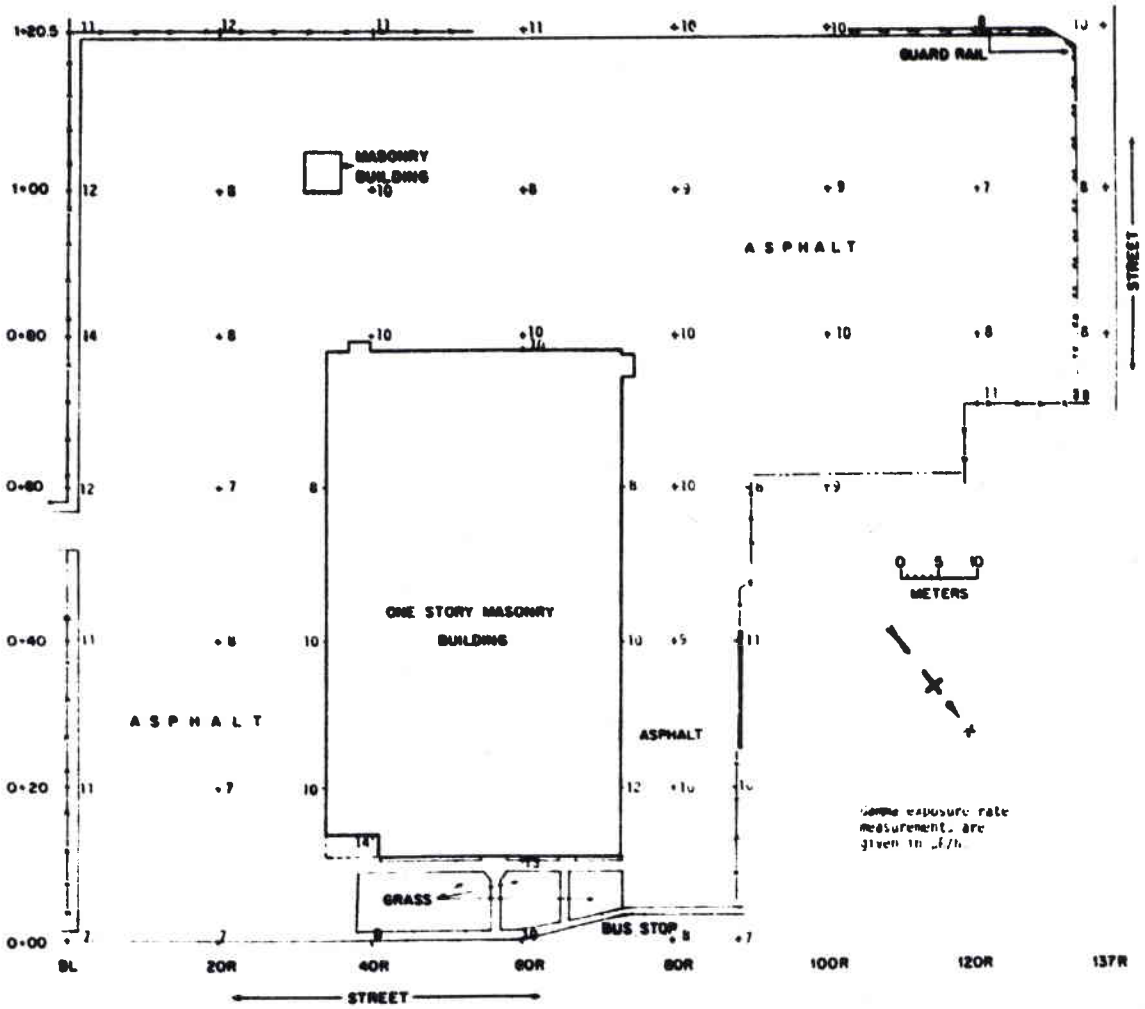

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 1160/1162 Central Avenue, Colonie, New York (AL020).

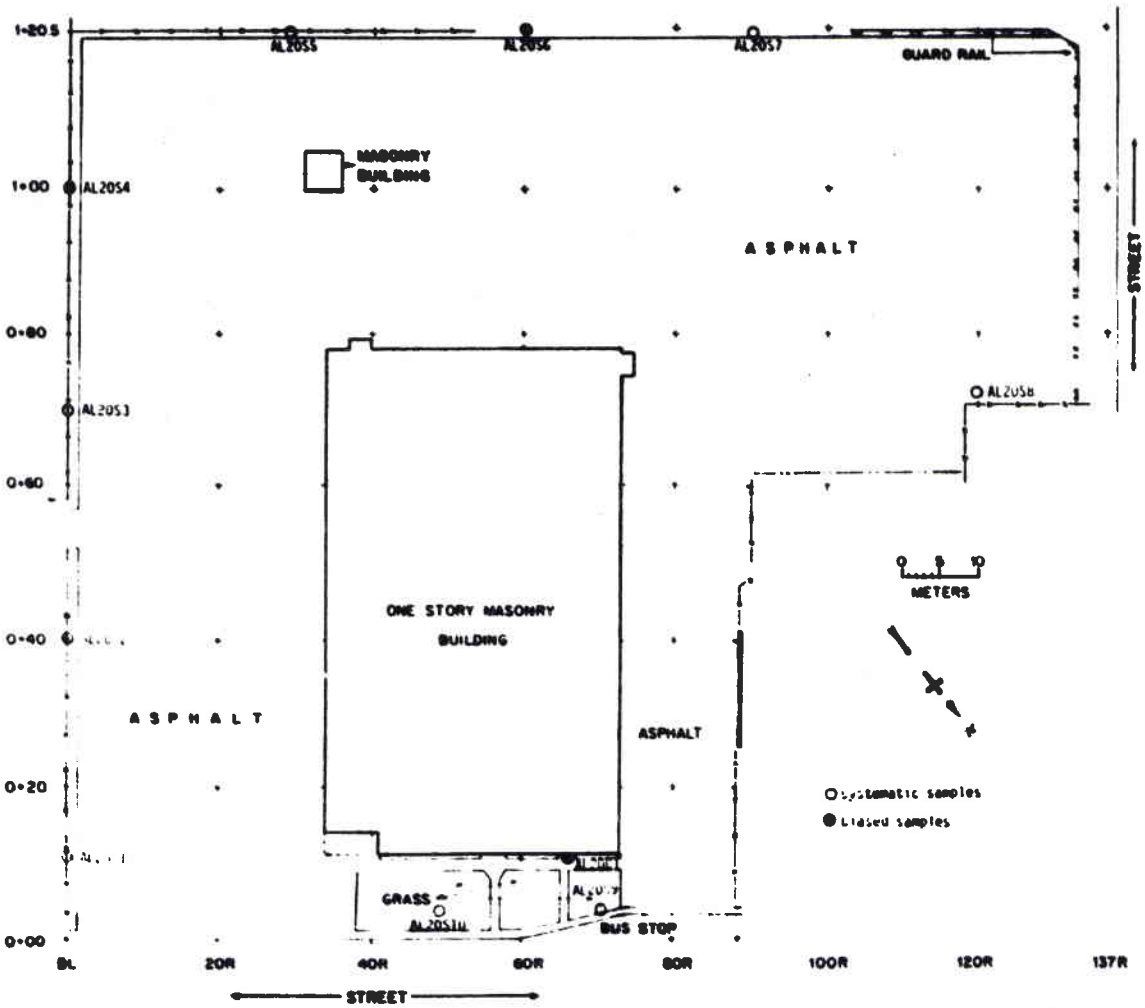

Fig. 5. Locations of soil samples on the property at 1160/1162 Central Avenue, Colonie, New York (AL020).

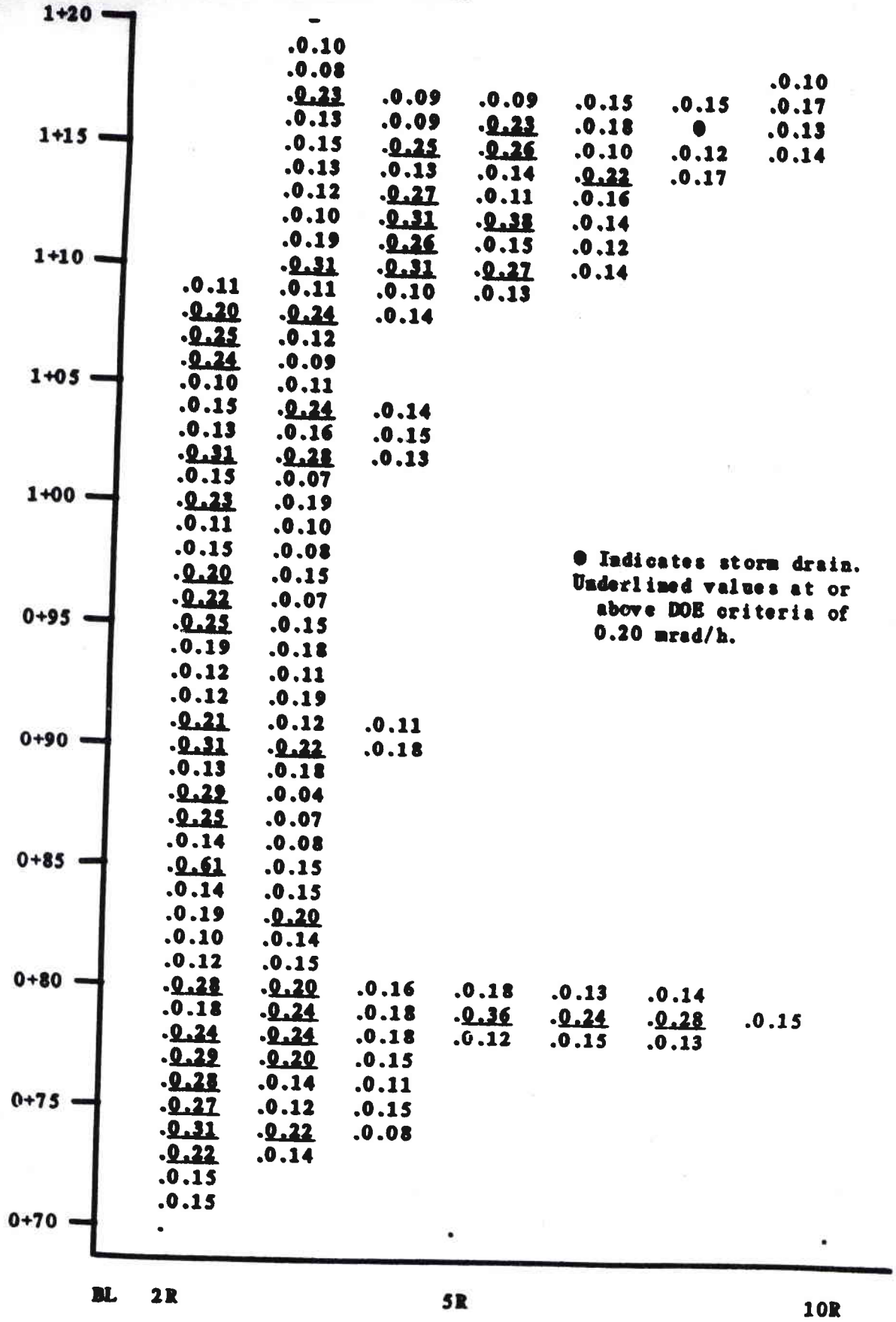

Fig. 6. Results of surface analysis of asphalt paving, 1 m grid, on the property at 1160/1162 Central Avenue, Colonie, New York (AL020).

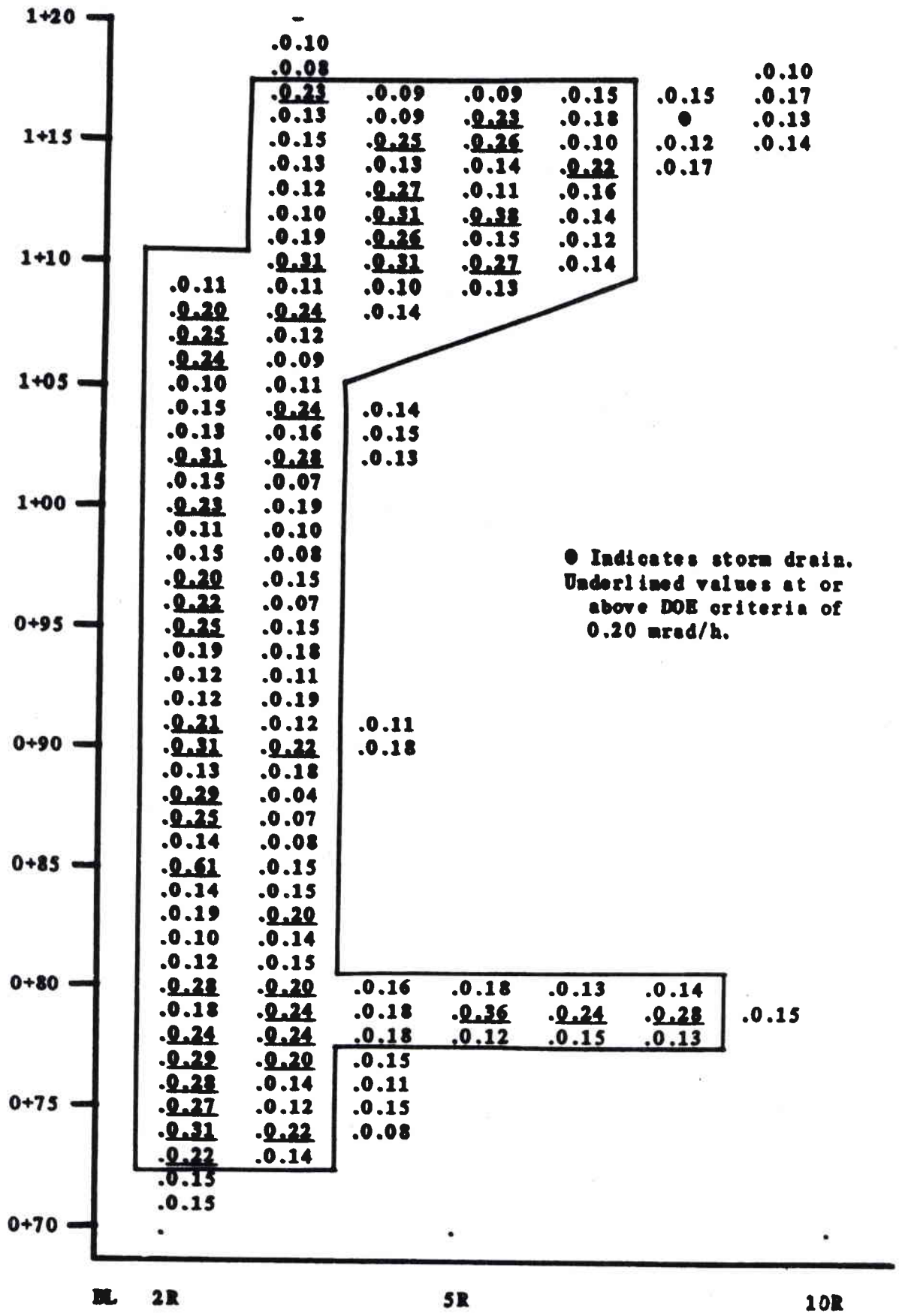

Fig. 7. Estimated area with contamination exceeding criterion, 1 m grid, on the property at 1160/1162 Central Avenue, Colonie, New York (AL020).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 1160/1162 Central Avenue, Albany, New York (AL020)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	7	7	6-11
0+20, BL	8	11	6-13
0+40, BL	8	11	7-12
0+60, BL	11	12	7-14
0+80, BL	12	14	7-15
1+00, BL	9	12	7-15
1+20.5, BL	11	11	-
0+00, 20R	7	7	7-14
0+20, 20R	7	7	7-12
0+40, 20R	8	8	8-12
0+60, 20R	7	7	7-10
0+80, 20R	8	8	7-11
1+00, 20R	7	8	7-12
1+20.5, 20R	10	12	-
0+20, 34R	10	10	-
0+40, 34RR	10	10	-
0+60, 34R	9	8	-
0+00, 40R	9	8	5-16
0+14, 40R	14	14	-
0+20, 40R	e	e	-
0+40, 40R	e	e	-
0+60, 40R	e	e	10-11
0+80, 40R	10	10	8-11
1+00, 40R	10	10	8-11
1+20.5, 40R	11	11	-
0+00, 60R	9	10	5-16
0+11, 60R	11	13	-
0+20, 60R	e	e	8-12
0+40, 60R	e	e	8-12
0+60, 60R	e	e	8-12
0+79, 60R	10	10	-
0+80, 60R	10	10	8-11
1+00, 60R	8	8	8-11
1+20.5, 60R	10	11	-
0+20, 73R	11	12	-
0+40, 73R	11	10	-
0+60, 73R	8	8	-
0+00, 80R	7	8	7-11
0+20, 80R	10	10	8-19

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+40, 80R	9	9	8-18
0+60, 80R	10	10	8-10
0+80, 80R	10	10	7-10
1+00, 80R	9	9	7-11
1+20.5, 80R	9	10	-
0+00, 88.5R	7	7	-
0+20, 88.5R	10	10	-
0+40, 88.5R	11	11	-
0+60, 90R	8	8	8-10
0+60, 100R	9	9	8-12
0+80, 100R	10	10	8-11
1+00, 100R	9	9	8-11
1+20.5, 100R	9	10	-
0+72, 120R	10	11	8-14
0+80, 120R	8	8	8-11
1+00, 120R	8	7	7-11
1+20.5, 120R	8	8	-
0+72, 137R	8	8	-
0+80, 137R	8	8	-
1+00, 137R	8	8	-
1+20.5, 137R	9	10	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analysis on the property at 1160/1162 Central Avenue, Colonie, New York (AL020)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
		Systematic samples[d]		
AL020S1A	0+10, BL	0-5	-	41
AL020S1B	0+10, BL	5-15	-	14
AL020S2A	0+40, BL	0-5	0.78 ± 0.2	35
AL020S2B	0+40, BL	5-15	-	14
AL020S3A	0+70, BL	0-5	-	81
AL020S3B	0+70, BL	5-15	-	21
AL020S4A	1+00, BL	0-5	-	55
AL020S4B	1+00, BL	5-15	-	14
AL020S5A	1+20.5, 30R	0-5	-	17
AL020S5B	1+20.5, 30R	5-15	-	3.1
AL020S6A	1+20.5, 60R	0-5	-	15
AL020S6B	1+20.5, 60R	5-15	-	27
AL020S7A	1+20.5, 90R	0-5	-	38
AL020S7B	1+20.5, 90R	5-15	-	4.7
AL020S8A	0+72, 120R	0-5	-	29
AL020S8B	0+72, 120R	5-15	-	16
AL020S9A	0+05, 70R	0-5	-	10
AL020S9B	0+05, 70R	5-15	-	7.5
AL020S10A	0+05, 50R	0-5	-	1.6
AL020S10B	0+05, 50R	5-15	-	12
		Biased samples[e]		
AL020B1A	0+11, 65R	0-5	0.71 ± 0.1	16
AL020B1B	0+11, 65R	5-15	-	14

Table 3 (continued)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]

Isotopic Analysis by Mass Spectrometry

Sample	Atom percent			
	^{235}U	^{234}U	^{236}U	^{238}U
AL20B1A	0.208	0.0009	0.0030	99.788

[a]Locations of soil samples are shown on Fig. 4.

[b]Indicated counting error is at the 95% confidence level ($\pm 2\sigma$).

[c]Analytical error of measurement results is $< \pm 5\%$ (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Results of surface analysis of the roofs of the buildings at 1160/1162 Central Avenue, Colonie, New York (AL020)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity	15	28,28,21,<7,35,<7,<7,28,42,35,35,14,7,14,35	-	23	-
Total	15	<7-42	-	23	-
Beta-Gamma	15	-	0.04,0.02,0.02,0.03,0.02,0.02,0.03,0.04,0.03,0.04,0.03,0.04,0.05,0.05,0.04	-	0.03
Total	15	-	0.02-0.05	-	0.03

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 ergs per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

Table 5. Results of surface analysis of the asphalt paving at 1160/1162 Central Avenue, Colonie, New York (AL020)

Grid location	Alpha activity (dpm/100 cm^2)	Beta-gamma activity (mrad/h)[a]
0+00, 2R[b]	21	0.04
0+10, 2R	-	0.07
0+20, 2R	21	0.07
0+30, 2R	-	0.15
0+40, 2R	35	0.15
0+50, 2R	-	0.20
0+60, 2R	1	0.03
0+60, 3R	-	0.15
0+70, 2R	-	0.17
0+80, 2R	<7	0.31
1+00, 2R	49	0.23
1+19, 2R	49	0.12
0+00, 20R	119	0.03
0+20, 20R	161	0.03
0+40, 20R	210	0.04
0+60, 20R	112	0.05
0+80, 20R	91	0.04
1+00, 20R	56	0.06
1+19, 20R	105	0.12
0+10, 34R	70	0.08
0+20, 34R	98	0.05
0+40, 34R	84	0.07
0+60, 34R	91	0.21
0+60, 33R	-	0.07
0+59, 34R	-	0.10
0+61, 34R	-	0.11
0+79, 34R	112	0.05
1+05, 34R	98	0.23
1+05, 33R	119	0.23
1+05, 32R	-	0.14
1+05, 35R	112	0.14
1+06, 34R	112	0.20
1+06, 33R	-	0.15
1+06, 35R	-	0.19
1+07, 34R	-	0.15
1+07, 35R	-	0.12
1+08, 34R	-	0.12
1+09, 34R	-	0.13
1+10, 34R	-	0.12
0+08, 40R	161	0.11
1+00, 40R	77	0.08
1+19, 40R	70	0.10
0+10, 50R	-	0.04
0+10, 59R	-	0.02

Table 5 (continued)

Grid location	Alpha activity (dpm/100 cm^2)	Beta-gamma activity (mrad/h)[a]
0+80, 60R	105	0.10
1+00, 60R	91	0.13
1+19, 60R	70	0.05
0+10, 73R	–	0.03
0+15, 73R	–	0.07
0+20, 73R	–	0.07
0+30, 73R	–	0.07
0+40, 73R	–	0.05
0+50, 73R	–	0.07
0+60, 73R	–	0.08
0+70, 73R	–	0.08
0+20, 80R	14	0.05
0+40, 80R	14	0.05
0+60, 80R	42	0.05
0+80, 80R	28	0.09
1+00, 80R	42	0.14
1+19, 80R	98	0.12
0+60, 100R	56	0.04
0+80, 100R	119	0.04
1+00, 100R	63	0.05
1+19, 100R	70	0.05
0+80, 120R	70	0.05
1+00, 120R	77	0.04
1+19, 120R	98	0.05
Total	42	68
Range	<7-210	0.02-0.31
Average	79	0.10

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 ergs per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

[b]2R, approximation. Locations on a line, approximately 15 cm (6") to the right of asphalt curbing, looking southwest.

Table 6. Summary of outdoor measurements and sample results on the property at 1160/1162 Central Avenue, Colonie, New York (AL020)

Measurement or sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	54	7-14	9
Gamma exposure rate at surface (μR/h)[a]	54	7-14	9
Scan, gamma exposure rate near surface (μR/h)[b]	-	5-19	-
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	20	1.6-81	23
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	2	14-16	15
Abundance of isotope ^{235}U in uranium (%)	1	-	0.208
Concentration of ^{226}Ra in surface soil (pCi/g)	2	0.71-0.78	0.75
Estimated area with contamination exceeding guidelines (m^2)	-	-	141
<u>Surface measurements</u>[e]			
Roofs of Buildings			
Alpha activity (dpm/100 cm^2)	15	<7-42	23
Beta-gamma activity (mrad/h)	15	0.02-0.05	0.03
Asphalt Paving and Walkways			
Alpha activity (dpm/100 cm^2)	42	<7-210	79
Beta-gamma activity (mrad/h)	68	0.02-0.31	0.10
Beta-gamma, 1 m grid (mrad/h)	142	0.04-0.61	0.24

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Biased samples, Table 3.
[e]Surface measurements, Table 4.

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1160 CENTRAL AVENUE, COLONIE, NEW YORK (AL021)

OPERATED BY
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DEPARTMENT OF ENERGY

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ORNL/RASA-84/224
(AL021)

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 1160 CENTRAL AVENUE, COLONIE, NEW YORK (AL021)

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1160 CENTRAL AVENUE, COLONIE, NEW YORK (AL021)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 16 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period May 29–June 7, 1984. The property at 1160 Central Avenue in Colonie, New York (AL021) was the subject of a radiological investigation on June 2, 1984.

This private property consisted of a two-story house and lawn areas. A diagram of the property showing the approximate property boundaries and the grid network established for measurements outside the residence is shown in Fig. 1. The L-shaped lot included in the radiological survey was approximately 15 m wide at the front, and 31 m wide at the rear by 51 m deep. Front and side views of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha and beta-gamma activity from surfaces of structures outdoors on the property. A comprehensive description of the survey methods and instrumentation has been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. The data is 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/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 7 to 12 μR/h (microroentgens* per hour) and averaged 9 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 7 to 13 μR/h and averaged 9 μR/h. The maximum gamma rate measured on the property, 15 μR/h, was at contact with the granite-like stones in the lower part of the house. Most brick and many naturally occurring stones used as construction materials exhibit an increase in gamma exposure rates when compared to surrounding soils. The increases are caused by the presence of trace amounts of naturally-occurring radioactive elements such as potassium, thorium, and uranium, which are present in these materials. All of these minute sources together make up the natural background from radioactivity that is a part of our environment. All other measurements were 13 μR/h or less.

---

*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.

Soil Sampling

Twenty-eight soil samples were taken on this property. Twenty-four of these from twelve locations [denoted as systematic samples (AL21S)] were taken without regard to gamma exposure rates at the sampling points. Four samples from two locations [denoted biased samples (AL21B)] were selected at locations having elevated gamma exposure levels. The locations of samples are shown on Fig. 5, and the results of analysis are presented in Table 3.

Samples were taken at 0 to 5 cm and at 5 to 15 cm depths at each location. Concentrations of ^{238}U in the systematic soil samples ranged from 3.4 to 29 pCi/g (picocuries* per gram) and averaged 13 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 16 pCi/g and averaged 10 pCi/g in the 5 to 15 cm depth samples. The ratio of (concentration at 0 to 5) to (concentration at 5 to 15 cm) depths was 1.69, indicating that the higher concentrations are located near the surface. The sample from grid location 0+10.5, 26R (AL21B1A) having the maximum concentration found on the property (49 pCi/g) was from an area of lawn approximately 1.5 x 2 m having elevated gamma rates. Sample AL21B1B from 5 to 15 cm depths contained 10 pCi/g ^{238}U.

The isotopic content of the uranium in the soil was determined by thermal ionization mass spectrometry. The uranium-235 isotope content of the uranium in sample AL21B1B was 0.245%.

Radium was measured in sample A21S2A. The concentration of ^{226}Ra was 0.74 pCi/g.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the roof of the house and on the surface of the concrete entrance walk. The results of these measurements are listed in Table 4. The alpha activity ranged from <7 to 42 dpm/100 cm^2 and averaged 19 dpm/100 cm^2. Beta-gamma activity ranged from 0.01 to 0.06 mrad/h and averaged 0.03 mrad/h.

---

*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.

SIGNIFICANCE OF FINDINGS

Measurements of the gamma exposure levels outdoors on the property determined that the exposure rate at 1 m above the ground surface ranged from 7 to 12 μR/h and averaged 9 μR/h, the same as the typical background for the Albany, New York area. For comparison, the background for the state of New York[8,9] averages 9.5 μR/h and ranges from 6.8 to 13 μR/h (one standard deviation) determined by 51 measurements. Based on information, there is no indication of risk to health caused by gamma exposure rates outdoors on the property.

The results of ^{238}U analysis establish the presence of uranium at concentrations significantly above background on the property. The average concentration of 13 pCi/g of ^{238}U is approximately 14 times the normal background of 0.96 pCi/g for the Albany area. However, it is below the DOE guideline[10] 35 pCi/g ^{238}U. The maximum concentration of ^{238}U measured, 49 pCi/g in sample AL21B1A, was approximately 1.4 times the DOE guideline.

The 0.245 atom percent ^{235}U determined by mass spectrometry establishes that the uranium which contaminated the property is depleted, i.e., it has been treated by a separations process; and a significant fraction of the ^{235}U has been removed. Natural uranium contains 0.7% uranium-235.

The 0.74 pCi/g of ^{226}Ra measured in the soil compares favorably with the Albany area background of 0.85 pCi/g of radium-226.

The average alpha activity of 19 dpm/100 cm^2 obtained by measurements on the roof and entrance walk of the house is well below the DOE criterion of 5000 dpm/100 cm^2 for alpha activity from natural uranium, uranium-235, or uranium-238.

The average and maximum beta-gamma activities of 0.03 and 0.06 mrad/h are less than the DOE criteria of 0.20 and 1.0 mrad/h at 1 cm respectively.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindekin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. Environmental Research Division, Action Description Memorandum. "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

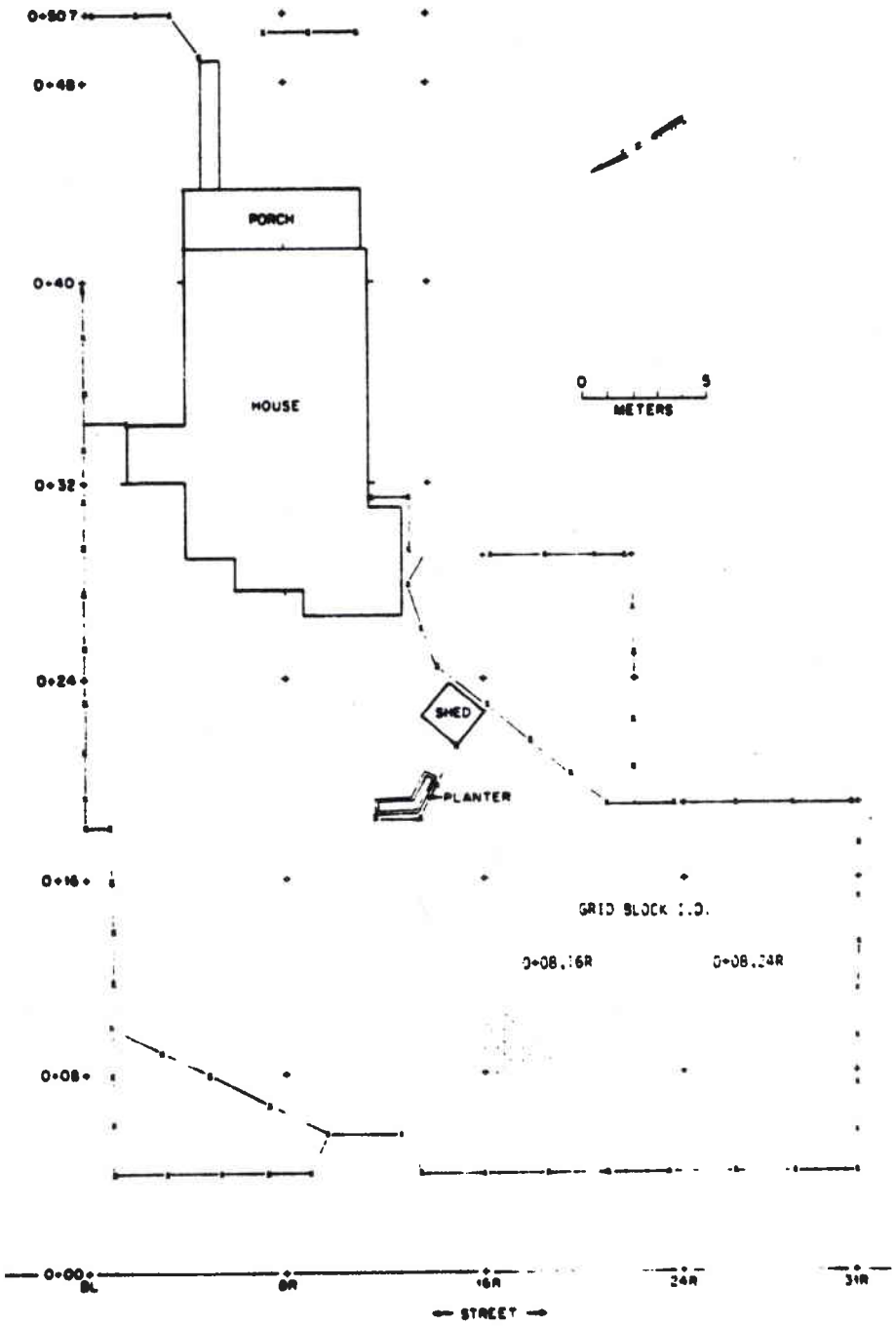

Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 1160 Central Avenue, Colonie, New York (AL021).

Fig. 2. Front view of the property at 1160 Central Avenue, Colonie, New York (AL021) looking north.

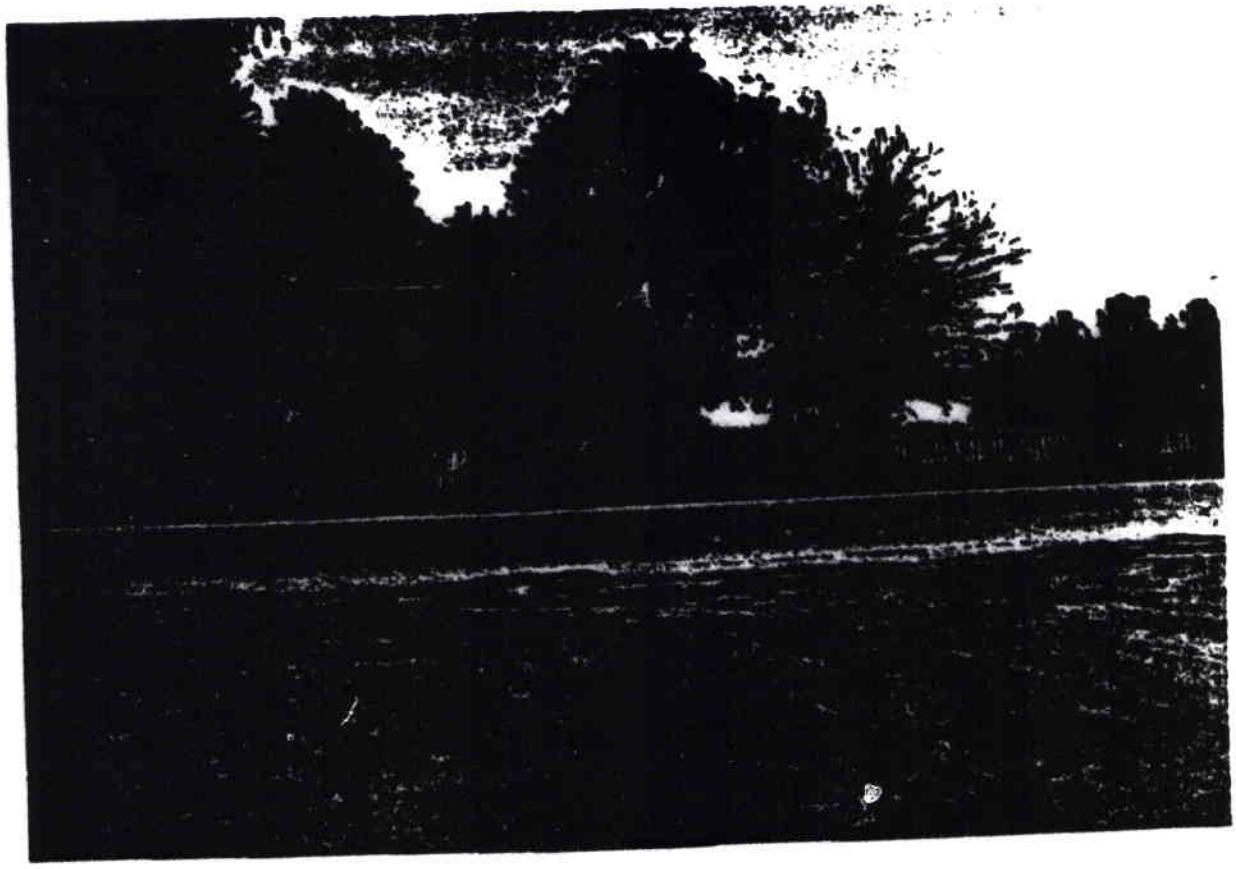

Fig. 3. Side view of the property at 1160 Central Avenue, Colonie, New York (AL021) looking east.

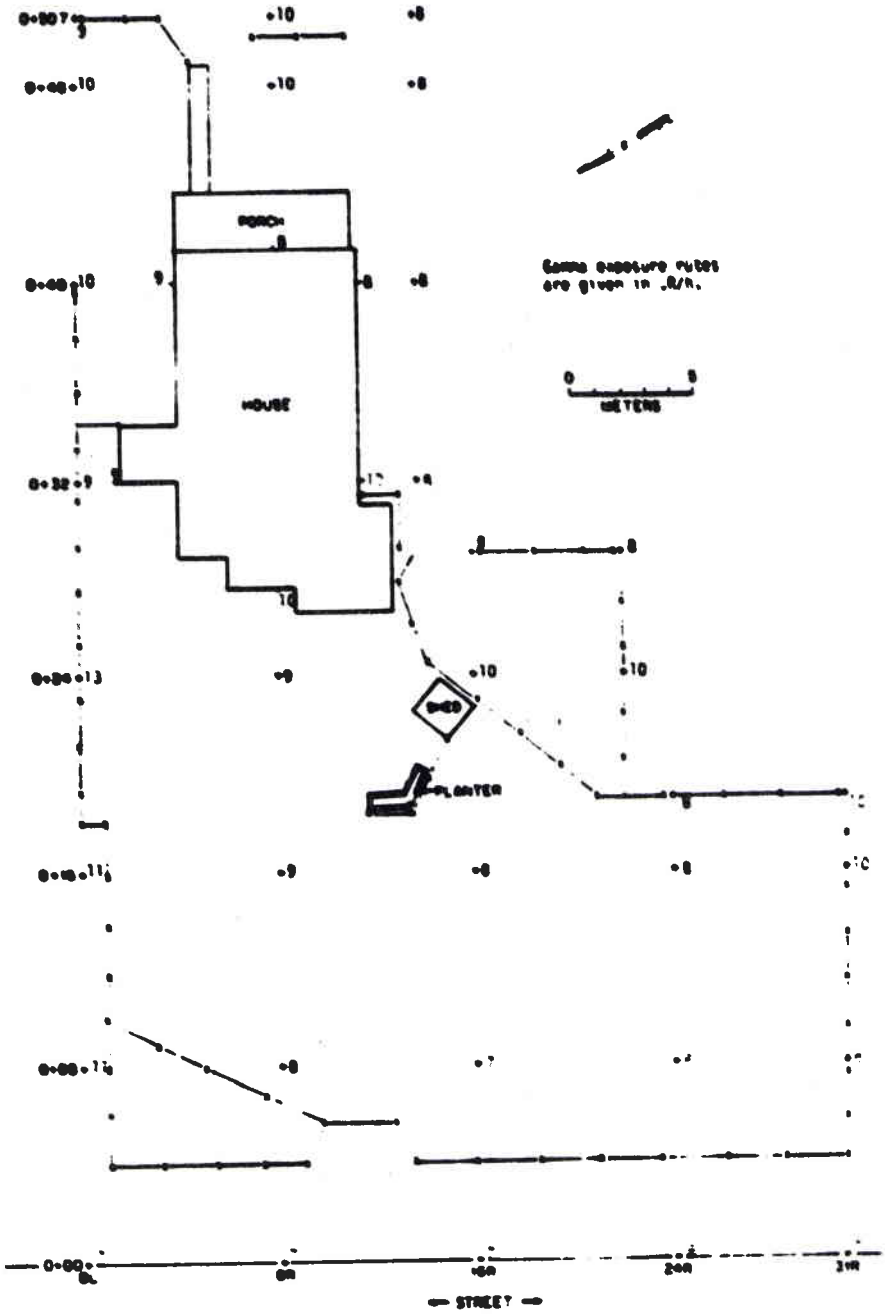

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 1160 Central Avenue, Colonie, New York (AL021).

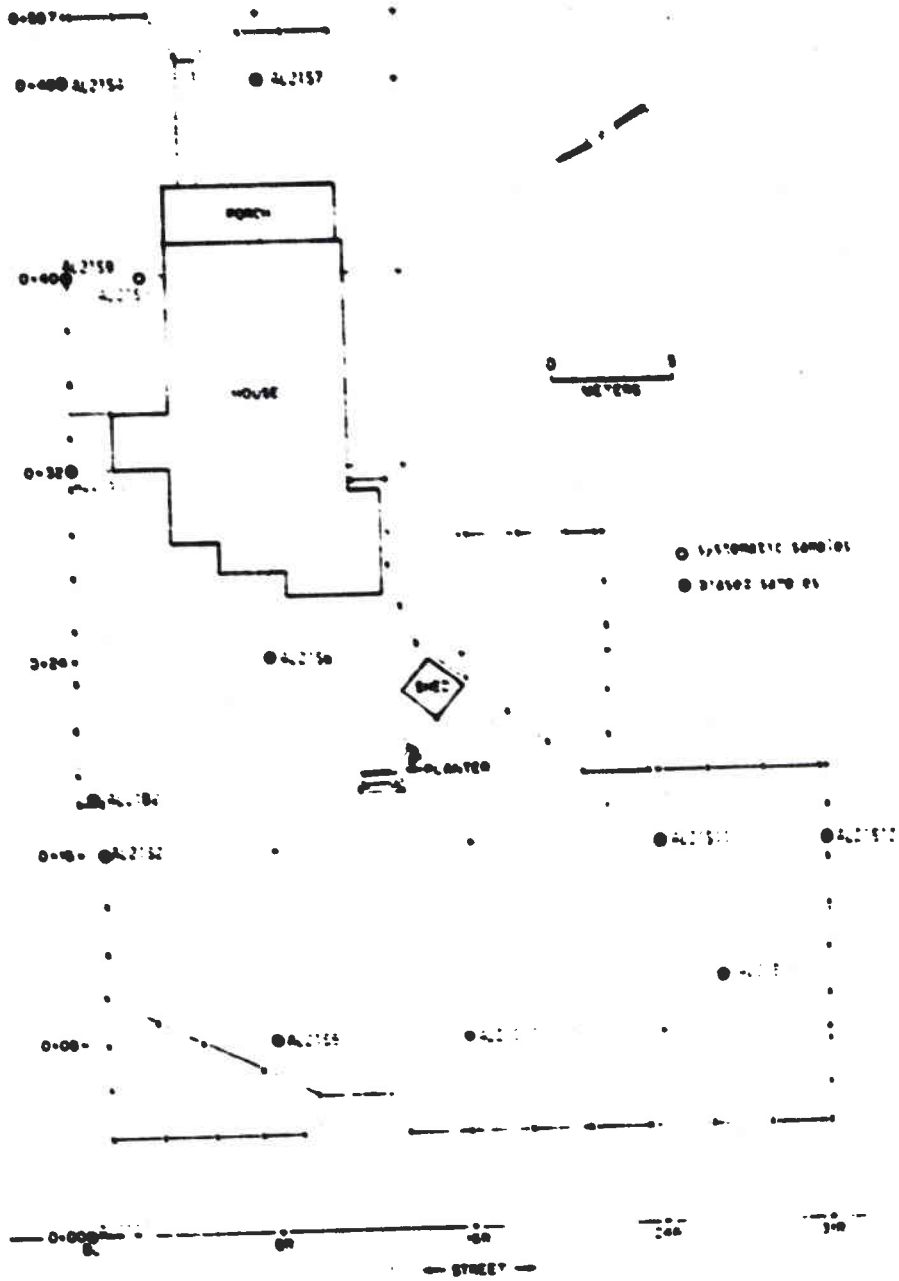

Fig. 5. Locations of soil samples on the property at 1160 Central Avenue, Colonie, New York (AL021).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 1160 Central Avenue, Colonie, New York (AL021)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	7	7	5-10
0+08, BL	10	11	6-13
0+16, BL	11	11	7-14
0+24, BL	12	13	8-13
0+32, BL	9	9	8-11
0+40, BL	10	10	8-15
0+48, BL	10	10	8-11
0+50.7, BL	9	9	-
0+32, 2R	9	9	-
0+42, 3.8R	8	9	-
0+00, 8R	8	7	7-11
0+08, 8R	8	8	7-10
0+16, 8R	8	9	7-10
0+24, 8R	8	9	7-11
0+29, 8R	10	10	-
0+32, 8R	e	e	8-11
0+40, 8R	e	e	8-12
0+41, 8R	9	8	-
0+48, 8R	9	10	8-11
0+50.7, 8R	9	10	-
0+32, 11R	9	10	-
0+40, 11R	8	8	-
0+29, 14R	9	8	-
0+32, 14R	8	8	-
0+40, 14R	7	8	-
0+48, 14R	8	8	-
0+50.7, 14R	8	8	-
0+00, 16R	7	7	7-9
0+08, 16R	7	7	7-12
0+16, 16R	8	8	7-11
0+24, 16R	10	10	7-10
0+29.5, 16R	8	8	-
0+24, 22.2R	9	10	-
0+29, 22.2R	7	8	-
0+00, 24R	8	8	8-11
0+08, 24R	8	8	8-13
0+16, 24R	8	8	8-11
0+19, 24R	8	8	-

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, 31R	7	7	-
0+08, 31R	8	8	-
0+16, 31R	9	10	-
0+19, 31R	9	10	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analysis on the property at 1160 Central Avenue, Colonie, New York (AL021)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
		Systematic samples[d]		
AL21S1A	0+00, BL	0-5	-	14
AL21S1B	0+00, BL	5-15	-	12
AL21S2A	0+16, BL	0-5	0.74 ± 0.1	27
AL21S2B	0+16, BL	5-15	-	17
AL21S3A	0+32, BL	0-5	-	6.6
AL21S3B	0+32, BL	5-15	-	10
AL21S4A	0+48, BL	0-5	-	14
AL21S4B	0+48, BL	5-15	-	3.4
AL21S5A	0+08, 8R	0-5	-	12
AL21S5B	0+08, 8R	5-15	-	5.6
AL21S6A	0+24, 8R	0-5	-	23
AL21S6B	0+24, 8R	5-15	-	9.2
AL21S7A	0+48, 8R	0-5	-	14
AL21S7B	0+48, 8R	5-15	-	18
AL21S8A	0+40, 3.8R	0-5	-	15
AL21S8B	0+40, 3.8R	5-15	-	8.7
AL21S9A	0+40, BL	0-5	-	5.5
AL21S9B	0+40, BL	5-15	-	6.7
AL21S10A	0+08, 16R	0-5	-	12
AL21S10B	0+08, 16R	5-15	-	7.7
AL21S11A	0+16, 24R	0-5	-	14
AL21S11B	0+16, 24R	5-15	-	9.8
AL21S12A	0+16, 31R	0-5	-	29
AL21S12B	0+16, 31R	5-15	-	16
		Biased samples[e]		
AL21B1A	0+10.5, 26R	0-5	-	49
AL21B1B	0+10.5, 26R	5-15	-	10
AL21B2A	0+18, 0.5R	0-5	-	45
AL21B2B	0+18, 0.5R	5-15	-	12

Table 3 (continued)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]

Isotopic Analysis by Mass Spectrometry

Sample	Atom percent			
	^{235}U	^{234}U	^{236}U	^{238}U
AL21E1B	0.245	0.0011	0.0037	99.750

[a]Locations of soil samples are shown on Fig. 5.

[b]Indicated counting error is at the 95% confidence level ($\pm 2\sigma$).

[c]Analytical error of measurement results is $< \pm 5\%$ (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Results of surface analysis of structures at 1160 Central Avenue, Colonie, New York (AL021)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity					
Roof of house	4	35,42,<7,<7	-	23	-
Entrance walk	2	7,14	-	11	-
Totals	6	<7-42	-	19	-
Beta-Gamma					
Roof of house	4	-	0.06,0.03,<0.01,0.03	-	0.03
Entrance walk	2	-	0.02,0.03	-	0.03
Totals	6	-	<0.01-0.06	-	0.03

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 erg per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

Table 5. Summary of outdoor measurements and sample results on the property at 1160 Central Avenue, Colonie, New York (AL021)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	40	7-12	9
Gamma exposure rate at surface (μR/h)[a]	40	7-13	9
Scan, gamma exposure rate near surface (μR/h)[b]	-	5-15	-
Concentration of ^{238}U in soil (pCi/g), systematic locations[c]	24	3.4-29	13
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	4	10-49	29
Abundance of isotope ^{235}U in uranium (%)	1	-	0.245
Concentration of ^{226}Ra in surface soil (pCi/g)[c]	1	-	0.74
<u>Surface measurements</u>[e]			
Alpha activity (dpm/100 cm^2)	6	<7-42	19
Beta-gamma activity (mrad/h)	6	<0.01-0.06	0.03

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Biased samples, Table 3.
[e]Surface measurements, Table 4.

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1118 CENTRAL AVENUE, COLONIE, NEW YORK (AL022)

OPERATED BY
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ORNL/RASA-84/225
(AL022)

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 1118 CENTRAL AVENUE, COLONIE, NEW YORK (AL022)

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1118 CENTRAL AVENUE, COLONIE, NEW YORK (AL022)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 16 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period May 29-June 7, 1984. The property at 1118 Central Avenue in Colonie, New York (AL022) was the subject of a radiological investigation on June 2, 1984.

This commercial property consisted of two buildings located on a rectangular area, approximately 85 m wide by 50 m deep, that was generally covered with asphalt paving. A diagram of the property showing the approximate boundaries and the grid network established for measurements outside the buildings is shown in Fig. 1. A front view of the property is shown in Fig. 2 and a rear view of Building A is shown in Fig. 3. This single-story concrete block structure houses a protective coating business. A side view of Building B is shown in Fig. 4. Building B is a two-level structure which houses a tavern and residence areas.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha and beta-gamma activity from surfaces of structures outdoors on the property. A comprehensive description of the survey methods and instrumentation has been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. The data is 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/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 5. Gamma exposure rates at 1 m above the ground surface ranged from 7 to 17 μR/h (microroentgens* per hour) and averaged 11 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 7 to 31 μR/h and averaged 13 μR/h. The maximum gamma exposure rates of 31 and 29μR/h were along the dripline of Building B and in the open area from approximately 0+75, 47L to 0+84, 50L, respectively. The gamma exposure rates from the paved area on the north side of Building B averaged 17 μR/h, almost two times the typical area background.

Soil Sampling

Twenty-eight soil samples were taken at this property. Sixteen of these at nine locations [denoted as systematic samples (AL22S)] were taken without regard to gamma exposure rates at the sampling points. Twelve samples at five locations [denoted biased samples (AL22B)] were selected at positions having elevated gamma exposure levels. The locations of the samples are shown on Fig. 6, and the results of analysis are presented in Table 3.

---

*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.

Except where blocked by underlying paving, samples were taken at 0 to 5 cm and at 5 to 15 cm depths. Concentrations of ^{238}U in the systematic soil samples ranged from 0.57 to 530 pCi/g (picocuries* per gram) and averaged 138 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm depth samples averaged 168 pCi/g and averaged 99 pCi/g in the 5 to 15 cm depth samples. The maximum concentration of ^{238}U found on the property was 530 pCi/g in sample AL22S5A at location 0+03, 48L in soil which appeared to be washed onto the asphalt paving by run-off from rains. Soil containing 440 pCi/g ^{238}U was found at a corner location, 0+85, 50L. It is believed that the uranium has migrated in depth primarily as a result of natural processes such as freezing and thawing, melting snow, and washing by rain. Sample AL22S9 from 0+85, 50L, located in an apparent drainage path is probably an excellent example of the effect of rain washing contaminants to an area where the uranium is absorbed and retained in the soil. It is also probable that the uranium will be further diffused, become less concentrated with time, as the above processes continue to disperse the uranium.

The isotopic content of the uranium in the soil was determined by thermal ionization mass spectrometry. The uranium-235 isotope content of the uranium in sample AL22B1A was 0.206%.

Systematic sample AL22S9A, 5 cm depth, contained 0.71 pCi/g radium-226. Biased samples AL22B1A-E, 0 to 60 cm depth (0-2') contained 1.9 pCi/g at the surface 0 to 5 cm; 3.5 pCi/g at 15 to 30 cm; and 0.52 pCi/g at 45 to 60 cm. The gamma exposure rate from the surface at 0+63.5, 15L the location of sample AL22B1 was 26 μR/h. The gamma rate increased to 34 μR/h at 30 cm depth (sample AL22B1C) and decreased to 13 μR/h at 60 cm (sample AL22B1E). It was observed that the area of the dripline of Building B along line about 0+63.5 contained considerable ashes or cinders. It is known that cinders resulting from the burning of most coals, can contain trace elements including the naturally occurring radioactive isotopes of potassium, radium, thorium, uranium since most metallic constituents remain with the residue. Sample AL22B1E, containing 0.52 pCi/g ^{226}Ra and 0.70 pCi/g ^{238}U was taken from soil below the strata containing any cinders.

The presence of radioactive isotopes in cinders under the paving area the probable contributors to the elevated gamma levels based in the soil sampling at the building (location 0+63.5, 15L) and at approximately 0+84, 30L. The soil containing cinders at the edge of the asphalt, 0+84.5, 30L, measured 18 μR/h at the surface, and measured 15 μR/h at 15 cm depth. A hole was chisseled through the paving at location 0+84.0, 30L having 18 μR/h at the surface. A bed of cinders was observed about 5 cm, the bottom of the asphalt. The gamma exposure rate at 5 cm was 22 μR/h. The bedding material was removed to 10 cm. The gamma at 10 cm depth increased to 36 μR/h (four times the typical background).

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the roofs of the buildings and surrounding asphalt parking lot. The results of these measurements are listed in Table 4. The alpha activity on Buildings A and B and on the parking area from grid line 0+35 to 0+84 ranged from <7 to 290 dpm/100 cm^2 and averaged 50 dpm/100 cm^2. Beta-gamma activity ranged from 0.02 to 0.30 mrad/h and averaged 0.08 mrad/h.

A summary of the outdoor measurement results is provided in Table 5.

SIGNIFICANCE OF FINDINGS

Measurements of the gamma exposure levels outdoors on the property determined that the exposure rate at 1 m above the ground surface ranged from 7 to 17 μR/h and averaged 11 μR/h, slightly above the typical background of 9 μR/h for the Albany, New York area. For comparison, the background for the state of New York[8,9] averages 9.5 μR/h and ranges from 6.8 to 13 μR/h (one standard deviation) determined by 51 measurements. Based on this information, there is no indication of significant risk to health caused by gamma exposure rates outdoors on the property.

The results of ^{238}U analysis of the systematic samples establish the presence of uranium at concentrations significantly above background over most of the areas with exposed soil. The average concentration of 138 pCi/g ^{238}U is 144 times the typical background of 0.96 pCi/g for the Albany area, also approximately four times the DOE guideline[10] of 35 pCi/g. The maximum concentrations found (530 and 440 pCi/g) were along the fence line adjacent to the former NL Industries property. It is noted that some samples at 5 to 15 cm depths exceed the DOE guideline.

---

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

The beta-gamma from the roof of buildings measured 0.21 and 0.30 mrad/h for the average and maximum, respectively, measured at 1 cm. The average is above the DOE criterion of 0.20 mrad/h; the maximum is well below the DOE criterion of 1.0 mrad/h. The beta-gamma from the roof of Building B measured 0.08 and 0.12 mrad/h fro the average and maximum. Both are less than the DOE criteria of 0.20 and 1.0 mrad/h. The beta gamma from the asphalt paving measured 0.06 and 0.14 mrad/h for the average and maximum. Both are less than the DOE criteria of 0.20 and 1.0 mrad/h.

The 0.206 atom percent ^{235}U determined by mass spectrometry establishes that the uranium which contaminated the property is depleted, i.e., it has been treated by a separations process; and a significant fraction of the ^{235}U has been removed. Natural uranium contains 0.7% uranium-235.

Concentrations of ^{226}Ra ranged from 0.52 to 3.5 pCi/g and averaged 1.7 pCi/g. The maximum, 3.5 pCi/g, is more than 4 times the typical background for the Albany area and was found at the Building B dripline at 0+63.5, 15L in soil containing cinders or ashes. The DOE criterion for ^{226}Ra in surface soil is 5 pCi/g.

The average alpha activity measurements of 50 dpm/100 cm^2 on the roofs of Building A and Building B and from the asphalt paving are well below the DOE criterion of 5000 dpm/100 cm^2 for alpha activity from natural uranium, uranium-235, or uranium-238.

The beta-gamma from the roof of the buildings measured 0.21 and 0.30 mrad/h for the average and maximum, respectively, measured at 1 cm. The average is above the DOE criterion of 0.20 mrad/h; the maximum is well below the DOE criterion of 1.0 mrad/h. The beta-gamma from the roof of Building B measured 0.08 and 0.12 mrad/h for the average and maximum. Both are less than the DOE criteria of 0.20 and 1.0 mrad/h. The beta-gamma from the ashalt paving measured 0.06 and 0.14 mrad/h for the average and maximum. Both are less than the DOE criteria of 0.20 and 1.0 mrad/h.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindekin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. Environmental Research Division, Action Description Memorandum. "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

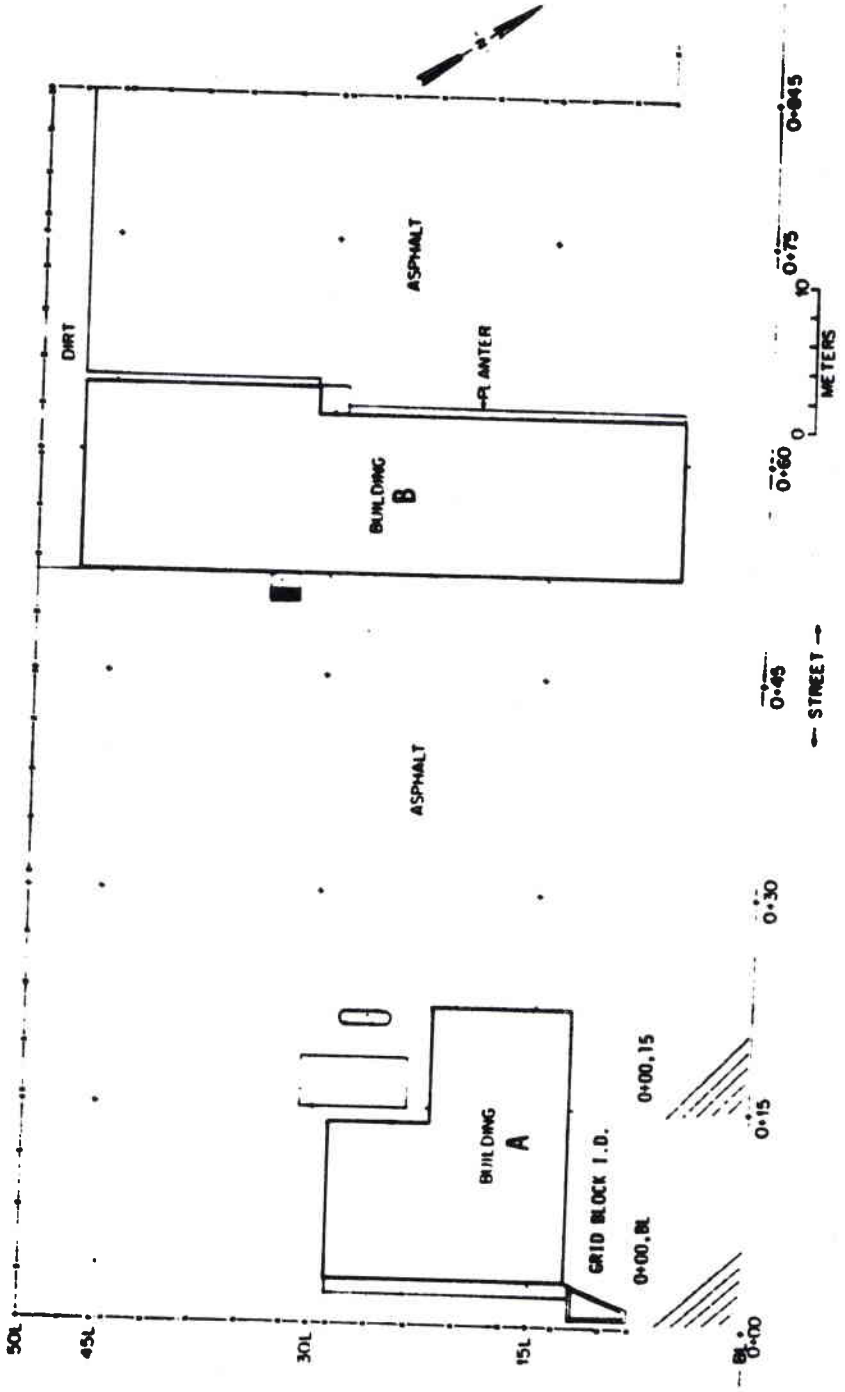

Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 1118 Central Avenue, Colonie, New York (AL022).

Fig. 2. Front view of the property at 1118 Central Avenue, Colonie, New York (AL022) looking south.

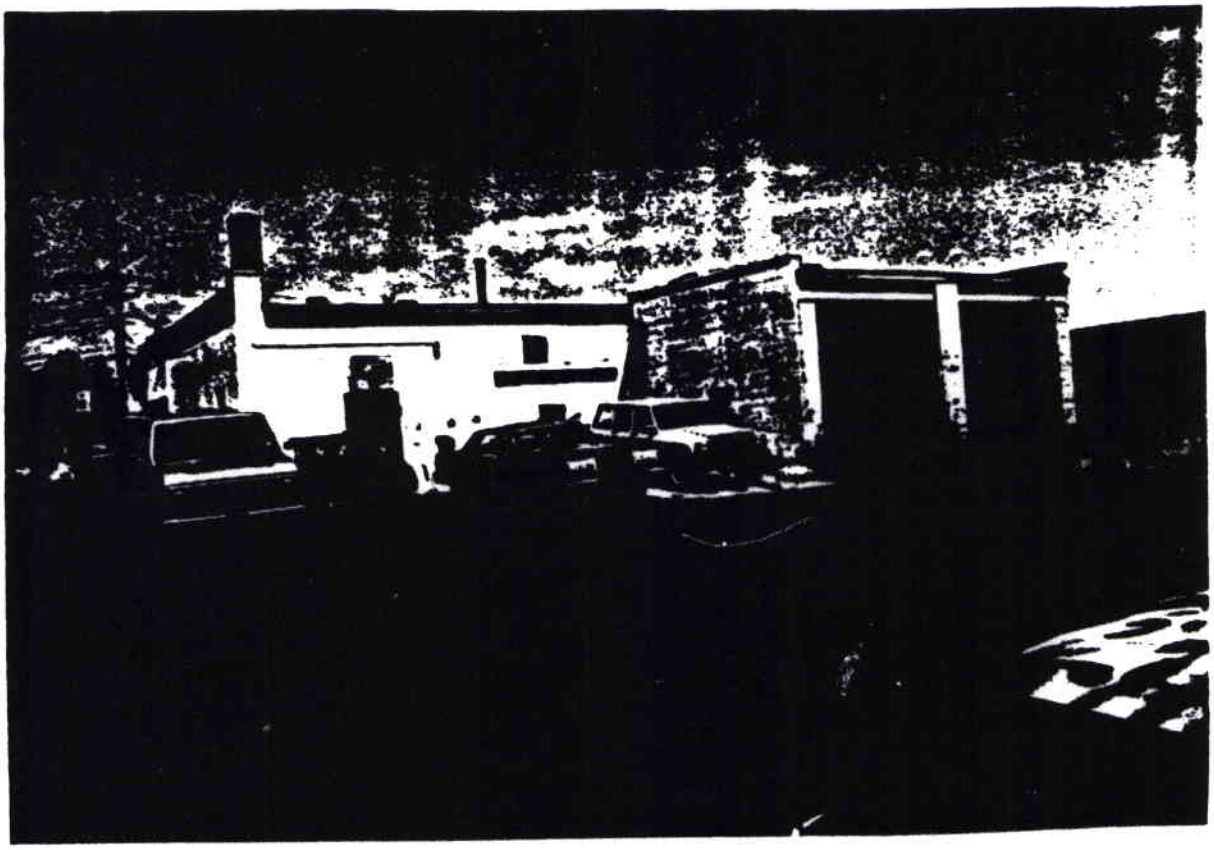

Fig. 3. Rear view of Building A on the property at 1118 Central Avenue, Colonie, New York (AL022) looking east.

Fig. 4. Side view of Building B on the property at 1118 Central Avenue, Colonie, New York (AL022) looking north.

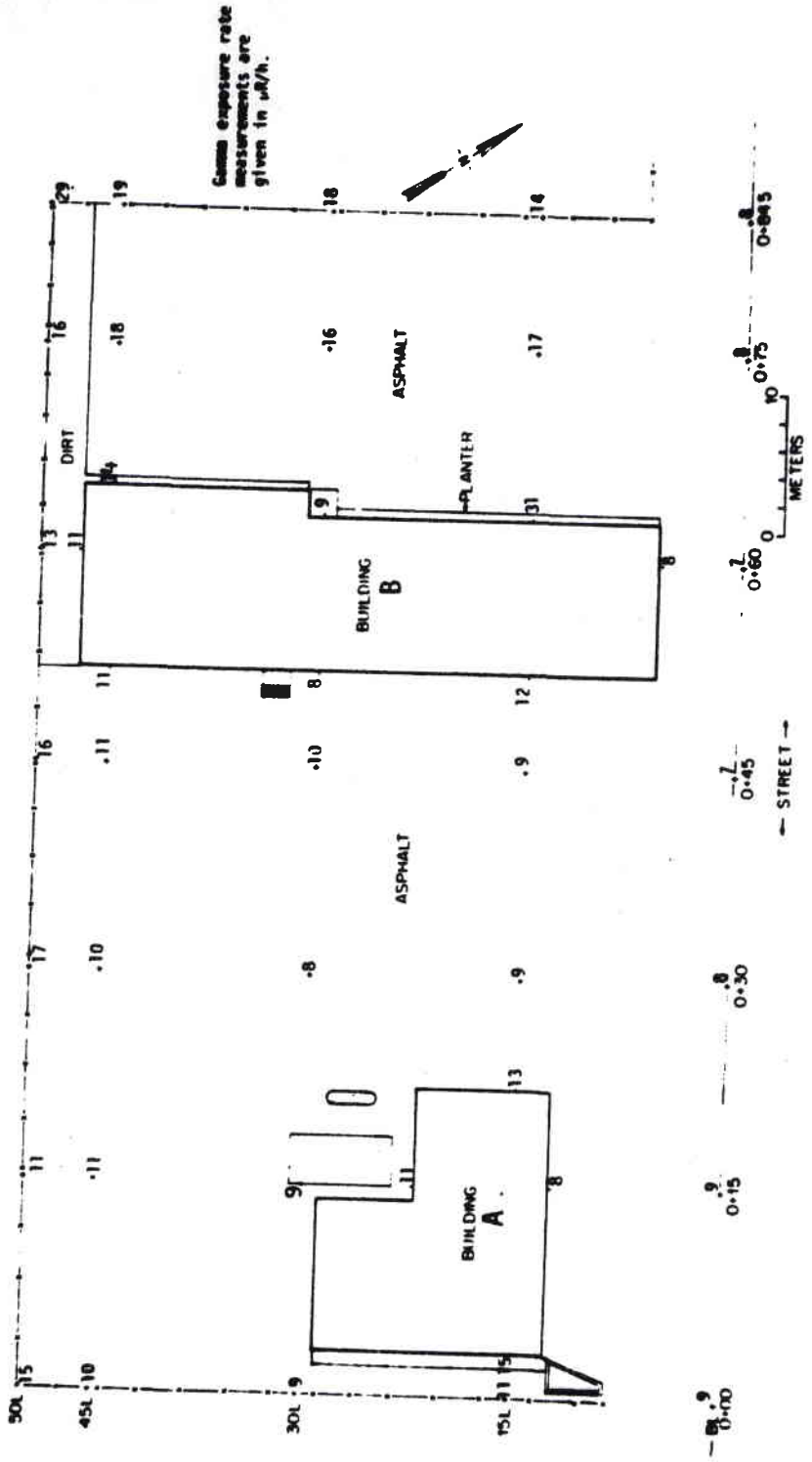

Fig. 5. Surface gamma exposure rates measured at grid points outdoors on the property at 1118 Central Avenue, Colonie, New York (AL022).

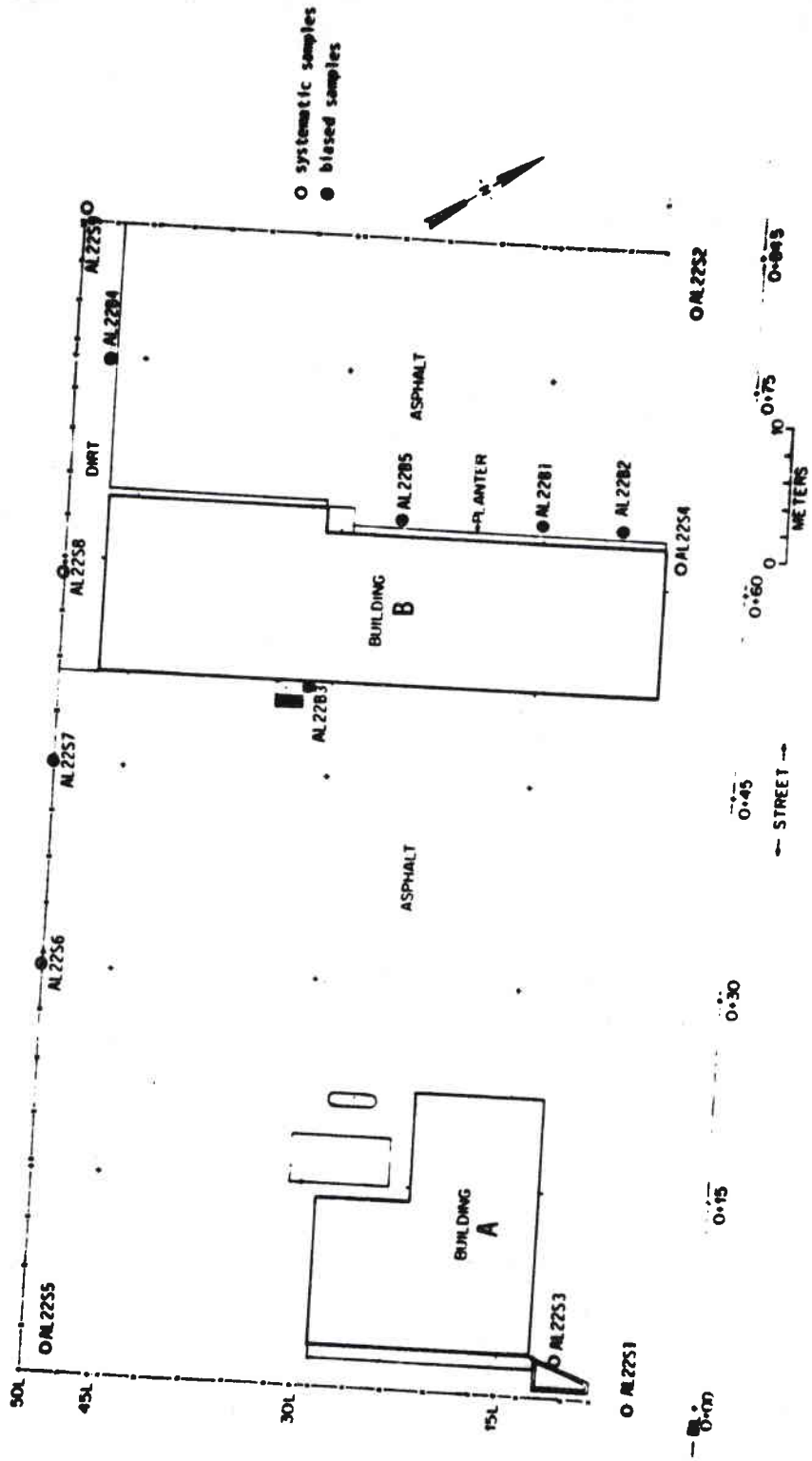

Fig. 6. Locations of soil samples on the property at 1118 Central Avenue, Colonie, New York (AL022).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 1118 Central Avenue, Colonie, New York (AL022)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	9	9	7-16
0+15, BL	8	9	7-12
0+30, BL	7	8	7-11
0+45, BL	8	7	6-16
0+60, BL	8	7	6-13
0+75, BL	8	8	8-12
0+84.5, BL	8	8	-
0+60, 6L	8	8	-
0+15, 12.5L	8	8	-
0+00, 15L	10	11	9-14
0+03, 15L	13	15	-
0+15, 15L	e	e	8-13
0+22, 15L	9	13	-
0+30, 15L	9	9	7-9
0+45, 15L	9	9	8-16
0+51, 15L	8	12	-
0+60, 15L	e	e	12-16
0+63, 15L	15	31	-
0+75, 15L	14	17	13-18
0+84.5, 15L	12	14	-
0+15, 22L	8	11	-
0+00, 30L	9	9	08-12
0+15, 30L	9	9	7-10
0+30, 30L	8	8	7-9
0+45, 30L	9	10	7-18
0+52, 30L	8	8	-
0+60, 30L	e	e	13-20
0+63, 30L	8	9	-
0+75, 30L	15	16	14-20
0+84.5, 30L	16	18	-
0+00, 45L	9	10	9-17
0+15, 45L	10	11	8-14
0+30, 45L	9	10	8-18
0+45, 45L	10	11	8-14
0+52, 45L	8	11	-
0+60, 45L	e	e	10-24
0+65, 45L	13	14	-
0+75, 45L	17	18	16-29
0+84.5, 45L	16	19	-

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+60, 48L	10	11	-
0+00, 50L	10	15	-
0+15, 50L	14	11	-
0+30, 50L	13	17	-
0+45, 50L	10	16	-
0+60, 50L	16	13	-
0+75, 50L	16	16	-
0+84.5, 50L	10	29	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 5.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analysis on the property at 1118 Central Avenue, Colonie, New York (AL022)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
		Systematic samples[d]		
AL22S1A	0+00, 5L	0-5	-	4.5
AL22S1B	0+00, 5L	5-15	-	5.6
AL22S2A	0+80, 5L	0-5	-	6.1
AL22S2B	0+80, 5L	5-15	-	5.8
AL22S3A	0+03, 10L	0-5	-	51
AL22S3B	0+03, 10L	5-15	-	37
AL22S4A	0+62, 5L	0-5	-	0.87
AL22S4B	0+62, 5L	5-15	-	0.57
AL22S5A	0+03, 48L	0-5	-	530
AL22S6A	0+30, 50L	0-5	-	120
AL22S6B	0+30, 50L	5-15	-	290
AL22S7A	0+45, 50L	0-5	-	330
AL22S8A	0+59, 50L	0-5	-	33
AL22S8B	0+59, 50L	5-15	-	47
AL22S9A	0+85, 50L	0-5	0.71 ± 0.09	440
AL22S9B	0+85, 50L	5-15	-	310
		Biased samples[e]		
AL22B1A	0+63.5, 15L	0-5	1.9 ± 0.1	87
AL22B1B	0+63.5, 15L	5-15	2.8 ± 0.17	22
AL22B1C	0+63.5, 15L	15-30	3.5 ± 0.12	21
AL22B1D	0+63.5, 15L	30-45	0.77 ± 0.09	2.0
AL22B1E	0+63.5, 15L	45-60	0.52 ± 0.12	0.70
AL22B2A	0+63.5, 9L	0-5	-	43
AL22B2B	0+63.5, 9L	5-15	-	17
AL22B3A	0+51, 32L	0-5	-	190
AL22B3B	0+51, 32L	5-15	-	66
AL22B4A	0+75, 47.5L	0-8	-	170
AL22B5A	0+63.5, 25L	0-5	-	110
AL22B5B	0+63.5, 25L	5-15	-	25

Table 3 (continued)

Sample	Locations[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]

Isotopic Analysis by Mass Spectrometry

Sample	Atom percent			
	^{235}U	^{234}U	^{236}U	^{238}U
AL22B1A	0.206	0.0008	0.0031	99.790

[a]Locations of soil samples are shown on Fig. 6.

[b]Indicated counting error is at the 95% confidence level ($\pm 2\sigma$).

[c]Analytical error of measurement results is $< \pm 5\%$ (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Results of surface analysis of structures at 1118 Central Avenue, Colonie, New York (AL022)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity					
Roof of Building A	5	290,120,120,63,120	–	143	–
Roof of Building B	8	70,130,140,84,98, 42,28,130	–	90	–
Asphalt paving	29	14,21,14,14,<7,14, 21,21,14,7,7,14, 14,35,56,28,21,28, 14,28,21,49,35,14, 21,27,28,35,42	–	23	–
Total	42	<7-290	–	50	–
Beta-Gamma					
Roof of Building A	5	–	0.30,0.12,0.11,0.23,0.07	–	0.21
Roof of Building B	7	–	0.06,0.11,0.11,0.07,0.03, 0.12	–	0.08
Asphalt paving	29	–	0.03,0.04,0.04,0.03,0.04, 0.04,0.06,0.09,0.04,0.03, 0.03,0.04,0.04,0.02,0.02, 0.04,0.04,0.04,0.07,0.05, 0.06,0.12,0.10,0.11,0.14, 0.14,0.08,0.11,0.09	–	0.06
Total	41	–	0.02-0.30	–	0.08

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 erg per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4 x 10^{-8} °C.)

Table 5. Summary of outdoor measurements and sample results on the property at 1118 Central Avenue, Colonie, New York (AL022)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	43	7-17	11
Gamma exposure rate at surface (μR/h)[a]	43	7-31	13
Scan, gamma exposure rate near surface (μR/h)[b]	-	6-31	-
Concentration of ^{238}U in soil (pCi/g), systematic locations[c]	16	0.57-530	138
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	12	2.0-190	63
Abundance of isotope ^{235}U in uranium (%)	1	-	0.206
Concentration of ^{226}Ra in soil (pCi/g)[c,d]	6	0.52-3.5	1.7
<u>Surface measurements</u>[e]			
Alpha activity (dpm/100 cm^2)	42	<7-290	50
Beta-gamma activity (mrad/h)	41	0.02-0.30	0.08

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Biased samples, Table 3.
[e]Surface measurements, Table 4.

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RESULTS OF THE RADIOLOGICAL SURVEY
AT 1148 CENTRAL AVENUE - REAR,
COLONIE, NEW YORK (AL023)

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Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 1148 CENTRAL AVENUE - REAR, COLONIE, NEW YORK (AL023)

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1148 CENTRAL AVENUE - REAR, COLONIE, NEW YORK (AL023)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 16 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period May 29-June 7, 1984. The property at 1148 Central Avenue in Colonie, New York (AL023) was the subject of a radiological investigation on June 3, 1984.

This commercial property consists of a concrete block warehouse located on a small lot, with an asphalt paved driveway. A diagram of the property showing the approximate property boundaries and the grid network established for measurements outside the building is shown in Fig. 1. The quadrilateral lot was approximately 35.5 m wide by 60 to 69 m deep. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha and beta-gamma activity from surfaces of structures outdoors on the property. A comprehensive description of the survey methods and instrumentation has been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. The data is 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/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 7 to 13 μR/h (microroentgens* per hour) and averaged 11 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 8 to 14 μR/h and averaged 11 μR/h. The maximum gamma exposure rate measured, 20 μR/h, was to the rear of the property at 0+68, 2R.

Soil Sampling

Twenty systematic soil samples were taken at ten locations on the property. Systematic denotes samples that were taken at grid locations irrespective of the gamma exposure level at the point of sampling. The locations of the samples are shown in Fig. 5, and the results of analysis are presented in Table 3.

---

*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.

Samples were taken at 0 to 5 cm and at 5 to 15 cm depths. The concentrations of ^{238}U in the systematic soil samples ranged from 0.80 to 78 pCi/g (picocuries* per gram) and averaged 22 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 37 pCi/g and averaged 7.7 pCi/g in the 5 to 15 cm depth samples. The ratio of concentration at 0 to 5 cm to concentration at 5 to 15 cm is 5.19. These data indicate that the predominant amount of ^{238}U is located in the 0 to 5 cm zone. It was noted during the survey that some of the surface soil on the property appeared to have been disturbed or moved recently, particularly to the rear of the building, while other areas appeared less disturbed; therefore, the soil was sampled from areas which appeared disturbed as well as from areas that appeared to have been in place for some longer period. No differences in uranium distribution among different conditions of soil disturbance were evident.

The isotopic content of the uranium in the soil was determined by thermal ionization mass spectrometry. The uranium-235 isotope content of the uranium in sample AL23S5A was 0.201%.

Radium was measured in sample AL23S5A. The concentration of ^{226}Ra was 0.49 pCi/g.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the roof of the warehouse and on the asphalt paving at the front of the building. The results of these measurements are listed in Table 4. The alpha activity from the roof of the warehouse ranged from 290 to 620 dpm/100 cm^2, averaging 434 dpm/100 cm^2 and ranged from 7 to 35 dpm/100 cm^2, averaging 23 dpm/100 cm^2 from the asphalt paving. the beta-gamma from the roof ranged from 0.09 to 0.26 mrad/h and averaged 0.20; the beta-gamma from the asphalt paving ranged from 0.04 to 0.12 mrad/h and averaged 0.06 mrad/h.

A summary of the outdoor measurement results is provided in Table 5.

---

*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.

SIGNIFICANCE OF FINDINGS

Measurements of the gamma exposure levels outdoors on the property determined that the exposure rate at 1 m above the ground surface ranged from 7 to 13 μR/h and averaged 11 μR/h, slightly greater than the typical background for the Albany, New York area. For comparison, the background for the Albany area is 9 μR/h; and the background for the state of New York[8,9] averages 9.5 μR/h and ranges from 6.8 to 13 μR/h (one standard deviation) based on 51 measurements. Based on this information, there is no indication of significant risk to health caused by gamma exposure rates outdoors on the property.

The results of ^{238}U analysis establish the presence of uranium at concentrations significantly above background on the property. The average concentration of 22 pCi/g of ^{238}U in the systematic samples is approximately 23 times the normal background of 0.96 pCi/g for the Albany area. However, the average is below the DOE guideline[10] of 35 pCi/g ^{238}U. The maximum concentration of ^{238}U measured, 78 pCi/g in sample AL23S2A, was approximately 2.2 times the DOE guideline.

The 0.201 atom percent ^{235}U determined by mass spectrometry establishes that the uranium which contaminated the property is depleted, i.e., it has been treated by a separations process; and a significant fraction of the ^{235}U has been removed. Natural uranium contains 0.7% uranium-235.

The 0.49 pCi/g of ^{226}Ra measured in the soil compares favorably with the Albany area background of 0.85 pCi/g of radium-226.

The alpha activity average of 434 dpm/100 cm^2 and 23 dpm/100 cm^2 obtained by measurements on the roof of the warehouse and from the paving are well below the DOE criterion of 5000 dpm/100 cm^2 for alpha activity from natural uranium, uranium-235, or uranium-238.

The beta-gamma activity from the roof averaged 0.20 mrad/h, the same as 0.20 mrad/h, the DOE criterion for the average of measurements taken; and the 0.26 mrad/h maximum from the roof is less than 1.0 mrad/h maximum, the DOE criterion. The 0.06 mrad/h average and the 0.12 mrad/h maximum, from the paving, are each less than 0.2 and 1.0 mrad/h, respectively, the DOE criteria.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindekin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. Environmental Research Division, Action Description Memorandum. "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

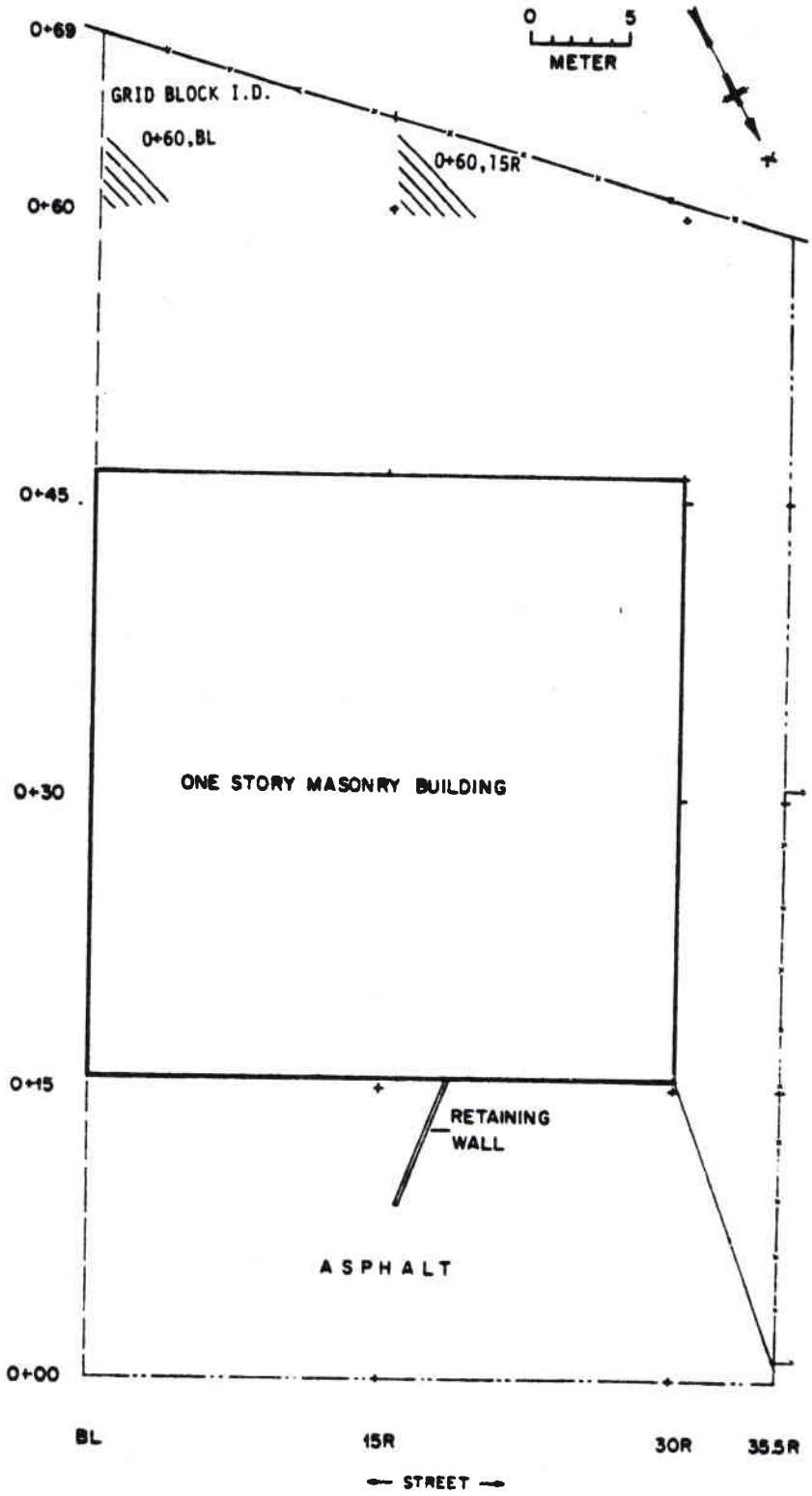

Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 1148 Central Avenue - Rear, Colonie, New York (AL023).

Fig. 2. Front view of the property at 1148 Central Avenue - Rear, Colonie, New York (AL023) looking southwest.

Fig. 3. Rear view of the property at 1148 Central Avenue - Rear, Colonie, New York (AL023) looking east.

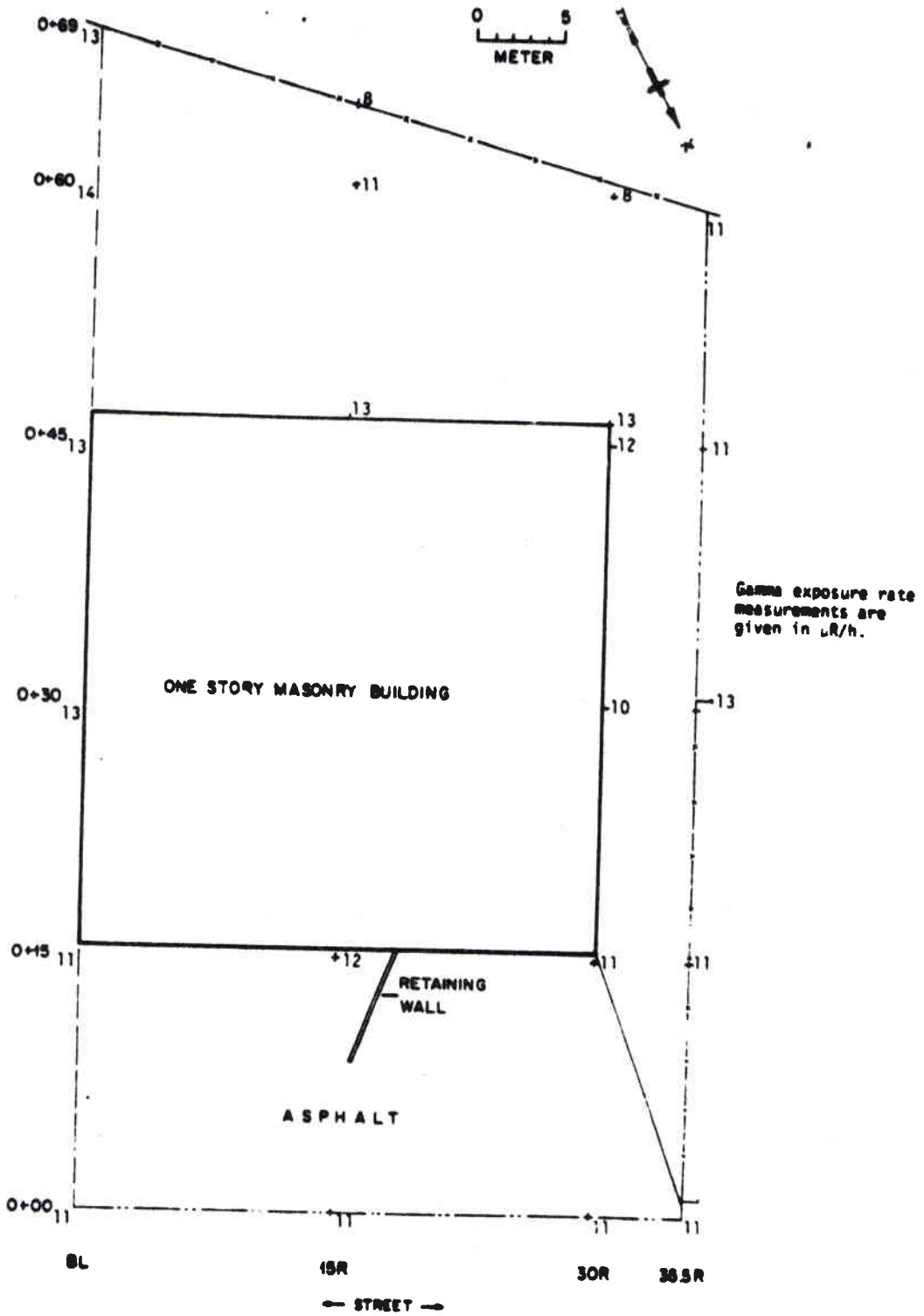

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 1148 Central Avenue - Rear, Colonie, New York (AL023).

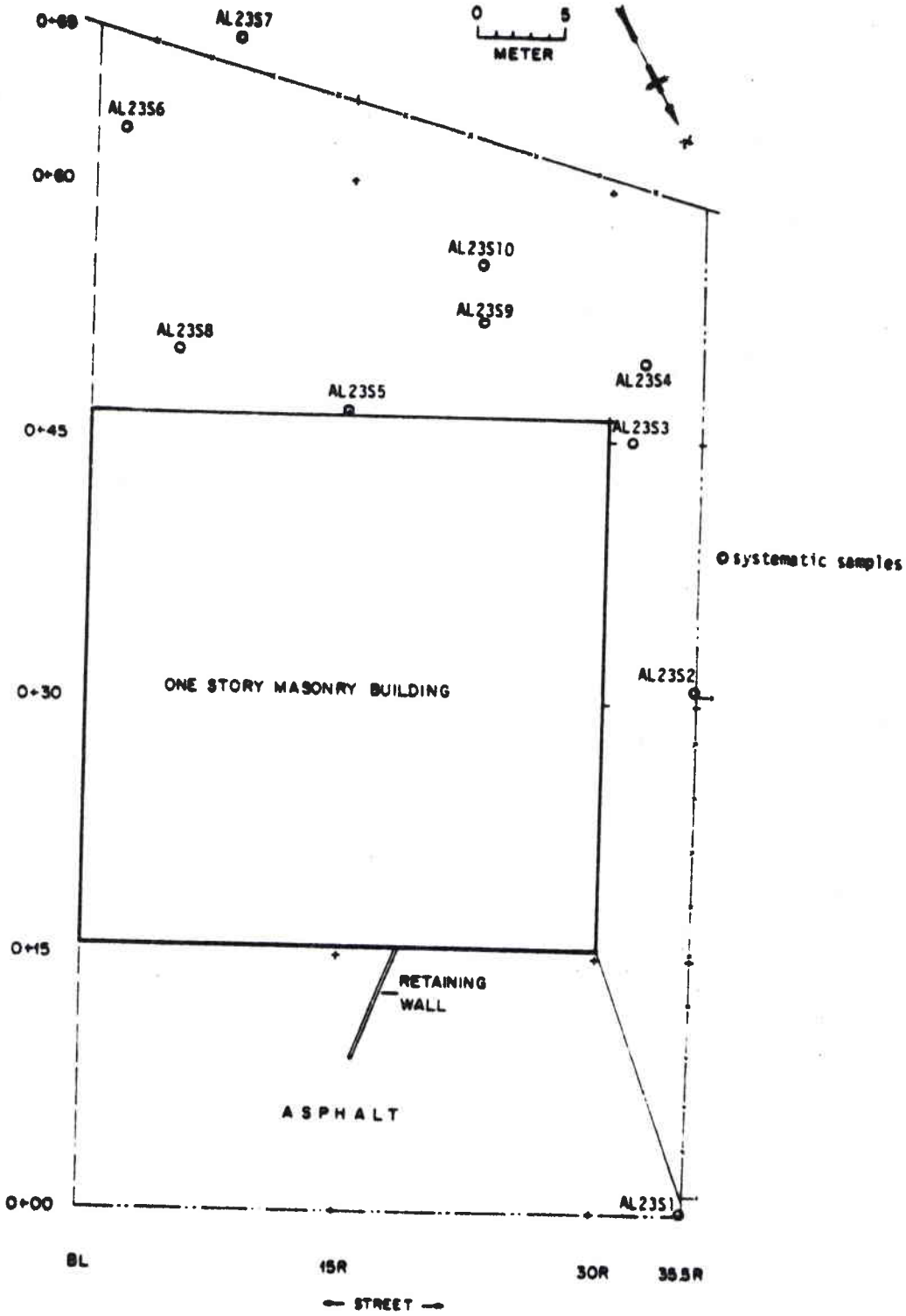

Fig. 5. Locations of soil samples on the property at 1148 Central Avenue - Rear, Colonie, New York (AL023).

Table 1. Background radiation levels in the Albany 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]	8–10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76–1.2	0.96
^{226}Ra	0.48–1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1–NY6) obtained from six locations around the Albany area.[7]

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 1148 Central Avenue - Rear, Colonie, New York (AL023)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	11	11	10-13
0+15, BL	11	11	10-13
0+30, BL	11	13	-
0+45, BL	8	13	10-18
0+60, BL	11	14	11-20
0+69, BL	13	13	-
0+00, 15R	10	11	10-13
0+15, 15R	11	12	10-13
0+15.6 15R	11	12	-
0+30, 15R	e	e	-
0+45, 15R	e	e	-
0+46.5, 15R	12	13	-
0+60, 15R	8	11	10-13
0+65, 15R	7	8	-
0+00, 30R	11	11	9-13
0+15, 30R	10	11	8-17
0+15.6, 30R	10	11	-
0+30, 30R	e	e	9-13
0+45, 30.4R	e	e	10-13
0+46.5, 30R	12	13	-
0+60, 30R	8	8	-
0+61, 30R	8	8	-
0+30, 30.5R	8	10	-
0+45, 30.5R	12	12	-
0+00, 35.5R	8	11	-
0+15, 35.5R	11	11	-
0+30, 35.5R	12	13	-
0+45, 35.5R	11	11	-
0+59, 35.5R	11	11	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analysis on the property at 1148 Central Avenue - Rear, Colonie, New York (AL023)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
		Systematic samples[d]		
AL23S1A	0+00, 35.5	0-5	-	48
AL23S1B	0+00, 35.5	5-15	-	7.5
AL23S2A	0+31, 35.5	0-5	-	78
AL23S2B	0+31, 35.5	5-15	-	17
AL23S3A	0+45, 32R	0-5	-	13
AL23S3B	0+45, 32R	5-15	-	0.80
AL23S4A	0+50, 33R	0-5	-	0.97
AL23S4B	0+50, 33R	5-15	-	0.87
AL23S5A	0+46.5, 15R	0-5	0.49 ± 0.06	66
AL23S5B	0+46.5, 15R	5-15	-	13
AL23S6A	0+63, 2R	0-5	-	69
AL23S6B	0+63, 2R	5-15	-	13
AL23S7A	0+69, 7.5R	0-5	-	23
AL23S7B	0+69, 7.5R	5-15	-	11
AL23S8A	0+50, 5R	0-5	-	6.9
AL23S8B	0+50, 5R	5-15	-	4.4
AL23S9A	0+51.5, 23R	0-5	-	1.8
AL23S9B	0+51.5, 23R	5-15	-	0.90
AL23S10A	0+55, 23R	0-5	-	63
AL23S10B	0+55, 23R	5-15	-	8.3

Isotopic Analysis by Mass Spectrometry

Sample	Atom percent			
	^{235}U	^{234}U	^{236}U	^{238}U
AL23S5A	0.201	0.0013	0.0028	99.795

[a]Locations of soil samples are shown on Fig. 5.
[b]Indicated counting error is at the 95% confidence level (± 2σ).
[c]Analytical error of measurement results is < ± 5% (95% confidence level).
[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

Table 4. Results of surface analysis of structures at 1148 Central Avenue - Rear, Colonie, New York (AL023)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity					
Roof of warehouse	8	430,340,440,500, 620,420,290,430	-	434	-
Asphalt paving	18	28,21,14,28,14,21, 7,35,21,28,28,35, 14,21,7,28,28,35	-	23	-
Total	26	7-620	-	149	-
Beta-Gamma					
Roof of warehouse	8	-	0.24,0.08,0.26,0.21,0.21, 0.26,0.14,0.19	-	0.20
Asphalt paving	18	-	0.05,0.12,0.06,0.05,0.09, 0.07,0.07,0.07,0.05,0.10, 0.06,0.06,0.08,0.05,0.04, 0.04,0.05,0.05	-	0.06
Total	26	-	0.04-0.26	-	0.11

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 erg per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

Table 5. Summary of outdoor measurements and sample results on the property at 1148 Central Avenue - Rear, Colonie, New York (AL023)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	25	7-13	11
Gamma exposure rate at surface (μR/h)[a]	25	8-14	11
Scan, gamma exposure rate near surface (μR/h)[b]	-	8-20	-
Concentration of ^{238}U in soil (pCi/g), systematic locations[c]	20	0.80-78	22
Abundance of isotope ^{235}U in uranium (%)	1	-	0.201
Concentration of ^{226}Ra in surface soil (pCi/g)[c]	1	-	0.49
<u>Surface measurements</u>[d]			
Alpha activity (dpm/100 cm^2)			
Roof of warehouse	26	7-620	149
Beta-gamma activity (mrad/h)	26	0.04-0.26	0.11

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Surface measurements, Table 4.

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ORNL/RASA-84/227
(AL024)

RESULTS OF THE RADIOLOGICAL SURVEY AT 1146 CENTRAL AVENUE, COLONIE, NEW YORK (AL024)

OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

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ORNL/RASA-84/237
(AL024)

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 1146 CENTRAL AVENUE, COLONIE, NEW YORK (AL024)

J. L. Marley, B. A. Berven, and W. D. Cottrell

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Work performed as part of the
RADIOLOGICAL SURVEY ACTIVITIES PROGRAM

Prepared by the
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Oak Ridge, Tennessee 37831
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The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha and beta-gamma activity from surfaces of structures outdoors on the property. A comprehensive description of the survey methods and instrumentation has been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. The data is 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/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 6 to 13 μR/h (microroentgens* per hour) and averaged 8 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 6 to 25 μR/h and averaged 9 μR/h.

The area on the west side of the building, approximately 0+09 to 0+32, and 15R to 19.7R was generally elevated in gamma exposure rates. The location with the maximum gamma level, 46 μR/h, was at a roof drain and driplime location, 0+24, 15.5R (Fig. 4).

Soil Sampling

Twenty-two soil samples were taken at this property. Sixteen of these at eight locations [denoted as systematic samples (AL24S)] were taken without regard to gamma exposure rates at the sampling points. Six samples at three locations [denoted biased samples (AL24B)] were selected at positions having elevated gamma exposure levels. The locations of samples are shown on Fig. 5, and the results of analysis are presented in Table 3.

---

*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.

RESULTS OF THE RADIOLOGICAL SURVEY AT 1146 CENTRAL AVENUE, COLONIE, NEW YORK (AL024)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 16 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period May 29–June 7, 1984. The property at 1146 Central Avenue in Colonie, New York (AL024) was the subject of a radiological investigation on June 3, 1984.

This commercial property consisted of a single building, apparently a former residence, on a lot that was covered on the east side and on the south side with asphalt paving. The opposite sides are open soil or grass covered. A diagram of the property showing the approximate property boundaries and grid network established for measurements outside the building is shown in Fig. 1. The rectangular lot included in the radiological survey was approximately 52 m deep by 19.7 m wide. Front and rear view of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

Alpha and beta-gamma activity were measured on the asphalt paved areas at the front, south side, and rear of the building. The alpha activity ranged from 7 to 49 dpm/100 cm^2 and averaged 21 dpm/100 cm^2. The beta-gamma activity ranged from 0.02 to 0.22 mrad/h and averaged 0.075 mrad/h. The results are presented in Table 5. It was decided that it was necessary to determine the location and extent of contamination associated with the asphalt. A spot which measured 0.25 mrad/h was chosen to determine whether the source of beta-gamma activity was from the surface coating, the asphalt layer, or from the soil below the asphalt. A layer, 3 to 6 mm thick, was chipped from the surface with a chisel, and beta-gamma was measured again. Beta-gamma from the new surface was only 0.03 mrad/h. The reduced activity clearly demonstrates that the source of activity was in the seal-coat layer on the surface. In order to determine the extent of contamination on the asphalt, a set of measurements based on a 1 m grid was planned beginning approximately at 0+43.5, 16R to 0+51.5, 16R and continuing to 0+43.5, 6R as shown in Table 6. The results of the 51 beta-gamma measurements, encompassing the sloping paved area at the rear of the building, ranged from 0.04 to 0.29 mrad/h and averaged 0.11 mrad/h.

A summary of the outdoor measurement results is provided in Table 5.

SIGNIFICANCE OF FINDINGS

Measurements of the gamma exposure levels outdoors on the property determined that the exposure rate at 1 m above the ground surface ranged from 6 to 13 μR/h and averaged 8 μR/h, a level less than the background for the Albany, New York area. For comparison, the typical background for the state of New York[8,9] averaged 9.5 and ranges from 6.8 to 13 μR/h (one standard deviation) based on 51 measurements. Based on this information, there is no indication of risk to health caused by gamma exposure rates outdoors on the property.

The results of ^{238}U analysis establish the presence of uranium at concentrations significantly above background on the property. The average concentration of 37 pCi/g of ^{238}U in the systematic samples is approximately 39 times the normal background of 0.96 pCi/g for the Albany area, and slightly above the DOE guideline[10] of 35 pCi/g ^{238}U. The maximum concentration of ^{238}U measured, 1500 pCi/g in sample AL24B2A, was approximately 43 times the DOE guideline.

The 0.202 atom percent ^{235}U determined by mass spectrometry establishes that the uranium which contaminated the property is depleted, i.e., it has been treated by a separations process; and a significant fraction of the ^{235}U has been removed. Natural uranium contains 0.7% uranium-235.

Samples were taken at 0 to 5 cm and at 5 to 15 cm depths at each location. The concentrations of ^{238}U in the systematic soil samples ranged from 2.6 to 150 pCi/g (picocuries* per gram) and averaged 37 pCi/g. The concentration of ^{238}U in the 0 to 5 cm samples averaged 62 pCi/g and averaged 12 pCi/g in the 5 to 15 cm depth samples. The ratio of concentration at 0 to 5 cm to concentration at 5 to 15 cm is 6.73. These data show the decrease in concentration of ^{238}U with increase in depth. Also, the concentrations found in the biased samples at the maximum depth of sampling indicates the existence of significant concentrations below 15 cm depth. The maximum concentration found on the property (1500 pCi/g ^{238}U) was in biased sample AL24B2A at location 0+24, 15.5R. The uranium is now shown to be present to 15 cm or more depths. It is believed that the uranium has migrated primarily as a result of natural processes such as freezing and thawing, melting snow, and washing by rain. Samples AL24B1, AL24B2, and AL24B3, located below drainage paths from the roof of the building, are probably excellent examples of the effect of rain washing the ^{238}U from the roof to the ground where the uranium is absorbed and retained in the soil. It is also probable that the uranium will be further diffused, become less concentrated with time, as the above processes continue to disperse the uranium.

The isotopic content of the uranium in the soil was determined by thermal ionization mass spectrometry. The uranium-235 isotope content of the uranium in sample AL24S8A was 0.203% and 0.201% in sample AL24B2A, averaging 0.202%.

Radium was measured in systematic sample AL24S8A and biased sample AL24B2A. The concentration of ^{226}Ra was 0.66 pCi/g in each.

Surface Measurements

Alpha and beta-gamma activity were measured at selected locations on the roof of the building. The alpha activity ranged from 7 to 210 dpm/100 cm^2 and averaged 61 dpm/100 cm^2. Beta-gamma activity ranged from 0.03 to 0.43 mad/h and averaged 0.12 mrad/h. The data is presented in Table 4.

---

*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.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindekin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. Environmental Research Division, Action Description Memorandum. "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

The 0.66 pCi/g of ^{226}Ra measured in the soil compares favorably with the Albany area background of 0.85 pCi/g of radium-226.

The average alpha activity of 61 dpm/100 cm^2 obtained by measurements on the roof of the building and 21 dpm/100 cm^2 from the asphalt paving are each well below the DOE criterion of 5000 dpm/100 cm^2 for alpha activity from natural uranium, uranium-235, or uranium-238.

The average and maximum beta-gamma activities of 0.12 and 0.42 mrad/h, measured on the roof of the building, are less than the DOE criteria of 0.20 and 1.0 mrad/h at 1 cm, respectively. The corresponding 0.075 mrad/h average, 0.22 maximum from grid points from asphalt paving over the entire property, as well as the 0.11 mrad/h average, 0.29 maximum, from the area with 1 m grid, are also within the limits of the DOE criteria.

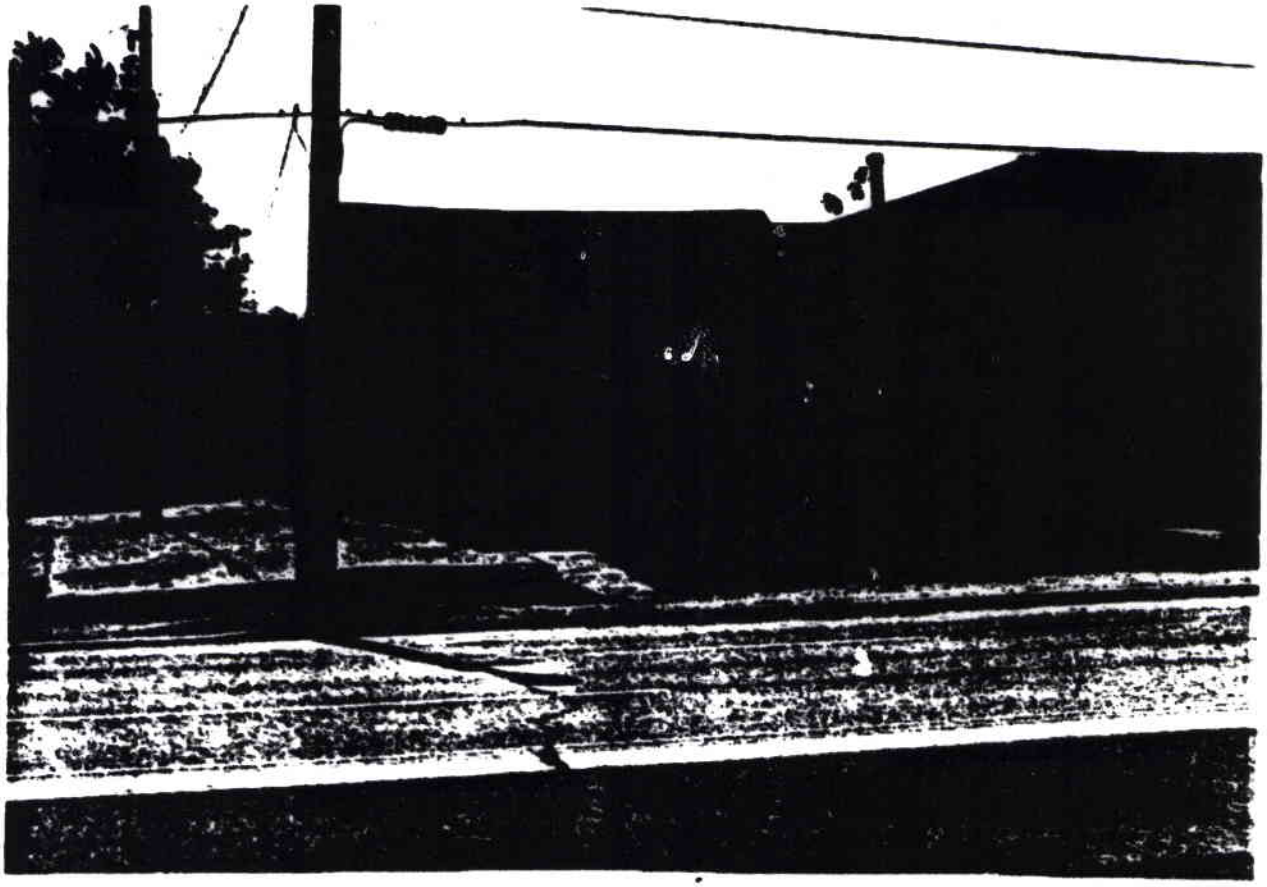


Fig. 2. Front view of the property at 1146 Central Avenue, Colonie, New York (AL024) looking west.

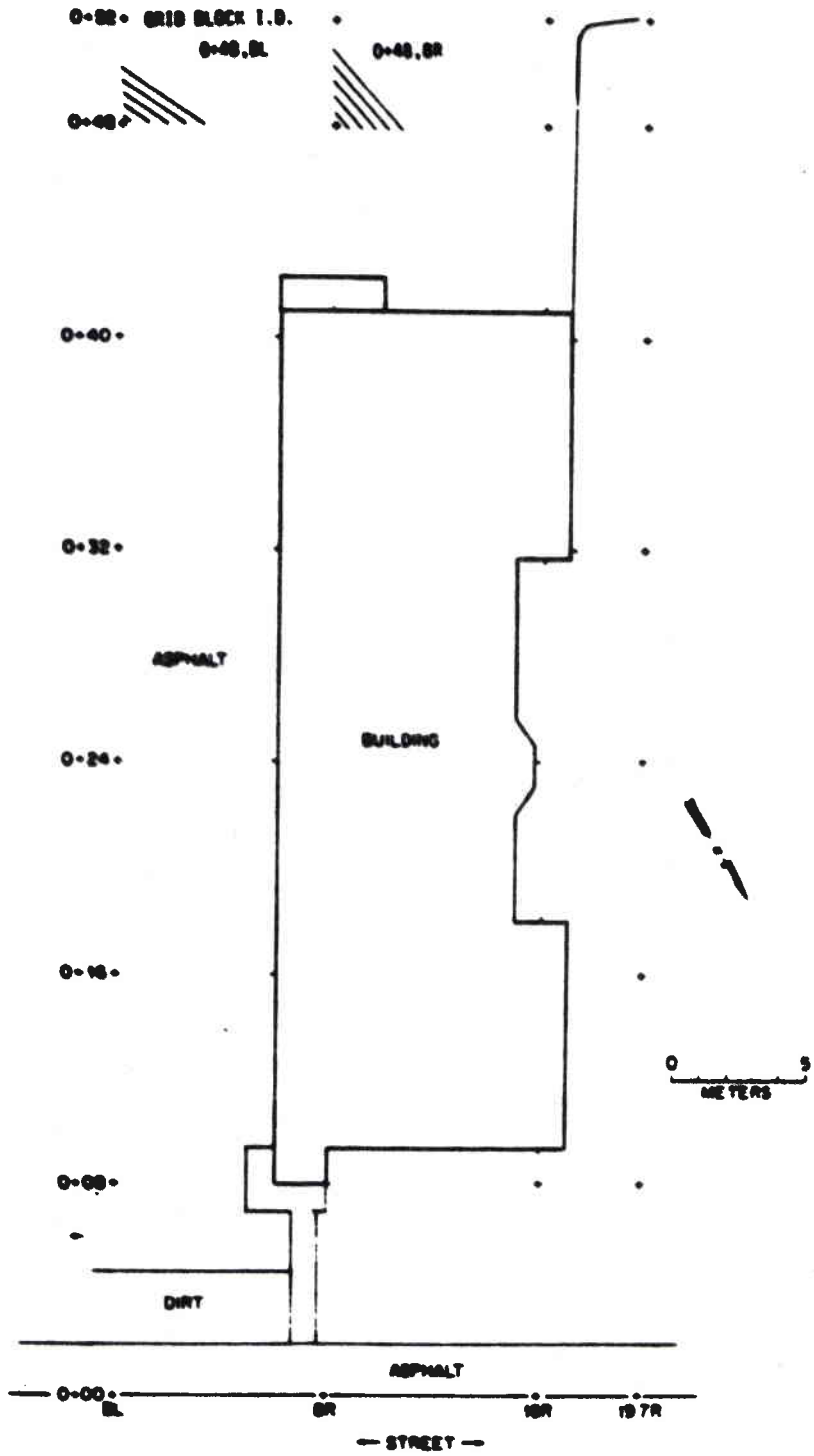


Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 1146 Central Avenue, Colonie, New York (AL024).

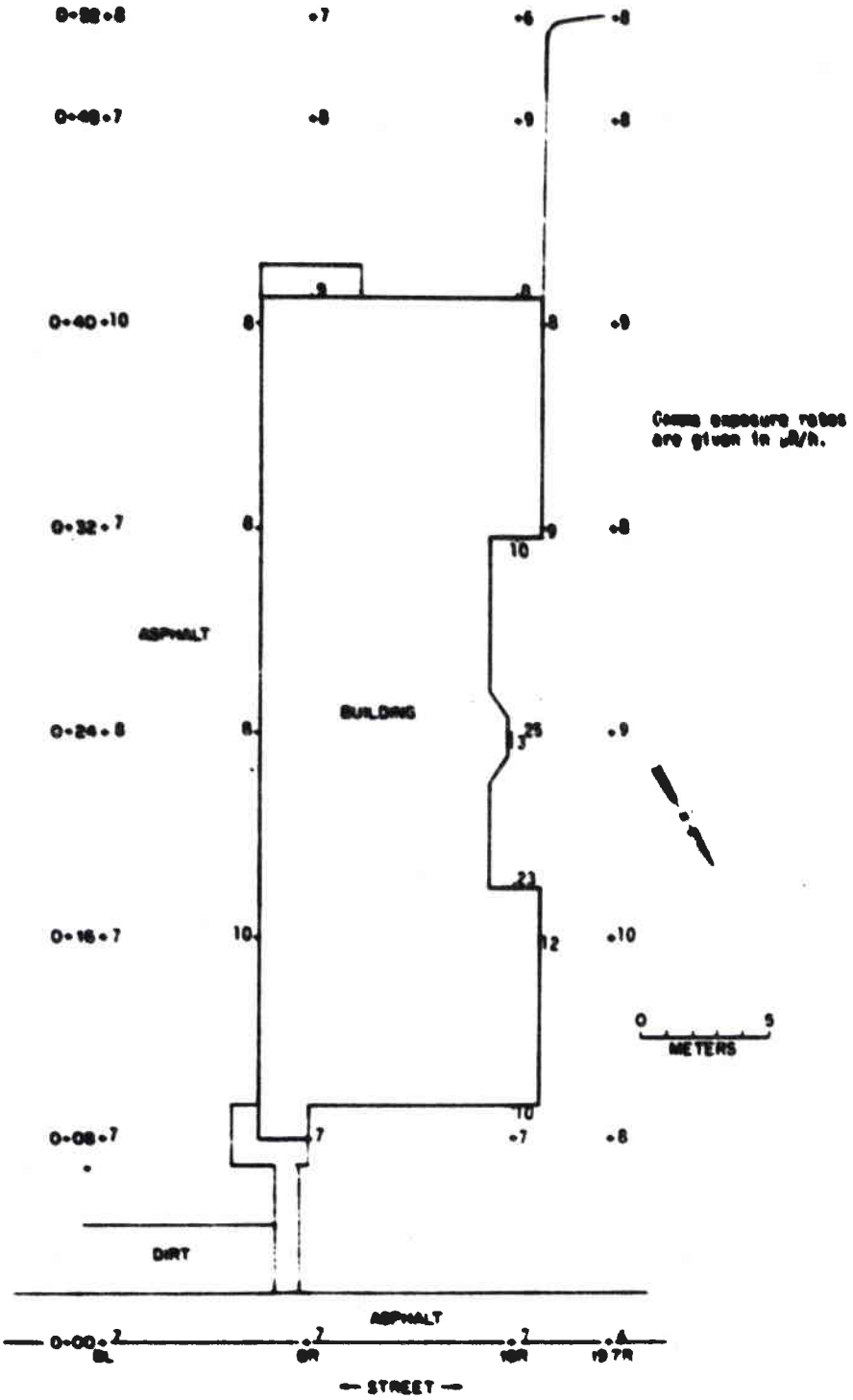


Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 1146 Central Avenue, Colonie, New York (AL024).

Fig. 3. Rear view of the property at 1146 Central Avenue, Colonie, New York (AL024) looking east.

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

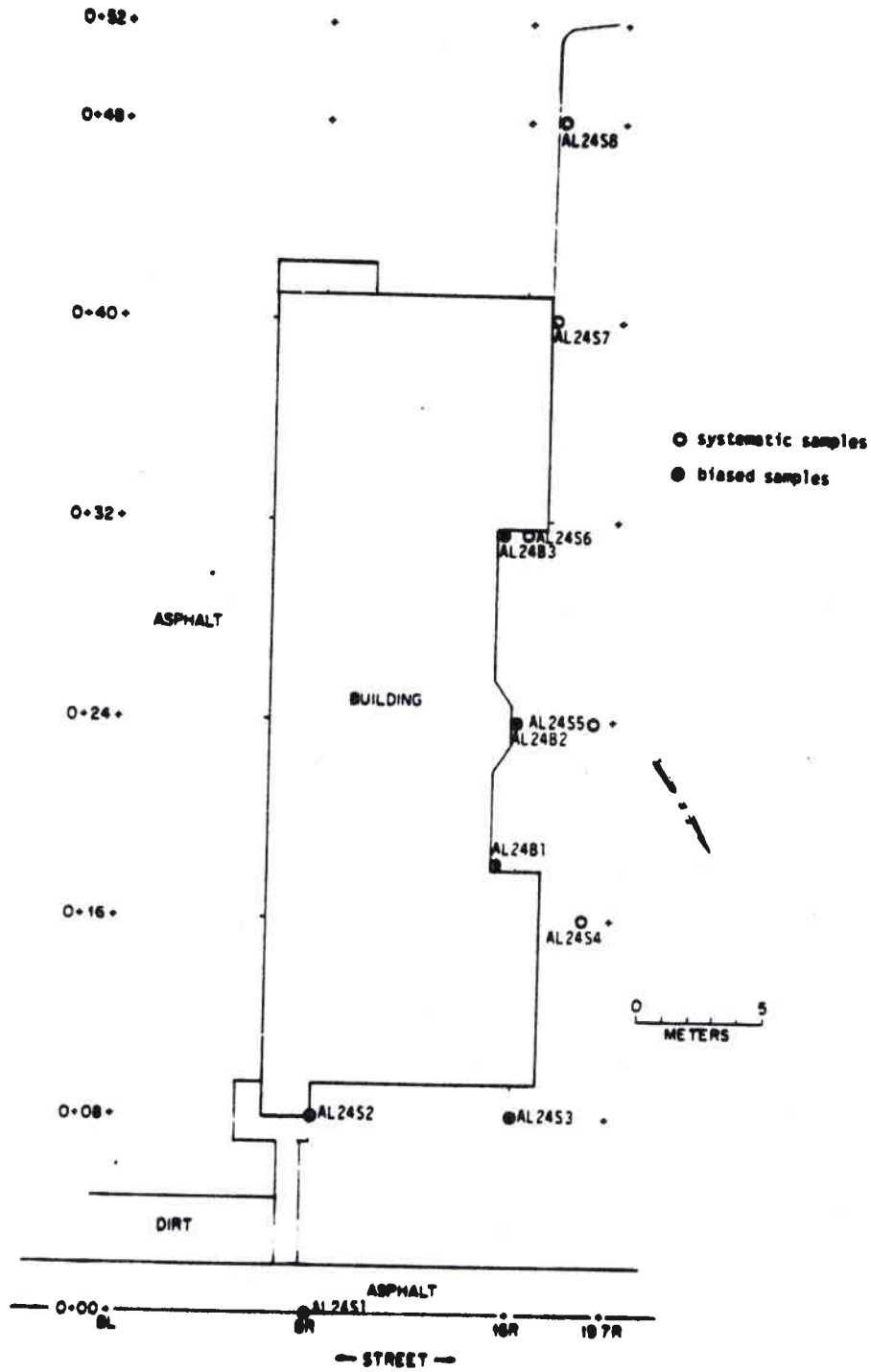


Fig. 5. Locations of soil samples on the property at 1146 Central Avenue, Colonie, New York (AL024).

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 1146 Central Avenue, Colonie, New York (AL024)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	6	7	7-10
0+08, BL	6	7	6-10
0+16, BL	7	7	7-10
0+24, BL	7	8	7-9
0+32, BL	6	7	7-10
0+40, BL	9	10	8-10
0+48, BL	7	7	7-9
0+52, BL	7	8	-
0+16, 6R	9	10	-
0+24, 6R	7	8	-
0+32, 6R	7	8	-
0+40, 6R	8	8	-
0+00, 8R	7	7	7-10
0+08, 8R	7	7	7-13
0+16, 8R	e	e	11-39
0+24, 8R	e	e	14-46
0+32, 8R	e	e	-
0+40, 8R	e	e	8-10
0+42.2, 8R	8	9	-
0+48, 8R	8	8	8-10
0+52, 8R	7	7	-
0+24, 14.5R	11	13	-
0+00, 16R	7	7	5-8
0+08, 16R	7	7	7-13
0+09, 16R	9	10	-
0+18, 16R	13	23	-
0+24, 16R	13	25	9-25
0+31.5, 16R	9	10	-
0+32, 16R	e	e	7-11
0+40, 16R	e	e	8-13
0+42.2, 16R	8	8	-
0+48, 16R	9	9	8-13
0+52, 16R	6	6	-
0+16, 17R	11	12	-
0+32, 17R	9	9	-
0+40, 17R	7	8	-

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, 19.7R	6	6	-
0+08, 19.7R	8	8	-
0+16, 19.7R	9	10	-
0+24, 19.7R	8	9	-
0+32, 19.7R	7	8	-
0+40, 19.7R	7	9	-
0+48, 19.7R	8	8	-
0+52, 19.7R	8	8	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3 (continued)

Sample	Locations[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]

Isotopic Analysis by Mass Spectrometry

Sample	Atom percent			
	^{235}U	^{234}U	^{236}U	^{238}U
AL24S8A	0.203	0.0007	0.0032	99.793
AL24B2A	0.201	0.0007	0.0030	99.795

[a]Locations of soil samples are shown on Fig. 5.

[b]Indicated counting error is at the 95% confidence level ($\pm 2\sigma$).

[c]Analytical error of measurement results is $< \pm 5\%$ (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 3. Results of soil sample analysis on the property at 1146 Central Avenue, Colonie, New York (AL024)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
		Systematic samples[d]		
AL24S1A	0+00, 8R	0-5	-	11
AL24S1B	0+00, 8R	5-15	-	6.5
AL24S2A	0+08, 8R	0-5	-	37
AL24S2B	0+08, 8R	5-15	-	10
AL24S3A	0+08, 16R	0-5	-	35
AL24S3B	0+08, 16R	5-15	-	18
AL24S4A	0+16, 18R	0-5	-	150
AL24S4B	0+16, 18R	5-15	-	31
AL24S5A	0+24, 18.5R	0-5	-	67
AL24S5B	0+24, 18.5R	5-15	-	5.7
AL24S6A	0+32, 16R	0-5	-	73
AL24S6B	0+32, 16R	5-15	-	4.5
AL24S7A	0+40, 17R	0-5	-	21
AL24S7B	0+40, 17R	5-15	-	2.6
AL24S8A	0+48, 17R	0-5	0.66 ± 0.1	100
AL24S8B	0+48, 17R	5-15	-	18
		Biased samples[e]		
AL24B1A	0+18, 14.5R	0-5	-	370
AL24B1B	0+18, 14.5R	5-15	-	160
AL24B2A	0+24, 15.5R	0-5	0.66 ± 0.3	1500
AL24B2B	0+24, 15.5R	5-15	-	91
AL24B3A	0+31, 14.5R	0-5	-	430
AL24B3B	0+31, 14.5R	5-15	-	48

Table 4. Results of surface analysis of the roof of the building at 1146 Central Avenue, Colonie, New York (AL024)

Structure	Number of measurements	Results		Average	
		(dpm/100 cm^2)	(mrad/h)[a]	(dpm/100 cm^2)	(mrad/h)
Alpha Activity	9	7,14,98,7,35,	-	61	-
	-	21,91,210,63	-	—	-
Total	9	7-210	-	61	-
Beta-Gamma	9	-	0.05,0.06,0.11,0.03,0.07,	-	0.12
	-	-	0.10,0.14,0.42,0.08	-	—
Total	9	-	0.03-0.42	-	0.12

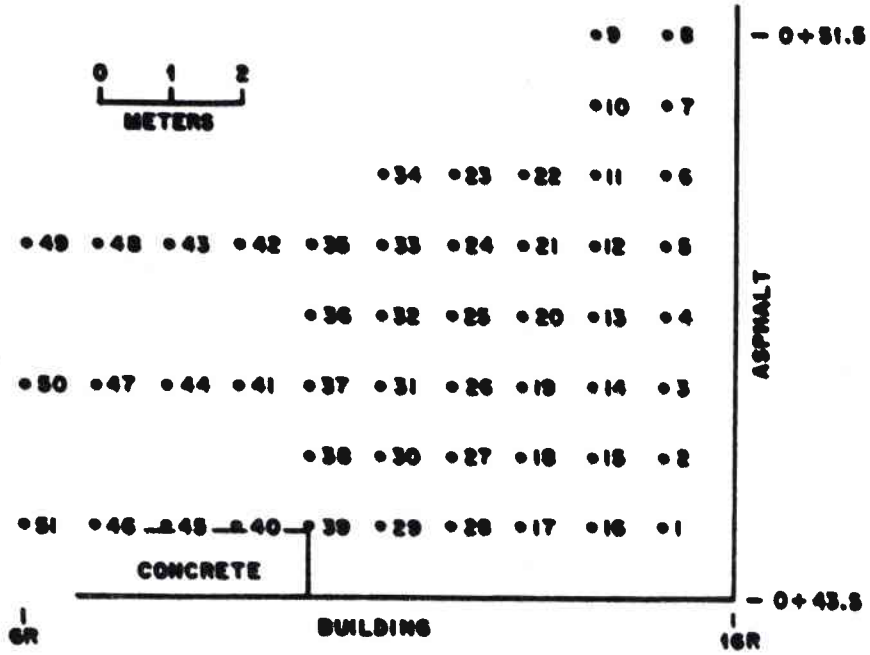
[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 ergs per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

Table 5. Results of surface analysis of the asphalt paving at 1146 Central Avenue, Colonie, New York (AL024)

Grid location	Alpha activity (dpm/100 cm^2)	Beta-gamma activity (mrad/h)[a]
0+00, BL	35	0.05
0+00, 8R	14	0.03
0+00, 18R	28	0.03
0+08, BL	21	0.05
0+08, 6R	7	0.03
0+16, BL	7	0.07
0+16, 6R	28	0.03
0+24, BL	7	0.06
0+24, 6R	7	0.03
0+32, BL	35	0.05
0+32, 6R	7	0.02
0+40, BL	21	0.12
0+40, 6R	49	0.09
0+44, 8R	21	0.11
0+42.5, 16R	28	0.20
0+52, BL	28	0.06
0+52, 8R	14	0.10
0+52, 16R	14	0.22
Range	7-0.49	0.02-0.022
Average	21	0.075

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 ergs per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

Table 6. Results and locations of beta-gamma activity in mrad/h and 1 m grid from paving at the rear of the property at 1146 Central Avenue, Colonie, New York (AL024)



Location of measurement	mrad/h[a]	Location of measurement	mrad/h	Location of measurement	mrad/h
1	0.10	18	0.10	35	0.08
2	0.15	19	0.09	36	0.13
3	0.11	20	0.10	37	0.08
4	0.13	21	0.13	38	0.10
5	0.16	22	0.14	39	0.08
6	0.18	23	0.08	40	0.07
7	0.29	24	0.09	41	0.20
8	0.13	25	0.15	42	0.08
9	0.04	26	0.09	43	0.08
10	0.13	27	0.14	44	0.09
11	0.15	28	0.11	45	0.11
12	0.09	29	0.08	46	0.10
13	0.15	30	0.10	47	0.08
14	0.16	31	0.08	48	0.05
15	0.20	32	0.07	49	0.04
16	0.09	33	0.10	50	0.10
17	0.12	34	0.10	51	0.08

Total measurements (1 m grid)	51
Range (mrad/h)	0.04–0.29
Average (mrad/h)	0.11

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 ergs per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

Table 7. Summary of outdoor measurements and sample results on the property at 1146 Central Avenue, Colonie, New York (AL024)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	38	6-13	8
Gamma exposure rate at surface (μR/h)[a]	38	6-25	9
Scan, gamma exposure rate near surface (μR/h)[b]	-	5-46	-
Concentration of ^{238}U in soil (pCi/g), systematic locations[c]	16	2.6-150	37
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	6	48-1500	430
Abundance of isotope ^{235}U in uranium (%)	2	0.201-0.203	0.202
Concentration of ^{226}Ra in surface soil (pCi/g)[c,d]	2	-	0.66
<u>Surface measurements</u>[e]			
Alpha activity (dpm/100 cm^2)			
Roof of the building	9	7-210	61
Asphalt paving	18	7-49	21
Beta-gamma activity (mrad/h)			
Roof of the building	18	0.02-0.22	0.075
Asphalt paving	51	0.04-0.29	0.11

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Biased samples, Table 3.
[e]Surface measurements, Table 4.

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1148 CENTRAL AVENUE, COLONIE, NEW YORK (AL025)

OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
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DEPARTMENT OF ENERGY

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ORNL/RASA-84/228
(AL025)

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 1148 CENTRAL AVENUE, COLONIE, NEW YORK (AL025)

J. L. Marley, B. A. Berven, and W. D. Cottrell

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RADIOLOGICAL SURVEY ACTIVITIES PROGRAM

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1148 CENTRAL AVENUE, COLONIE, NEW YORK (AL025)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 16 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period May 29–June 7, 1984. The property at 1148 Central Avenue in Colonie, New York (AL025) was the subject of a radiological investigation on June 4, 1984.

This private property was the location of a residence and a portion of the buildings of a business. A diagram showing the approximate property boundaries and the grid network established for measurements outside the structures on the property is shown in Fig. 1. The rectangular lot included in the radiological survey was approximately 30 m wide by 50 m deep. A two-story frame residence is located on the north side of the lot (to the right, viewed from the front, looking west) as shown in Fig. 2. A concrete block warehouse is located on the south side of the lot. A two-car frame garage is located directly behind the house as shown in Fig. 3, looking northeast.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha and beta-gamma activity from surfaces of structures outdoors on the property. A comprehensive description of the survey methods and instrumentation has been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. The data is 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/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 8 to 13 μR/h (microroentgens* per hour) and averaged 10 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 7 to 18 μR/h and averaged 11 μR/h. The maximum gamma exposure rate measured, 32 μR/h, was at the northwest corner of the back porch of the house at grid location 0+30, 24R.

Soil Sampling

Thirty-nine systematic soil samples were taken from ten locations on the property. Systematic denotes samples that were taken at grid locations irrespective of the gamma exposure level at the point of sampling. The locations of the samples are shown in Fig. 5, and the results of analysis are presented in Table 3. A special program of sampling was followed at this property. In order to obtain a detailed

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*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.

profile of the distribution of the uranium with depth in the soil, samples were taken from the following depths at each location: 0 to 1 cm, 1 to 2.5 cm, 2.5 to 5 cm, and 5 to 15 cm. The one exception was AL25S3A at grid location 0+40, 24R. The grass turf was so thick that it was not possible to obtain adequate and representative material within one centimeter of the surface; therefore the 0 to 2.5 cm depth was selected for the sample.

The ^{238}U concentrations of the 39 soil samples ranged from 1.4 to 190 pCi/g (picocuries* per gram) and averaged 43 pCi/g. The average concentrations at the four depth ranges examined were from 16 to 60 pCi/g, with the maximum ^{238}U in the 1 to 2.5 cm region, as shown in Table 4. Samples AL25S9A-D from location 0+15, 16R contain the highest concentrations of ^{238}U from each depth over the property; and although the samples from the AL25S9 location have the effect of raising the averages for each sampling level, it is noted that they do not distort the pattern of averages. For example, by elimination of the AL25S9 set, the averages from 0 to 15 cm are 37, 44, 32, and 18 pCi/g, respectively, still with the maximum occurring at the 1 to 2.5 cm level (refer to Table 4).

The data is helpful in understanding the distribution of the uranium contamination that has occurred. To the extent the deposition of uranium resulted from stack emissions, the original strata of ^{238}U concentration would be at the surface, and the soil beneath the surface would still be at background with respect to ^{238}U (Table 1). Such is now not the case. The uranium is now present to 15 cm or more depths. It is believed that the uranium has migrated primarily as a result of natural processes such as freezing and thawing, melting snow, washing by rain. Sample AL25S9, from 0+15, 16R, a location below a drainage path from the roof of the house, is probably an excellent example of the effect of rain washing the ^{238}U from the roof to the ground where the uranium is absorbed and retained in the soil. It is also probable that the uranium will be further diffused, become less concentrated with time, as the above processes continue to disperse the uranium.

The isotopic content of the uranium in the soil was determined by thermal ionization mass spectrometry. The uranium-235 content of the uranium in sample AL25S1A was 0.204%.

Radium was measured in four samples and ranged from 0.60 to 0.87 pCi/g, averaging 0.74 pCi/g of ^{226}Ra.

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*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.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the roof of the buildings, on the asphalt paved area, and on the concrete walkways. The results of these measurements are listed in Table 5. The alpha activity ranged from 7 to 220 dpm/100 cm^2 and averaged 68 dpm/100 cm^2. Beta-gamma activity ranged from 0.03 to 0.14 mrad/h and averaged 0.06 mrad/h.

A summary of the outdoor measurement results is provided in Table 6.

SIGNIFICANCE OF FINDINGS

Measurements of the gamma exposure levels outdoors on the property determined that the exposure rate at 1 m above the ground surface ranged from 8 to 13 μR/h and averaged 11 μR/h. For comparison, the typical background for the Albany area is 9 μR/h; the background for the state of New York[8,9] averages 9.5 μR/h and ranges from 6.8 to 13 μR/h (one standard deviation) based on 51 measurements. Based on this information, there is no indication of significant risk to health caused by gamma exposure rates outdoors on the property.

The results of ^{238}U analysis establish the presence of uranium at concentrations significantly above background on the property. The average concentration of 43 pCi/g of ^{238}U in the systematic samples is approximately 45 times the background of 0.96 pCi/g for the Albany area, and is approximately 1.2 times the DOE guideline[10] of 35 pCi/g of ^{238}U in soil. The highest concentration of ^{238}U measured was 190 pCi/g (sample AL25S9B), approximately 5.4 times the DOE guideline in the soil along the dripline of the house. The concentration at the dripline is probably caused by localized absorption into the soil from ^{238}U-bearing rain washing from the roof of the house.

The analysis for uranium in the soil demonstrates that the uranium tends to be concentrated in layers near the surface. The region of highest concentration tends to be approximately 1 to 2.5 cm (1/2" to 1") and the ^{238}U decreases as depth increases. The 0.204 atom percent ^{235}U determined by mass spectrometry establishes that the uranium which contaminated the property is depleted, i.e., it has been treated by a separation process and a significant fraction of the ^{235}U has been removed. Natural uranium, by comparison, contains 0.7% uranium-235.

The concentration of 0.74 pCi/g for ^{226}Ra measured in the soil compares favorably with the Albany area background of 0.85 pCi/g of radium-226.

The average alpha activity of 68 dpm/100 cm^2 is well below the DOE criterion of 5000 dpm/100 cm^2 for alpha activity from natural uranium, uranium-235, and uranium-238.

The average and maximum beta-gamma activities of 0.06 and 0.14 mrad/h are less than the DOE criteria of 0.20 and 1.0 mrad/h at 1 cm, respectively.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/NE (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Knerre, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindeken, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. Environmental Research Division, Action Description Memorandum, "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

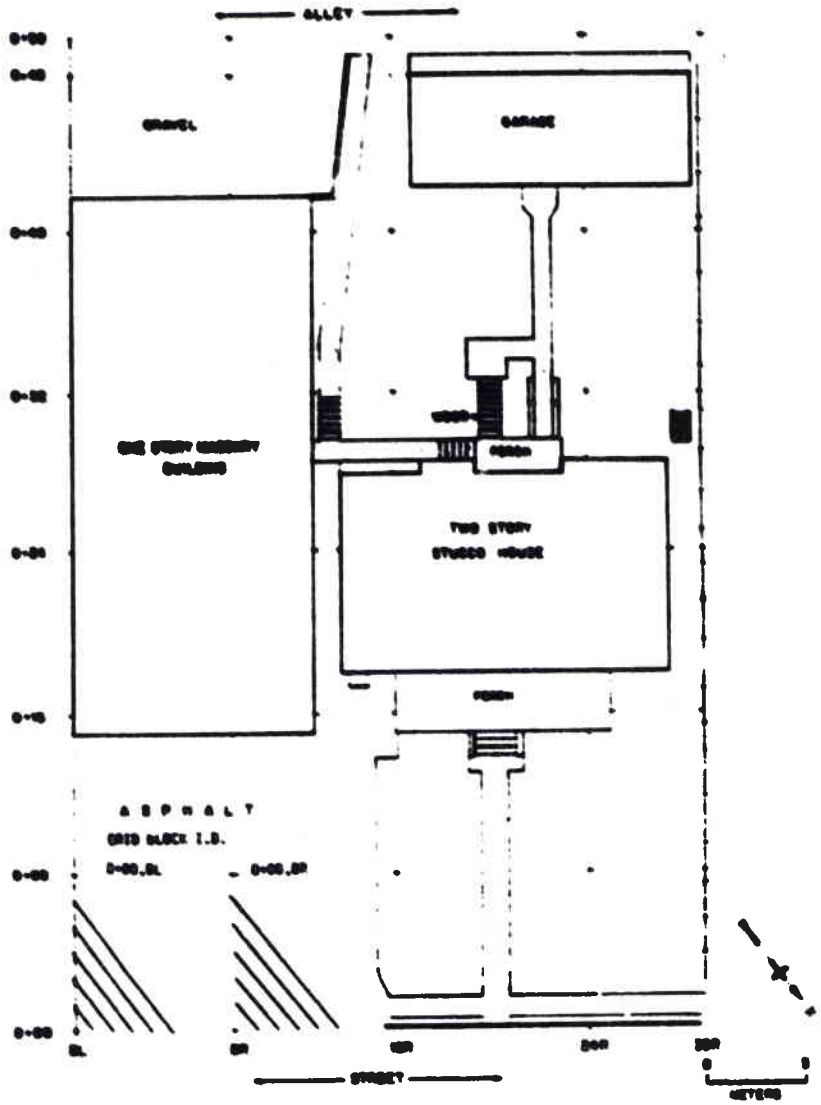

Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 1148 Avenue, Colonie, New York (AL025).

Fig. 2. Front view of the property at 1148 Central Avenue, Colonie, New York (AL025) looking west.

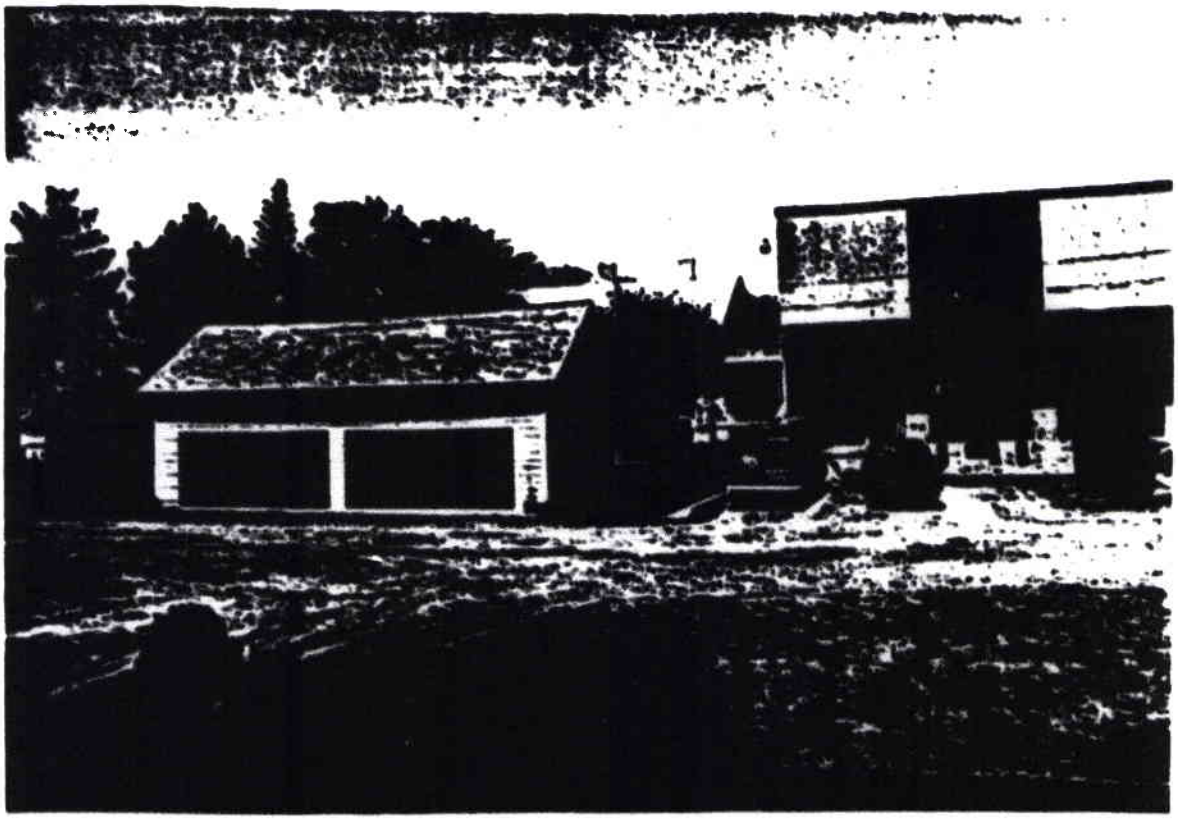

Fig. 3. Rear view of the property at 1148 Central Avenue, Colonie, New York (AL025) looking northeast.

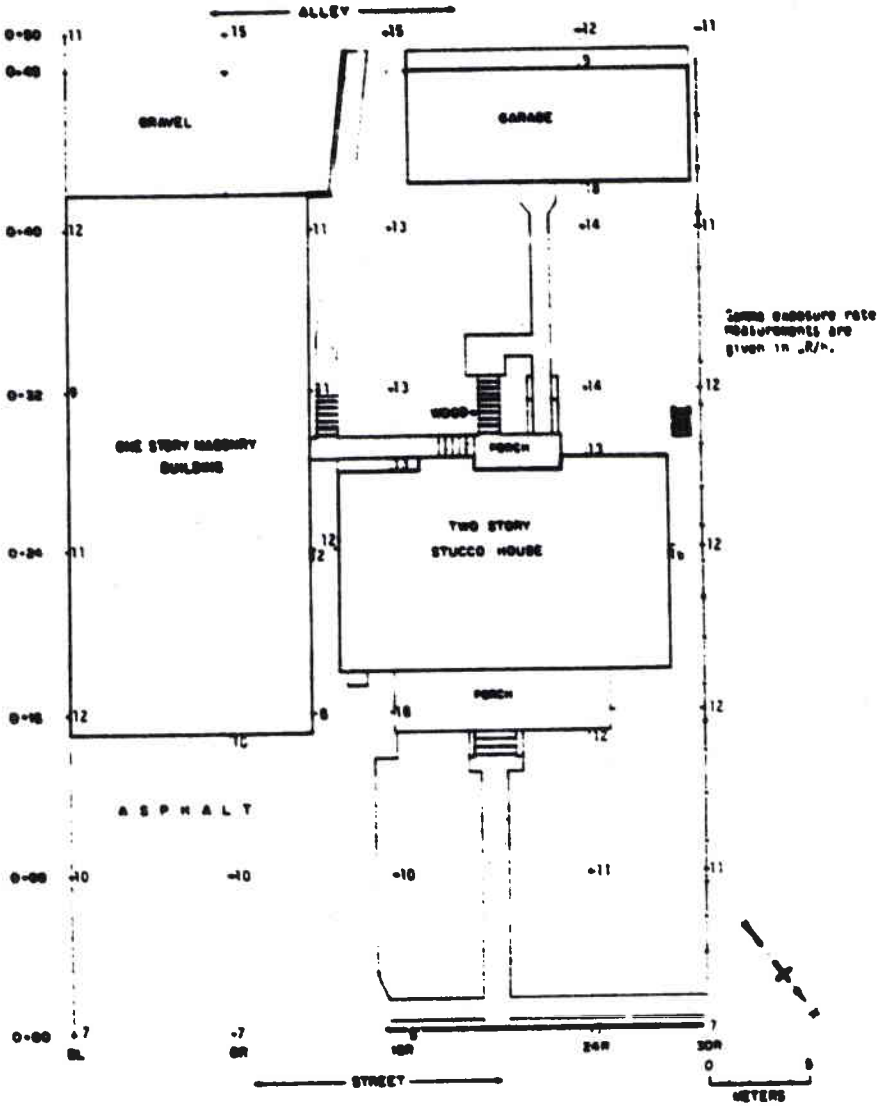

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 1148 Central Avenue, Colonie, New York (AL025).

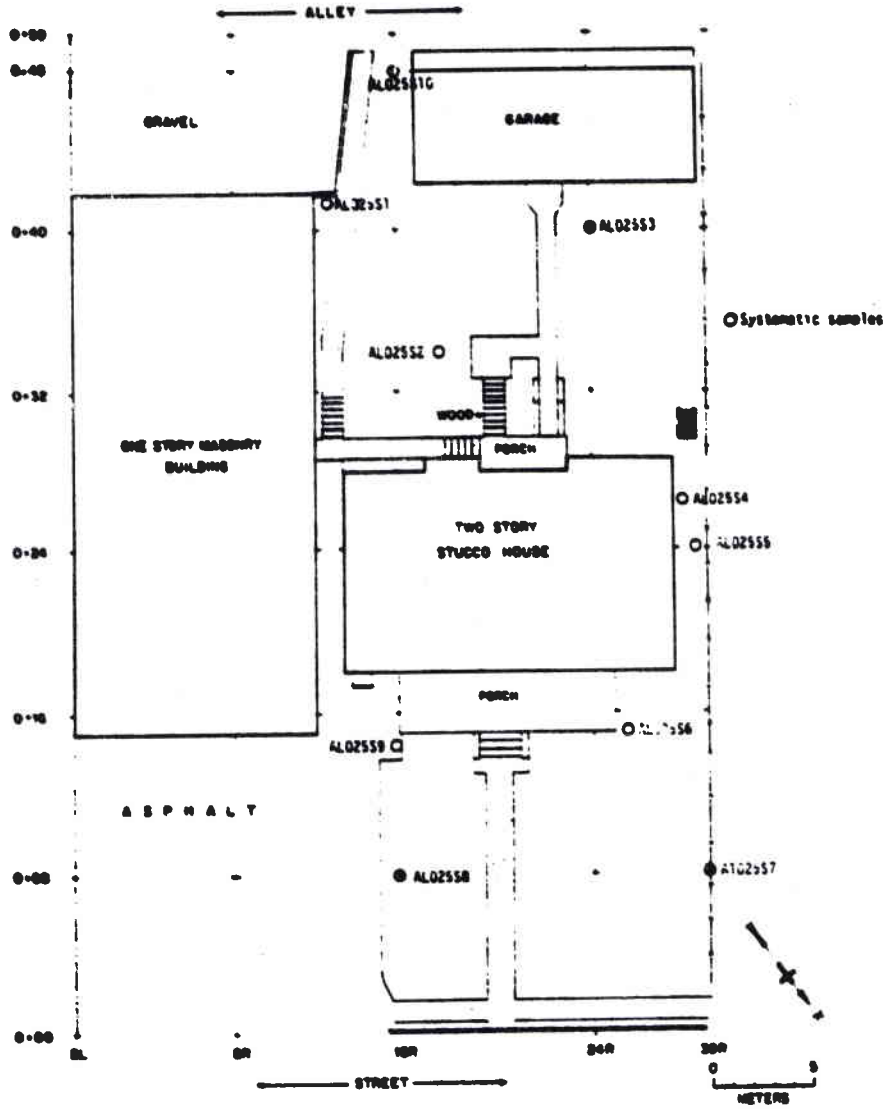

Fig. 5. Locations of soil samples on the property at 1148 Central Avenue, Colonie, New York (AL025).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 1148 Central Avenue, Colonie, New York (AL025)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	8	7	6-12
0+08, BL	11	10	7-12
0+16, BL	11	12	-
0+24, BL	11	11	-
0+32, BL	9	9	-
0+40, BL	10	12	10-15
0+50, BL	11	11	-
0+00, 8R	9	7	7-11
0+08, 8R	10	10	9-12
0+15.8, 8R	8	10	-
0+16, 8R	e	e	11-13
0+24, 8R	e	e	11-13
0+32, 8R	e	e	9-12
0+40, 8R	e	e	9-15
0+42, 8R	e	e	11-13
0+50, 8R	13	15	-
0+16, 12R	8	8	-
0+24, 12R	9	12	-
0+32, 12R	11	11	-
0+40, 12R	11	11	-
0+24, 13.3R	11	12	-
0+00, 16R	8	8	7-11
0+08, 16R	11	10	8-26
0+15, 16R	11	18	-
0+16, 16R	e	e	-
0+24, 16R	e	e	-
0+28, 16R	10	13	9-15
0+32, 16R	12	13	9-15
0+40, 16R	11	13	11-26
0+50, 16R	13	15	-
0+00, 24R	8	7	7-9
0+08, 24R	10	11	8-12
0+15, 24R	11	12	-
0+16, 24R	e	e	11-16
0+24, 24R	e	e	11-32
0+30, 24R	12	13	-
0+32, 24R	11	14	11-14
0+40, 24R	11	14	11-15

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+42, 24R	11	18	-
0+49, 24R	9	9	-
0+50, 24R	13	12	-
0+24, 28.5R	11	16	-
0+00, 30R	8	7	-
0+08, 30R	11	11	-
0+16, 30R	11	12	-
0+24, 30R	11	12	-
0+32, 30R	12	12	-
0+40, 30R	10	11	-
0+50, 30R	11	11	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analysis on the property at 1148 Central Avenue, Colonie, New York (AL025)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
		Systematic samples[d]		
AL025S1A	0+41, 13R	0-1	0.83 ± 0.1	40
AL025S1B	0+41, 13R	1-2.5	±	37
AL025S1C	0+41, 13R	2.5-5	±	28
AL025S1D	0+41, 13R	5-15	±	21
AL025S2A	0+34, 18R	0-1	±	22
AL025S2B	0+34, 18R	1-2.5	0.65 ± 0.2	62
AL025S2C	0+34, 18R	2.5-5	±	50
AL025S2D	0+34, 18R	5-15	±	14
AL025S3A	0+40, 24R	0-2.5	±	68
AL025S3B	0+40, 24R	2.5-5	±	92
AL025S3C	0+40, 24R	5-15	±	35
AL025S4A	0+26, 28.5R	0-1	±	52
AL025S4B	0+26, 28.5R	1-2.5	±	30
AL025S4C	0+26, 28.5R	2.5-5	±	9.9
AL025S4D	0+26, 28.5R	5-15	±	3.4
AL025S5A	0+24, 29R	0-1	±	31
AL025S5B	0+24, 29R	1-2.5	±	32
AL025S5C	0+24, 29R	2.5-5	0.60 ± 0.2	17
AL025S5D	0+24, 29R	5-15	±	5.9
AL025S6A	0+15.5, 26R	0-1	±	58
AL025S6B	0+15.5, 26R	1-2.5	±	14
AL025S6C	0+15.5, 26R	2.5-5	±	4.1
AL025S6D	0+15.5, 26R	5-15	±	1.4
AL025S7A	0+08, 30R	0-1	±	19
AL025S7B	0+08, 30R	1-2.5	±	19
AL025S7C	0+08, 30R	2.5-5	±	22
AL025S7D	0+08, 30R	5-15	±	12
AL025S8A	0+08, 30R	0-1	±	36
AL025S8B	0+08, 30R	1-2.5	±	67
AL025S8C	0+08, 30R	2.5-5	±	29
AL025S8D	0+08, 30R	5-15	±	13
AL025S9A	0+15, 16R	0-1	±	150
AL025S9B	0+15, 16R	1-2.5	±	190
AL025S9C	0+15, 16R	2.5-5	±	160
AL025S9D	0+15, 16R	5-15	±	43
AL025S10A	0+48, 16R	0-1	±	41
AL025S10B	0+48, 16R	1-2.5	±	93
AL025S10C	0+48, 16R	2.5-5	±	35
AL025S10D	0+48, 16R	5-15	0.87 ± 0.14	14

Table 3 (continued)

Isotopic Analysis by Mass Spectrometry

	Atom Percent			
	^{235}U	^{234}U	^{236}U	^{238}U
AL25S1A	0.204	0.0008	0.0029	99.792

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

Table 4. Change in concentration of uranium-238 in surface soil[a] with depth at 1148 Central Avenue, Colonie, New York (AL025)

Depth of sampling (range in cm)	Number of samples	Range of ^{238}U concentration (pCi/g)	Average ^{238}U concentration (pCi/g)
0-1	9	19-150	50
0-2.5	1	-	68
1-2.5	9	14-190	60
2.5-5	10	4.1-160	45
5-15	10	1.4-43	16

[a]Surface soil is defined as soil at 0-15 cm (0-6") depth. [USDOE Interim Planning Guidelines and Criteria for Formerly Utilized Sites Remedial Action Program (FUSRAP) and Remote Surplus Facilities Management Program (SFMP) Sites, (October 1984).]

Table 5. Results of surface analysis of structures at 1148 Central Avenue, Colonie, New York (AL025)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity					
Roof of house	4	56,63,63,120	-	76	-
Roof of garage	3	21,70,110	-	67	-
Roof of warehouse	6	140,150,180, 200,210,220	-	183	-
Walkways and paving	18	14,7,7,21,21,28, 42,7,35,56,28,42, 56,49,21,14,21,35	-	28	-
Totals	31	7-220	-	68	-
Beta-Gamma					
Roof of house	4	-	0.05,.12,.08,.13	-	0.10
Roof of garage	3	-	0.03,.05,.05	-	0.04
Roof of warehouse	6	-	0.09,.09,.09, .05,.08,.14	-	0.09
Walkways and paving	18	-	0.03,.03,.03,.06,.03, .05,.07,.08,.09,.04,.12, .07,.03,.03,.03,.03,.04,.08	-	0.06
Totals	31	-	0.03-0.13	-	0.06

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 erg per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-5} °C.)

Table 6. Summary of outdoor measurements and sample results on the property at 1148 Central Avenue, Colonie, New York (AL025)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	40	8-13	10
Gamma exposure rate at surface (μR/h)[a]	40	7-18	11
Scan, gamma exposure rate near surface (μR/h)[b]	-	6-32	-
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	39	1.4-190	43
Abundance of isotope ^{235}U in uranium (%)	1	-	0.204
Concentration of ^{226}Ra in surface soil (pCi/g), systematic locations[c]	3	0.60-0.84	0.74
<u>Surface measurements</u>[d]			
Alpha activity (dpm/100 cm^2)	31	7-220	68
Beta-gamma activity (mrad/h)	31	0.03-0.14	0.06

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Surface measurements, Table 4.

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1150 CENTRAL AVENUE, COLONIE, NEW YORK (AL026)

OPERATED BY
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FOR THE UNITED STATES
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ORNL/RASA-84/239
(AL026)

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 1150 CENTRAL AVENUE, COLONIE, NEW YORK (AL026)

J. L. Marley, B. A. Berven, and W. D. Cottrell

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1150 CENTRAL AVENUE, COLONIE, NEW YORK (AL026)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 16 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period May 29-June 7, 1984. The property at 1150 Central Avenue in Colonie, New York (AL026) was the subject of a radiological investigation on June 4, 1984.

This residence consisted of a two-story frame house on a fenced lot. The outdoor area surrounding the house was generally covered with grass and shrubbery. A diagram of the property showing the approximate property boundaries and the grid network established for measurements outside the house is shown in Fig. 1. The rectangular lot included in the radiological survey was approximately 15 m wide by 50 m deep. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha and beta-gamma activity from surfaces of structures outdoors on the property. A comprehensive description of the survey methods and instrumentation has been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. The data is 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/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 7 to 11 μR/h (microroentgens* per hour) and averaged 9 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 6 to 14 μR/h and averaged 10 μR/h. The maximum gamma exposure rate measured at the property was 16 μR/h in an area near the front of the house at approximately grid location 0+14, 7R.

Soil Sampling

Twenty-two systematic soil samples were taken at eleven locations on the property. Systematic denotes samples that were taken at grid locations irrespective of the gamma exposure level at the point of sampling. The locations of the samples are shown in Fig. 5, and the results of analysis are presented in Table 3.

---

*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.

Samples were taken at 0 to 5 cm and at 5 to 15 cm depths from each location. Concentrations of ^{238}U in the soil samples ranged from 4.8 to 85 pCi/g (picocuries* per gram) and averaged 23 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 35 pCi/g and averaged 11 pCi/g in the 5 to 15 cm depth samples. The ratio of (concentration at 0 to 5 cm) to (concentration at 5 to 15 cm) depths was 3.27, indicating that the higher concentrations are located near the surface. The sample from grid location 0+24, 13R (AL26S5A) having the maximum concentration found on the property (85 pCi/g) and all others exceeding the DOE guidelines concerning ^{238}U in soil are from depths of 0 to 5 cm.

The isotopic content of the uranium in the soil was determined by thermal ionization mass spectrometry. The uranium-235 isotope content of the uranium in sample AL26S3A was 0.213%.

Radium was measured in sample AL26S3A. The concentration of ^{226}Ra was 1.0 pCi/g.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the roof and walkways at the house. The results of these measurements are listed in Table 4. The alpha activity ranged from 21 to 170 dpm/100 cm^2 and averaged 51 dpm/100 cm^2. Beta-gamma activity ranged from 0.03 to 0.06 mard/h and averaged 0.04 mrad/h.

A summary of the outdoor measurement results is provided in Table 5.

SIGNIFICANCE OF FINDINGS

Measurements of the gamma radiation exposure levels outdoors on the property determined that the exposure rate at 1 m above the ground surface ranged from 7 to 11 μR/h and averaged 9 μR/h; the same as the background for the Albany area. For comparison, the typical background for the state of New York[8,9] averages 9.5 μR/h and ranges from 6.8 to 13 μR/h (one standard deviation) based on 51 measurements. Based on this information, there is no indication of risk to health caused by gamma exposure rates outdoors on the property.

---

*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.

The results of ^{238}U analysis establish the presence of uranium at concentrations significantly above background on the property. The average concentration of 23 pCi/g of ^{238}U in the systematic samples is approximately 24 times the background of 0.96 pCi/g for the Albany area. However, the average is below the DOE guideline[10] of 35 pCi/g ^{238}U. The maximum concentration of ^{238}U measured, 85 pCi/g in sample AL2685A, was approximately 2.4 times the DOE guideline.

The 0.213 atom percent ^{235}U determined by mass spectrometry establishes that the uranium which contaminated the property is depleted, i.e., it has been treated by a separations process; and a significant fraction of the ^{235}U has been removed. Natural uranium contains 0.7% uranium-235.

The 1.0 pCi/g of ^{226}Ra measured in the soil compares favorably with the Albany area background of 0.85 pCi/g of radium-226.

The average alpha activity of 51 dpm/100 cm^2 obtained by measurements on outside structures is well below the DOE criterion of 5000 dpm/100 cm^2 for alpha activity from natural uranium, uranium-235, or uranium-238.

The average and maximum beta-gamma activities of 0.04 and 0.06 mrad/h are less than the DOE criteria of 0.20 and 1.0 mrad/h at 1 cm, respectively.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindokin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. Environmental Research Division, Action Description Memorandum, "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

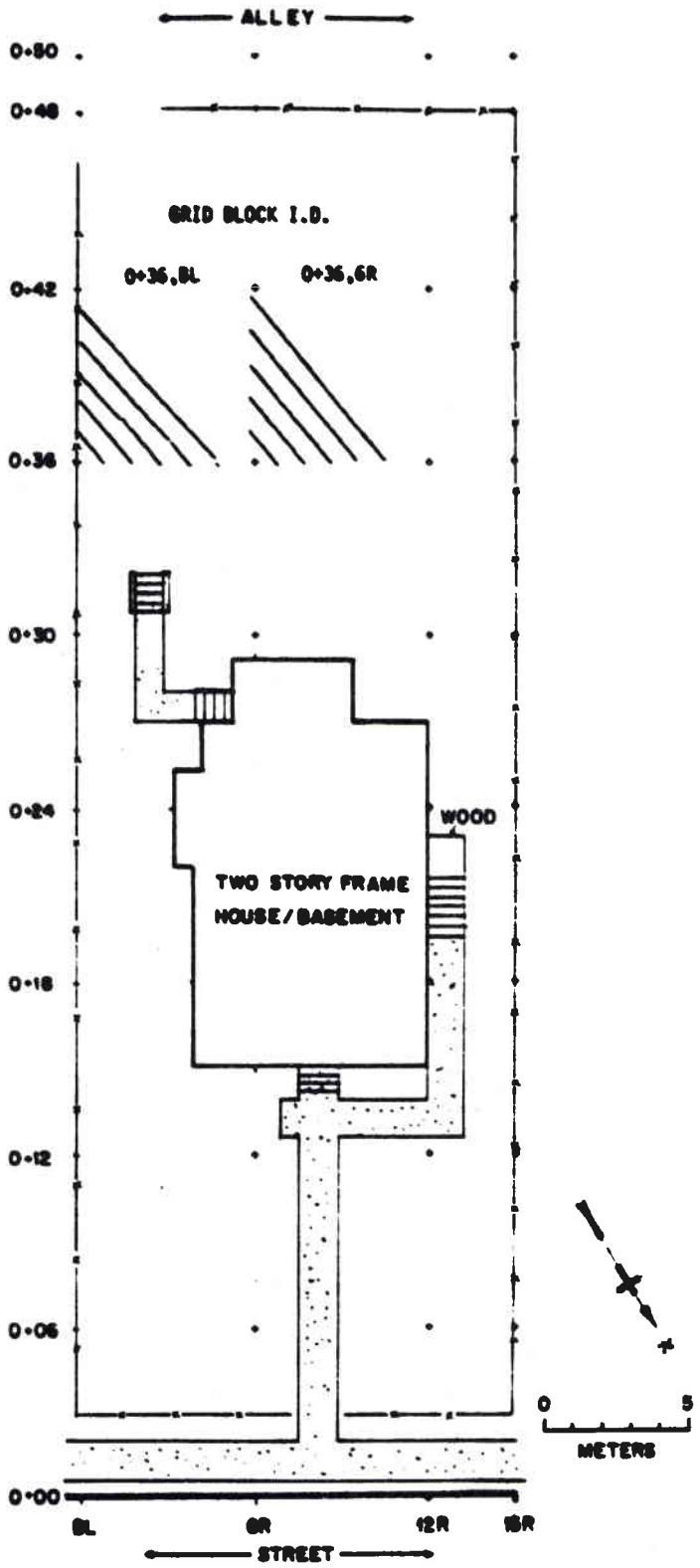

Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 1150 Central Avenue, Colonie, New York (AL026).

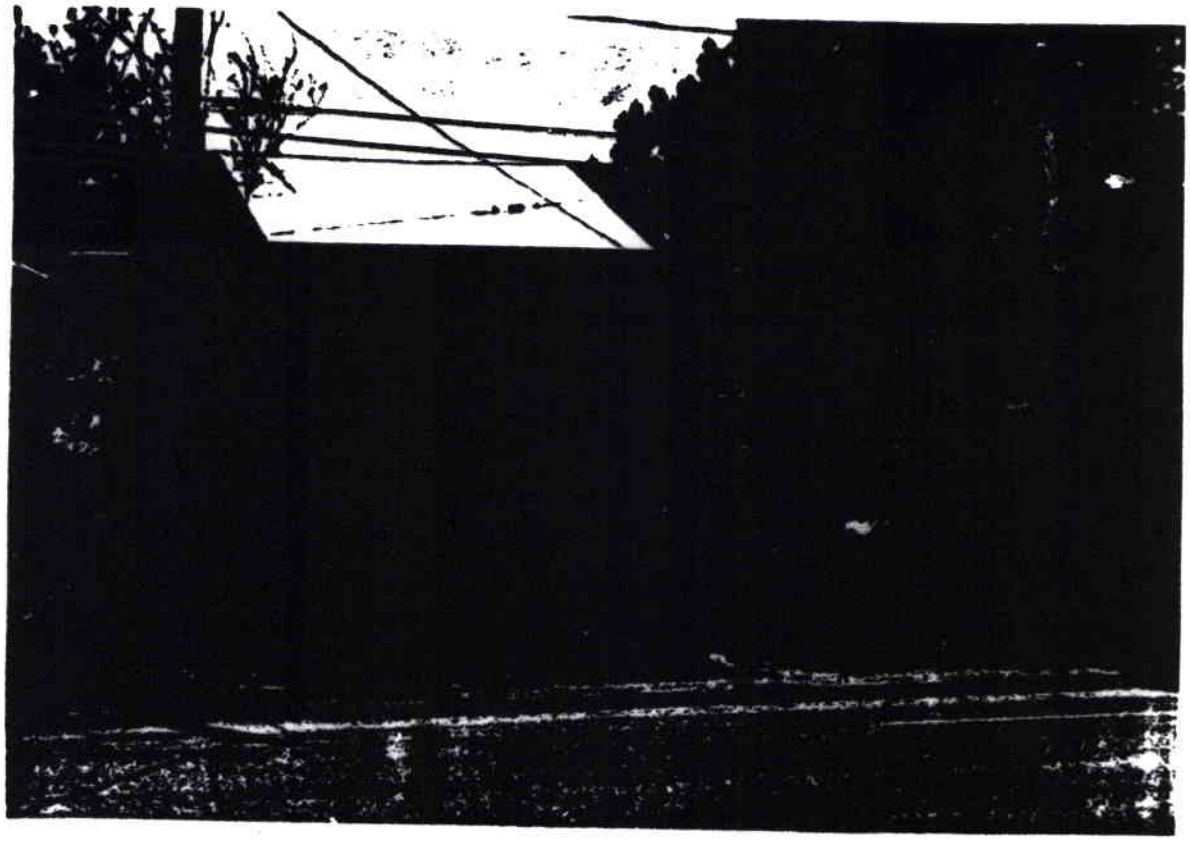

Fig. 2. Front view of the property at 1150 Central Avenue, Colonie, New York (AL026) looking southwest.

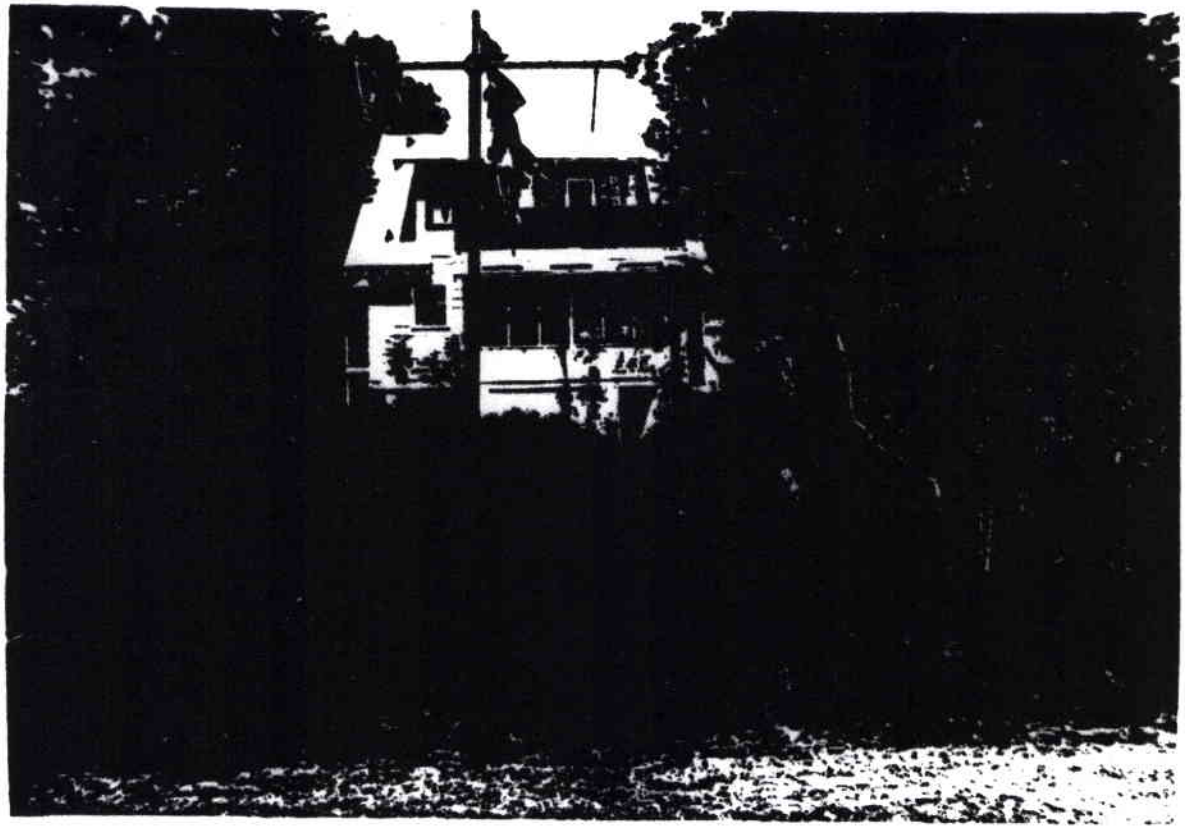

Fig. 3. Rear view of the property at 1150 Central Avenue, Colonie, New York (AL026) looking northeast.

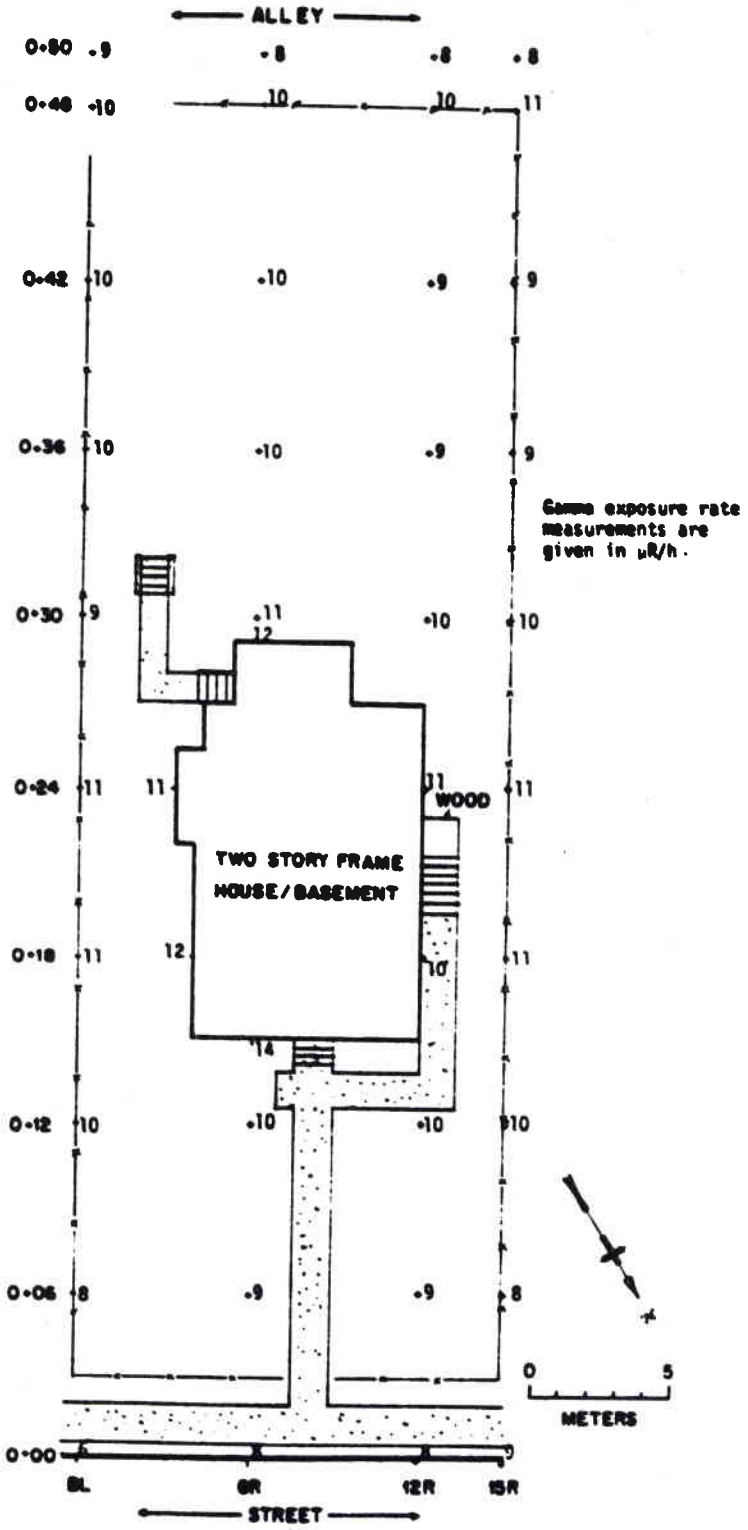

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 1150 Central Avenue, Colonie, New York (AL026).

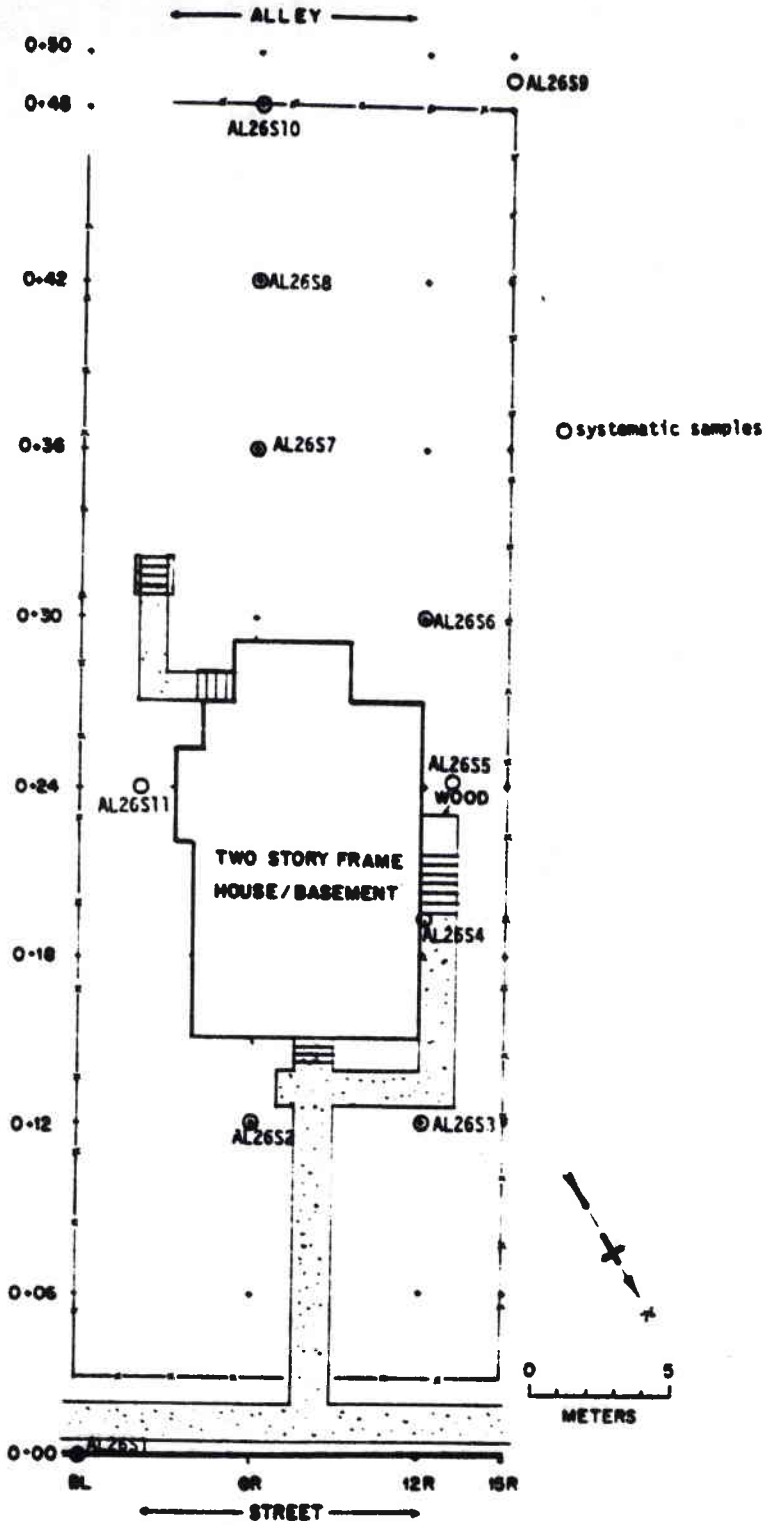

Fig. 5. Locations of soil samples on the property at 1150 Central Avenue, Colonie, New York (AL026).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 1150 Central Avenue, Colonie, New York (AL026)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	7	6	6-8
0+06, BL	8	8	7-9
0+12, BL	9	10	8-14
0+18, BL	9	11	9-11
0+24, BL	10	11	8-11
0+30, BL	10	9	8-10
0+36, BL	10	10	8-10
0+42, BL	9	10	8-10
0+48, BL	10	10	8-10
0+50, BL	9	9	-
0+24, 3.5R	10	11	-
0+18, 4R	11	12	-
0+00, 6R	7	8	-
0+06, 6R	8	9	8-10
0+12, 6R	9	10	9-16
0+15, 6R	11	14	-
0+16, 6R	e	e	-
0+24, 6R	e	e	9-15
0+29, 6R	10	12	-
0+30, 6R	10	11	8-10
0+36, 6R	9	10	9-10
0+46, 6R	9	10	8-10
0+48, 6R	10	10	9-10
0+50, 6R	10	8	-
0+00, 12R	8	8	6-9
0+06, 12R	9	9	7-9
0+12, 12R	10	10	8-10
0+18, 12R	9	10	8-11
0+24, 12R	10	11	9-16
0+30, 12R	10	10	8-10
0+36, 12R	9	9	8-10
0+42, 12R	10	9	8-10
0+48, 12R	10	10	8-10
0+50, 12R	8	8	-
0+00, 15R	7	9	-
0+06, 15R	7	8	-
0+12, 15R	9	10	-
0+18, 15R	10	11	-

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+24, 15R	10	11	-
0+30, 15R	10	10	-
0+36, 15R	9	9	-
0+42, 15R	10	9	-
0+48, 15R	10	11	-
0+50, 15R	9	8	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analysis on the property at 1150 Central Avenue, Colonie, New York (AL026)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
			Systematic samples[d]	
AL026S1A	0+00, BL	0-5	±	4.8
AL026S1B	0+00, BL	5-15	±	12
AL026S2A	0+12, 6R	0-5	±	22
AL026S2B	0+12, 6R	5-15	±	14
AL026S3A	0+12, 12R	0-5	1.0 ± 0.3	23
AL026S3B	0+12, 12R	5-15	±	9.2
AL026S4A	0+20, 12R	0-5	±	43
AL026S4B	0+20, 12R	5-15	±	14
AL026S5A	0+24, 13R	0-5	±	85
AL026S5B	0+24, 13R	5-15	±	14
AL026S6A	0+30, 12R	0-5	±	50
AL026S6B	0+30, 12R	5-15	±	5.4
AL026S7A	0+36, 6R	0-5	±	20
AL026S7B	0+36, 6R	5-15	±	8.2
AL026S8A	0+42, 6R	0-5	±	33
AL026S8B	0+42, 6R	5-15	±	13
AL026S9A	0+49, 15R	0-5	±	43
AL026S9B	0+49, 15R	5-15	±	14
AL026S10A	0+48, 6R	0-5	±	38
AL026S10B	0+48, 6R	5-15	±	15
AL026S11A	0+24, 3R	0-5	±	18
AL026S11B	0+24, 3R	5-15	±	7.0

Isotopic Analysis by Mass Spectrometry

	Atom Percent			
	^{235}U	^{234}U	^{236}U	^{238}U
AL26S3A	0.213	0.0008	0.0030	99.783

[a]Locations of soil samples are shown on Fig. 5.

[b]Indicated counting error is at the 95% confidence level (± 2σ).

[c]Analytical error of measurement results is < ± 5% (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

Table 4. Results of surface analysis of structures at 1150 Central Avenue, Colonie, New York (AL026)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity					
Roof of house	4	35,35,84,170	-	81	-
Walkways	4	21,14,21,28	-	21	-
Totals	8	14-170	-	51	-
Beta-Gamma					
Roof of house	4	-	0.05,.04,.04,.06	-	0.05
Walkways	4	-	0.03,.04,.03,.03	-	0.03
Totals	8	-	0.03-0.06	-	0.04

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 erg per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4 x 10^{-8} °C.)

Table 5. Summary of outdoor measurements and sample results on the property at 1150 Central Avenue, Colonie, New York (AL026)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	42	7-11	9
Gamma exposure rate at surface (μR/h)[a]	42	6-14	10
Scan, gamma exposure rate near surface (μR/h)[b]	-	6-16	-
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	22	4.8-85	23
Abundance of isotope ^{235}U in uranium (%)	1	-	0.213
Concentration of ^{226}Ra in surface soil (pCi/g), systematic locations[c]	1	-	1.0
<u>Surface measurements</u>[d]			
Alpha activity (dpm/100 cm^2)	8	21-170	51
Beta-gamma activity (mrad/h)	8	0.03-0.06	0.04

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Surface measurements, Table 4.

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1152 CENTRAL AVENUE, COLONIE, NEW YORK (AL027)

OPERATED BY
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Health and Safety Research Division

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J. L. Marley, B. A. Berven, and W. D. Cottrell

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1152 CENTRAL AVENUE, COLONIE, NEW YORK (AL027)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 16 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period May 29-June 7, 1984. The property at 1152 Central Avenue in Colonie, New York (AL027) was the subject of a radiological investigation on June 4, 1984.

This private property consisted of a two-level, wood-frame house with a wood-frame garage to the rear of the lot. A driveway, part asphalt, part gravel, ran the length of the lot. The remaining outside area was generally grass covered. A diagram of the property showing the approximate property boundaries and the grid network established for measurements outside the buildings is shown in Fig. 1. The rectangular lot included in the radiological survey was approximately 15 m wide by 50 m deep. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha and beta-gamma activity from surfaces of structures outdoors on the property. A comprehensive description of the survey methods and instrumentation has been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. The data is 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/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 8 to 14 μR/h (microroentgens* per hour) and averaged 11 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 7 to 18 μR/h and averaged 12 μR/h.

Elevated gamma exposure rates were observed along the dripline areas of both the house and the garage, with the areas at the garage generally higher. The maximum gamma exposure rate observed, 23 μR/h, was at 0+43.5, 11R, a location at the dripline of the garage.

Soil Sampling

Sixteen soil samples were taken at this property. Fourteen of these at seven locations [denoted as systematic samples (AL27S)] were taken without regard to gamma exposure levels at the sampling points.

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*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.

Two samples at one locations [denoted biased samples (AL27B)] were selected from a location having elevated gamma exposure levels. The locations of samples are shown on Fig. 5, and the results of analysis are presented in Table 3.

Samples were taken at 0 to 5 cm and at 5 to 15 cm depths from each location. The concentrations of ^{238}U in the systematic soil samples ranged from 7.2 to 260 pCi/g picocuries* per gram and averaged 58 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 95 pCi/g and averaged 21 pCi/g in the 5 to 15 cm depth samples. The ratio of concentration at 0 to 5 cm to concentration at 5 to 15 cm is 3.95. The highest concentration of ^{238}U found in the property, 450 pCi/g, was from a dripline area at 0+43.5, 11R in sample AL27B1A (0 to 5 cm). Sample AL25B1B (5 to 15 cm) contained 150 pCi/g ^{238}U (Table 3) indicating that uranium has migrated deeper than 15 cm.

The isotopic content of the uranium in the soil was determined by thermal ionization mass spectrometry. The uranium-235 isotope content of the uranium in sample AL27B6A was 0.203%.

Radium was measured in samples AL27B6A and AL27B1B. The concentrations of ^{226}Ra were 0.82 and 1.1 pCi/g, averaging 0.96 pCi/g.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the roofs of the house, garage, and walkways to the house and garage. The results of these measurements are listed in Table 4. The alpha activity measured 21 to 70 dpm/100 cm^2 for an average of 37 dpm/100 cm^2. Beta-gamma activity ranged from 0.03 to 0.12 mrad/h and averaged 0.07 mrad/h.

A summary of the outdoor measurement results is provided in Table 5.

SIGNIFICANCE OF FINDINGS

Measurements of the gamma exposure levels outdoors on the property determined that the exposure rate at 1 m above the ground surface ranged from 8 to 14 μR/h and averaged 11 μR/h, a level slightly greater than the background for the Albany area. For comparison, the typical background

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*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.

for the Albany area is 9 μR/h; and the background for the state of New York[8,9] averages 9.5 μR/h and ranges from 6.8 to 13 μR/h (one standard deviation) based on 51 measurements. Based on this information, there is no indication of significant risk to health caused by gamma exposure rates outdoors on the property.

The results of ^{238}U analysis establish the presence of uranium at concentrations significantly above background on the property. The average concentration of 58 pCi/g of ^{238}U in the systematic samples is approximately 60 times the background of 0.96 pCi/g for the Albany area; also the average is above the DOE guideline[10] of 35 pCi/g of ^{238}U. The maximum concentration of ^{238}U measured, 450 pCi/g in sample AL27B1A, was approximately 13 times the DOE guideline.

The 0.203 atom percent ^{235}U determined by mass spectrometry establishes that the uranium which contaminated the property is depleted, i.e., it has been treated by a separations process; and a significant fraction of the ^{235}U has been removed. Natural uranium contains 0.7% uranium-235.

The 0.96 pCi/g average for ^{226}Ra measured in the soil compares favorably with the Albany area background of 0.85 pCi/g of radium-226.

The average alpha activity of 50 dpm/100 cm^2 obtained is well below the DOE criterion of 5000 dpm/100 cm^2 for alpha activity from natural uranium, uranium-235, or uranium-238.

The average and maximum beta-gamma activities of 0.07 and 0.12 mrad/h are less than the DOE criteria of 0.20 and 1.0 mrad/h at 1 cm, respectively.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/EQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindekin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. Environmental Research Division, Action Description Memorandum. "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

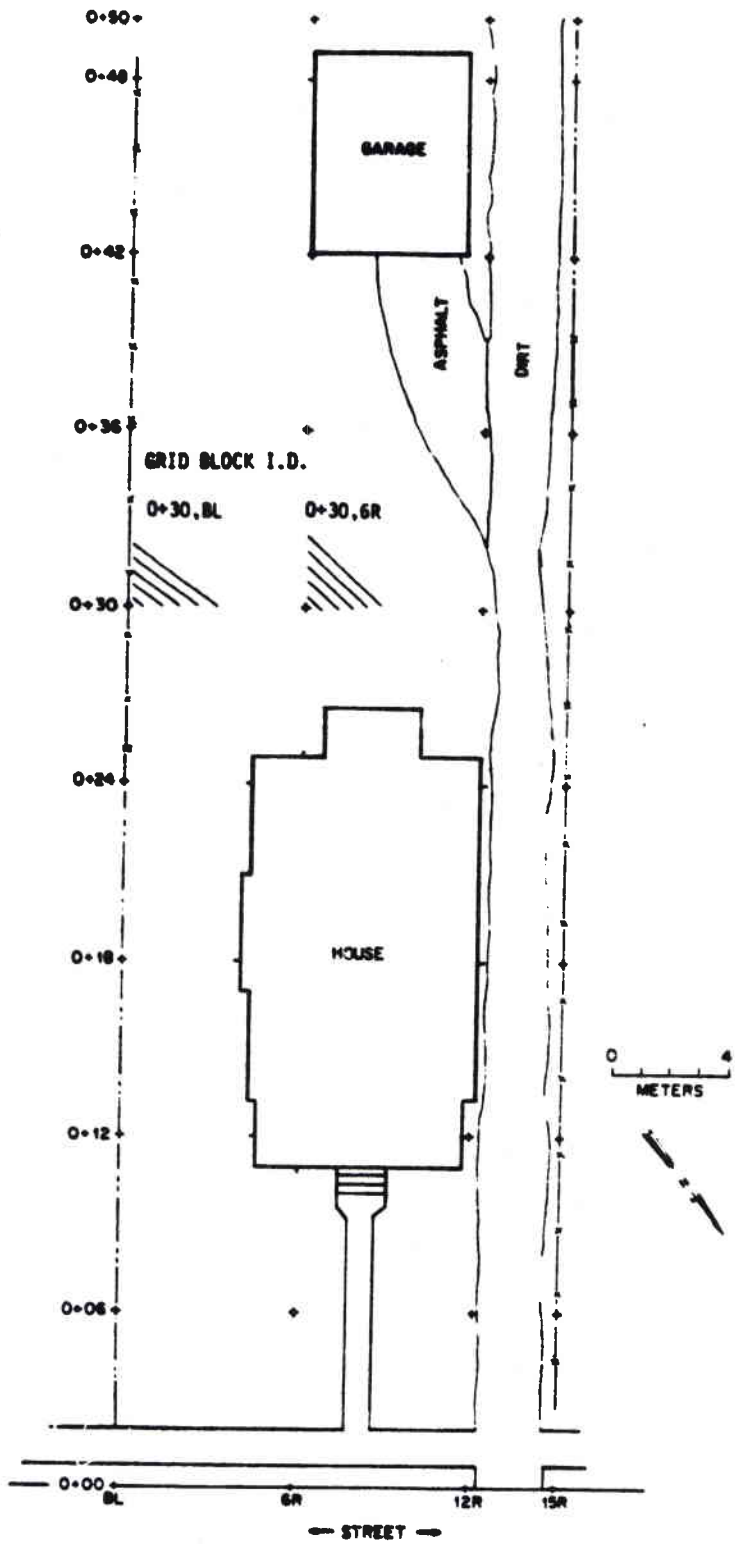

Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 1152 Central Avenue, Colonie, New York (AL027).

Fig. 2. Front view of the property at 1152 Central Avenue, Colonie, New York (AL027) looking southwest.

Fig. 3. Rear view of the property at 1152 Central Avenue, Colonie, New York (AL027) looking northeast.

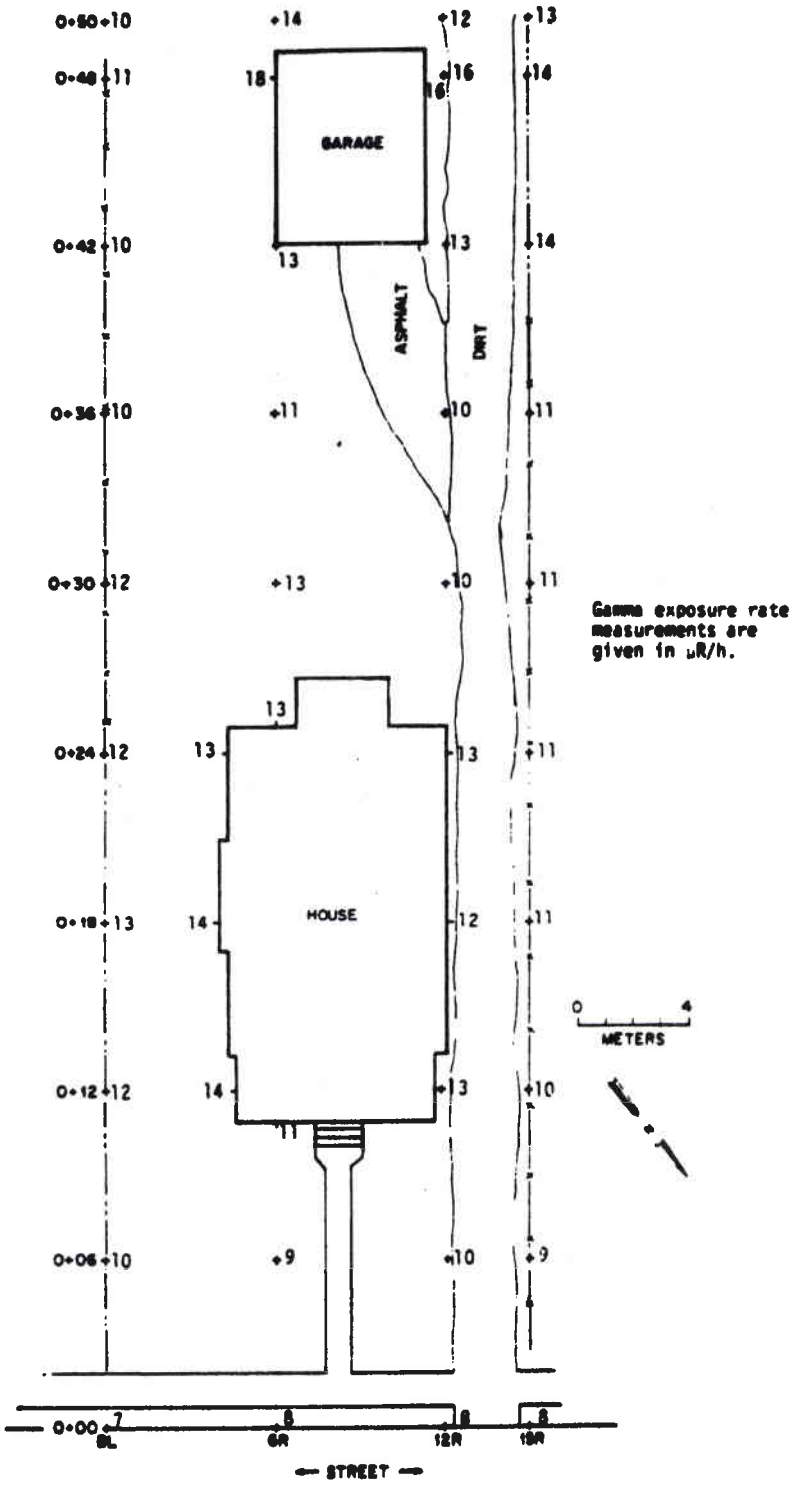

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 1152 Central Avenue, Colonie, New York (AL027).

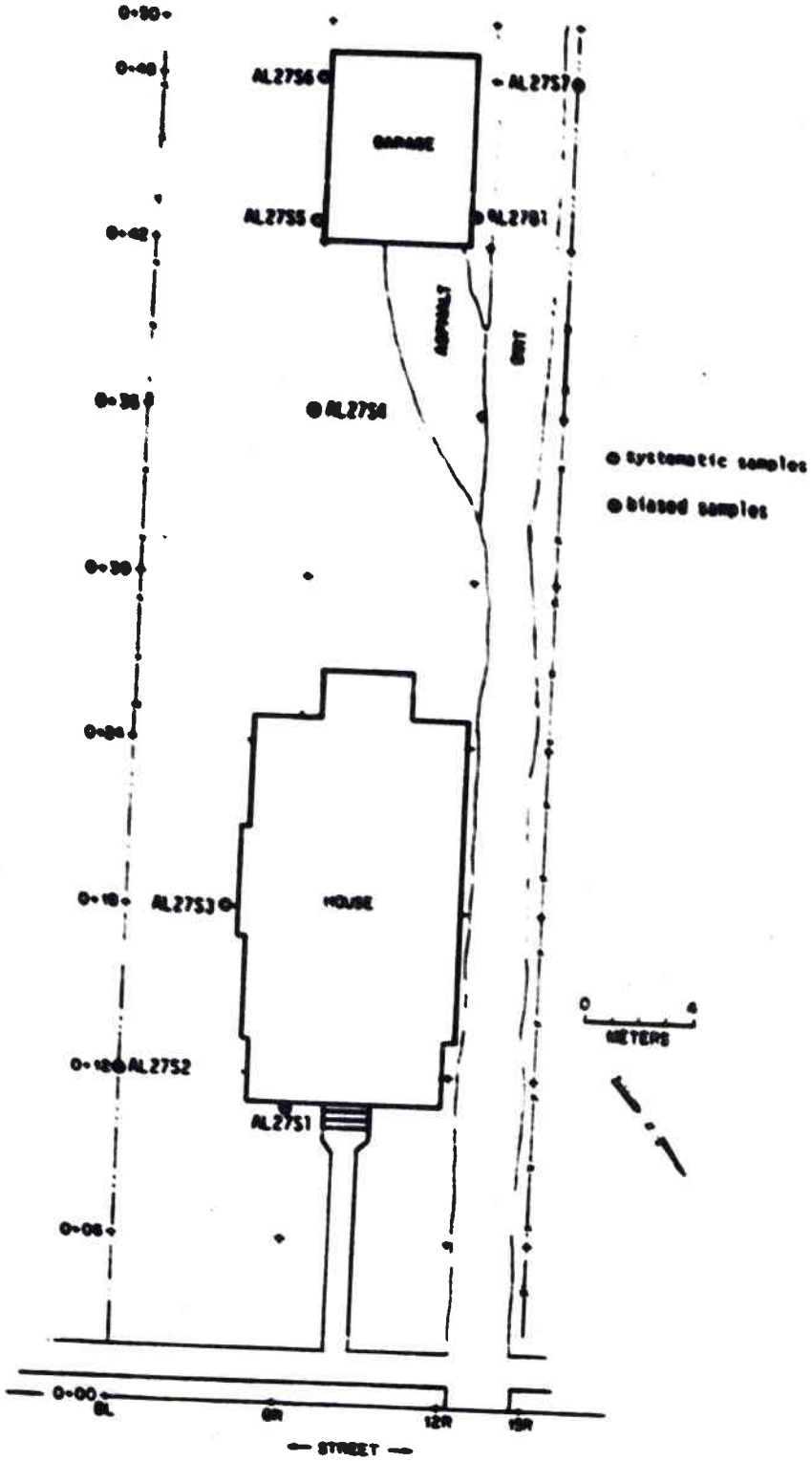

Fig. 5. Locations of soil samples on the property at 1152 Central Avenue, Colonie, New York (AL027).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NR1-NR6) obtained from six locations around the Albany area.[7]

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 1152 Central Avenue, Colonie, New York (AL027)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	8	7	7-10
0+06, BL	10	10	9-13
0+12, BL	11	12	10-16
0+18, BL	12	13	10-16
0+24, BL	13	12	10-14
0+30, BL	11	12	9-14
0+36, BL	10	10	9-12
0+42, BL	10	10	9-17
0+48, BL	11	11	9-11
0+50, BL	10	10	-
0+18, 4R	13	14	-
0+24, 4R	12	14	-
0+12, 4.5R	10	13	-
0+00, 6R	8	8	8-11
0+06, 6R	8	9	8-13
0+11, 6R	10	11	-
0+12, 6R	•	•	-
0+18, 6R	•	•	-
0+24, 6R	•	•	10-16
0+25, 6R	14	13	-
0+30, 6R	11	13	9-13
0+36, 6R	10	11	8-14
0+42, 6R	12	13	13-21
0+48, 6R	12	18	10-18
0+50, 6R	13	14	-
0+48, 11R	10	16	-
0+00, 12R	8	8	7-9
0+06, 12R	9	10	8-14
0+12, 12R	9	13	9-14
0+18, 12R	10	12	9-13
0+24, 12R	12	13	9-13
0+30, 12R	10	10	9-10
0+36, 12R	10	10	10-13
0+42, 12R	13	13	10-16
0+48, 12R	13	16	10-16
0+50, 12R	13	12	-

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, 15R	8	8	-
0+06, 15R	9	9	-
0+12, 15R	10	10	-
0+18, 15R	11	11	-
0+24, 15R	11	11	-
0+30, 15R	10	11	-
0+36, 15R	11	11	-
0+42, 15R	12	14	-
0+48, 15R	13	14	-
0+50, 15R	11	13	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analysis on the property at 1152 Central Avenue, Colonie, New York (AL027)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
		Systematic samples[d]		
AL27R1A	0+11, 6R	0-5	-	17
AL27R1B	0+11, 6R	5-15	-	8.2
AL27R2A	0+12, BL	0-5	-	68
AL27R2B	0+12, BL	5-15	-	14
AL27R3A	0+18, 4R	0-5	-	73
AL27R3B	0+18, 4R	5-15	-	20
AL27R4A	0+36, 6R	0-5	-	21
AL27R4B	0+36, 6R	5-15	-	7.2
AL27R5A	0+43, 6R	0-5	-	180
AL27R5B	0+43, 6R	5-15	-	45
AL27R6A	0+48, 6R	0-5	0.82 ± 0.2	260
AL27R6B	0+48, 6R	5-15	-	32
AL27R7A	0+48, 15R	0-5	-	44
AL27R7B	0+48, 15R	5-15	-	22
		Biased samples[e]		
AL27R1A	0+43.5, 11R	0-5	-	450
AL27R1B	0+43.5, 11R	5-15	1.1 ± 0.1	150

Isotopic Analysis by Mass Spectrometry

Sample	Atom percent			
	^{235}U	^{234}U	^{236}U	^{238}U
AL27R6A	0.203	0.0008	0.0029	99.793

[a]Locations of soil samples are shown on Fig. 5.

[b]Indicated counting error is at the 95% confidence level (± 2σ).

[c]Analytical error of measurement results is < ± 5% (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Results of surface analysis of structures at 1152 Central Avenue, Colonie, New York (AL027)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity					
Roof of house	4	70,35,28,56	-	47	-
Roof of garage	2	63,49	-	56	-
Walkways	6	21,21,21,28,21,28	-	23	-
Totals	12	21-70	-	37	-
Beta-Gamma					
Roof of house	4	-	0.11,.06,.06,.08	-	0.08
Roof of garage	2	-	0.07,0.08	-	0.08
Walkways	6	-	0.12,.12,.04,.03,.03,.03	-	0.07
Totals	12	-	0.03-0.12	-	0.07

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 erg per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

Table 5. Summary of outdoor measurements and sample results on the property at 1152 Central Avenue, Colonie, New York (AL027)

Measurement or sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	43	8-14	11
Gamma exposure rate at surface (μR/h)[a]	43	7-18	12
Scan, gamma exposure rate near surface (μR/h)[b]	-	7-21	-
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	14	7.2-260	58
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	2	150-450	300
Abundance of isotope ^{235}U in uranium (%)	1	-	0.208
Concentration of ^{226}Ra in surface soil (pCi/g)[c,d]	2	0.82-1.1	0.96
<u>Surface measurements</u>[e]			
Alpha activity (dpm/100 cm^2)	12	21-70	37
Beta-gamma activity (mrad/h)	12	0.03-0.12	0.07

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Biased samples, Table 3.
[e]Surface measurements, Table 4.

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1159 CENTRAL AVENUE, COLONIE, NEW YORK (AL028)

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ORNL/RASA-84/231
(AL028)

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 1159 CENTRAL AVENUE, COLONIE, NEW YORK (AL028)

J. L. Marley, B. A. Berven, and W. D. Cottrell

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1159 CENTRAL AVENUE, COLONIE, NEW YORK (AL028)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 16 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period May 29-June 7, 1984. The property at 1159 Central Avenue in Colonie, New York (AL028) was the subject of a radiological investigation on June 4, 1984.

This private property consisted of a two-story wood-frame house with surrounding grassed yard area. The lot to the rear was tree and brush covered. A gravel driveway at the side of the house ended at an old garage used as a storage area. A diagram of the property showing the approximate property boundaries and the grid network established for measurements outside the structures is shown in Fig. 1. The rectangular lot included in the radiological survey was approximately 23 m wide by 130 m deep. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

Soil Sampling

Twenty-nine soil samples were taken at this property. Twenty-three of these were taken at 12 locations [denoted as systematic samples (AL28S)] without regard to gamma exposure rates at the sampling points. Six samples at three locations [denoted biased samples (AL28B)] were selected at locations having elevated gamma exposure levels. The locations of samples are shown on Fig. 5, and the results of analysis are presented in Table 3.

Samples were taken at 0 to 5 cm and at 5 to 15 cm depths at each location unless prevented by obstruction, such as underlying concrete encountered at 0+40, 10L (Table 3). Concentrations of ^{238}U in the systematic soil samples ranged from 1.0 to 43 pCi/g (picocuries* per gram) and averaged 12 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 17 pCi/g and averaged 7.2 pCi/g in the 5 to 15 cm depth samples. The ratio of (concentration at 0 to 5 cm) to (concentration at 5 to 15 cm) is 2.07. The data indicates a trend of decrease in ^{238}U concentration with increase in depth. The maximum concentration of ^{238}U measured was 190 pCi/g in sample AL28B1A at location 0+66, 5L at the rear of the storage building. Samples AL28B2 and AL28B3, containing 86 and 36 pCi/g, respectively, were from dripline locations and locations with cinders present.

The isotopic content of the uranium in the soil was determined by thermal ionization mass spectrometry. The uranium-235 isotope content of the uranium in samples AL28S6B and AL28B1A was 0.206 and 0.244%, averaging 0.225%.

Radium was measured in samples AL28S6B and AL28B1A. The concentrations of ^{226}Ra were 1.3 and 0.89 pCi/g, averaging 1.1 pCi/g.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the roof of the house. The alpha activity ranged from 42 to 180 dpm/100 cm^2 and averaged 106 dpm/100 cm^2. Beta-gamma data activity ranged from 0.08 to 0.14 mrad/h and averaged 0.11 mrad/h.

A summary of the outdoor measurement results is provided in Table 5.

---

*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.

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5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindekin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. Environmental Research Division, Action Description Memorandum. "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

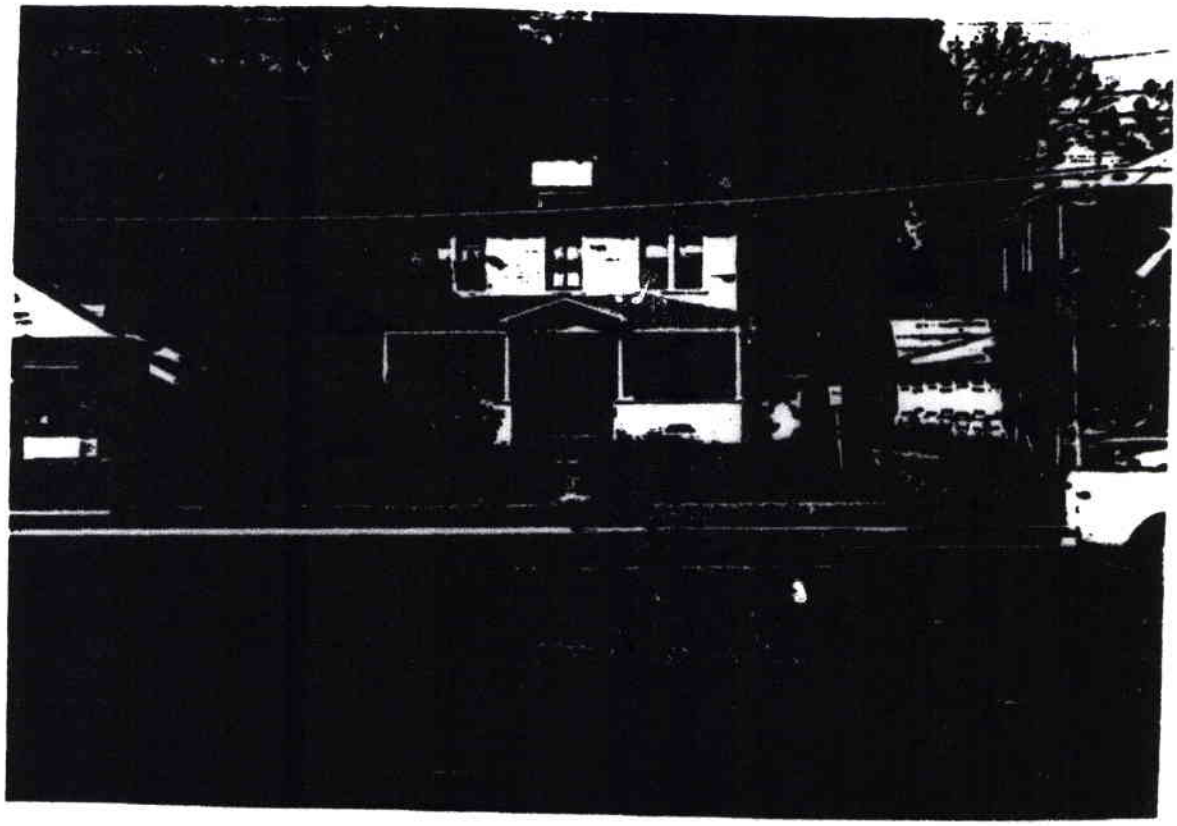

Fig. 2. Front view of the property at 1159 Central Avenue, Colonie, New York (AL028) looking northeast.

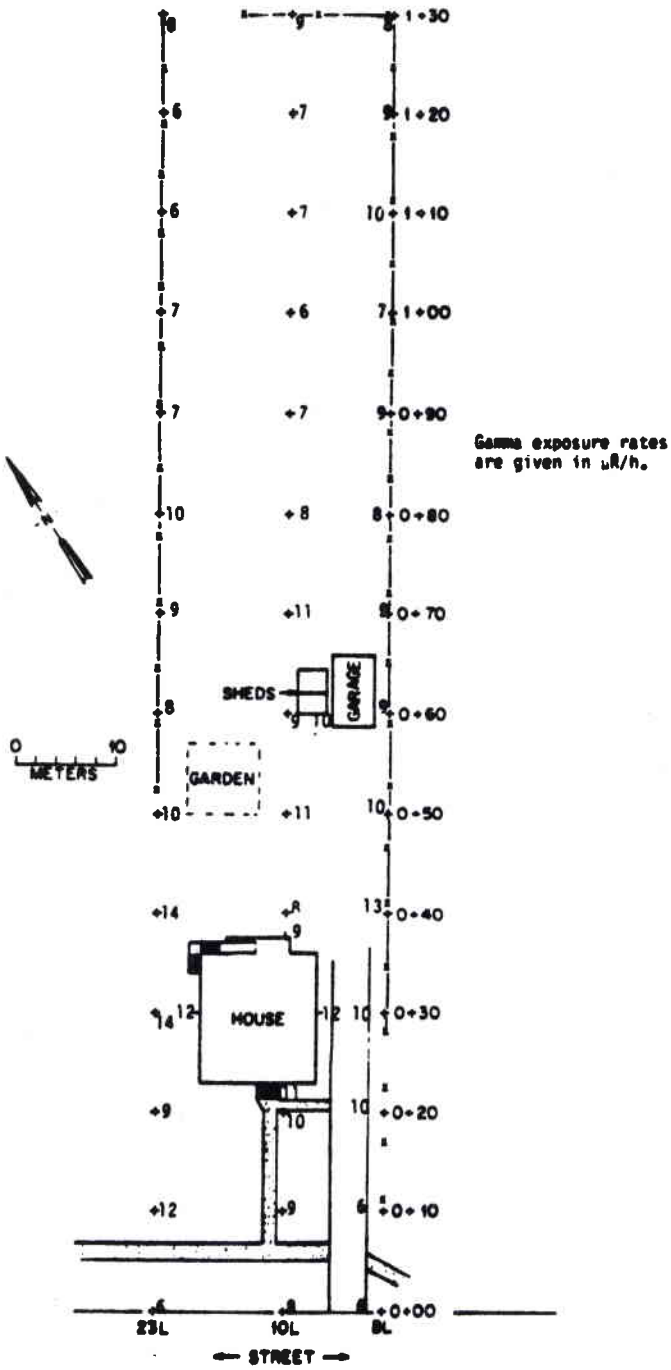

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 1159 Central Avenue, Colonie, New York (AL028).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, 23L	9	6	-
0+10, 23L	10	12	-
0+20, 23L	9	9	-
0+30, 23L	14	14	-
0+40, 23L	10	14	-
0+50, 23L	9	10	-
0+60, 23L	8	8	-
0+70, 23L	8	9	-
0+80, 23L	8	10	-
0+90, 23L	7	7	-
1+00, 23L	8	7	-
1+10, 23L	6	6	-
1+20, 23L	6	6	-
1+30, 23L	8	8	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3 (continued)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]

Isotopic Analysis by Mass Spectrometry

Sample	Atom percent			
	^{235}U	^{234}U	^{236}U	^{238}U
AL28S6B	0.206	0.0012	0.0037	99.751
AL28B1A	0.244	0.0009	0.0031	99.790

[a]Locations of soil samples are shown on Fig. 5.

[b]Indicated counting error is at the 95% confidence level ($\pm 2\sigma$).

[c]Analytical error of measurement results is $< \pm 5\%$ (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 5. Summary of outdoor measurements and sample results on the property at 1159 Central Avenue, Colonie, New York (AL028)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	47	6-14	9
Gamma exposure rate at surface (μR/h)[a]	47	6-14	9
Scan, gamma exposure rate near surface (μR/h)[b]	-	6-18	-
Concentration of ^{238}U in soil (pCi/g), systematic locations[c]	23	1.0-43	12
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	6	29-190	72
Abundance of isotope ^{235}U in uranium (%)	2	0.206-0.244	0.225
Concentration of ^{226}Ra in soil (pCi/g)[c,d]	2	0.89-1.3	1.1
<u>Surface measurements</u>[e]			
Alpha activity (dpm/100 cm^2)	4	42-180	106
Beta-gamma activity (mrad/h)	4	0.08-0.14	0.11

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Biased samples, Table 3.
[e]Surface measurements, Table 4.

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RESULTS OF THE RADIOLOGICAL SURVEY AT 5 YARDBORO AVENUE, ALBANY, NEW YORK (AL031)

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(AL031)

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 5 YARDBORO AVENUE, ALBANY, NEW YORK (AL031)

J. L. Marley, B. A. Berven, and W. D. Cottrell

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W. D. Cottrell - FUSRAP Project Director
J. L. Marley - Field Survey Supervisor

Work performed as part of the
RADIOLOGICAL SURVEY ACTIVITIES PROGRAM

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RESULTS OF THE RADIOLOGICAL SURVEY AT 5 YARDBORO AVENUE, ALBANY, NEW YORK (AL031)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 22 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period September 4-13, 1984. The property at 5 Yardboro Avenue in Albany, New York (AL031) was the subject of a radiological investigation on September 6, 1984.

This private property consisted of a two-story frame house with metal siding, with a small front grassed area and a fenced backyard. A diagram of the property showing the approximate property boundaries and the grid network established for measurements outside the building is shown in Fig. 1. The quadrilateral lot, near a parallelogram in shape, included in the radiological survey was approximately 9 m wide by 30 m deep. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

Soil Sampling

Twenty systematic soil samples were taken at ten locations on the property. Systematic denotes samples that were taken at grid locations irrespective of the gamma exposure level at the point of sampling. The locations of the samples are shown in Fig. 4, and the results of analysis are presented in Table 3.

Samples were taken at 0 to 5 cm and at 5 to 15 cm depths from each location. Concentrations of ^{238}U in the systematic soil samples ranged from 0.77 to 70 pCi/g (picocuries* per gram) and averaged 16 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 23 pCi/g and averaged 10 pCi/g in the 5 to 15 cm depth samples. The ratio of concentration at 0 to 5 cm to concentration at 5 to 15 cm depths was 2.77, indicating that the higher concentrations are located near the surface. The sample from grid location 0+00, 1.5R (AL31S3A) having the maximum concentration found on the property (70 pCi/g) was at the location of a downspout from a gutter. The area with excessive uranium, i.e., the area with uranium greater than the DOE guidelines is estimated at 9.4 m^2 and is shown in Fig. 6. Sample AL31S5B shows that the uranium is in soil to 15 cm depth. It is believed that the uranium has migrated primarily as a result of natural processes such as freezing and thawing, melting snow, and washing by rain. The location below a drainage path from the roof of the house, is probably an excellent example of the effect of rain washing the ^{238}U from the roof to the ground where the uranium is absorbed and retained in the soil. It is also probable that the uranium will be further diffused, become less concentrated with time, as the above processes continue to disperse the uranium.

Radium was measured in sample AL31S1A. The concentration of ^{226}Ra was 0.95 pCi/g.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the roof of the house and on the areas and walkways of asphalt at the front and rear of the property. The results of these measurements are listed in Table 4. Alpha activity ranged from <7 to 56 dpm/100 cm^2 and averaged 27 dpm/100 cm^2. The beta-gamma activity ranged from 0.03 to 0.07 mrad/h and averaged 0.05 mrad/h.

A summary of the outdoor measurement results is provided in Table 5.

---

*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.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

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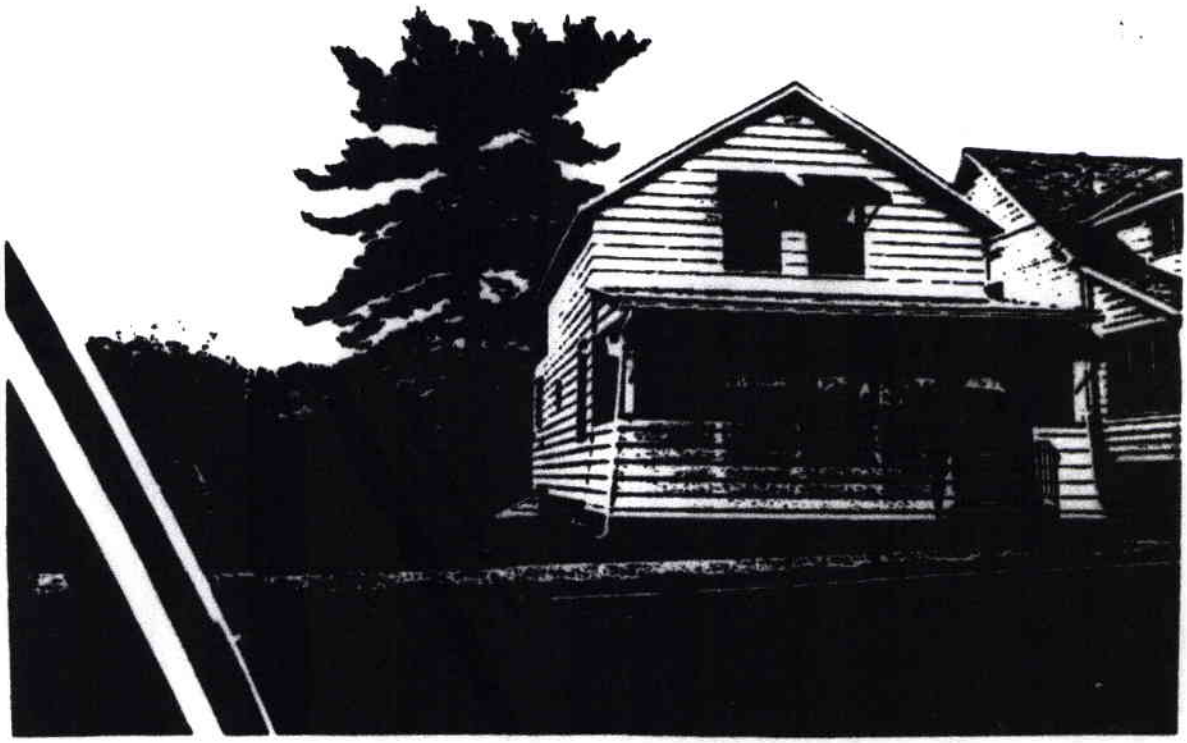

Fig. 2. Front view of the property at 5 Yardboro Avenue, Albany, New York (AL031) looking southwest.

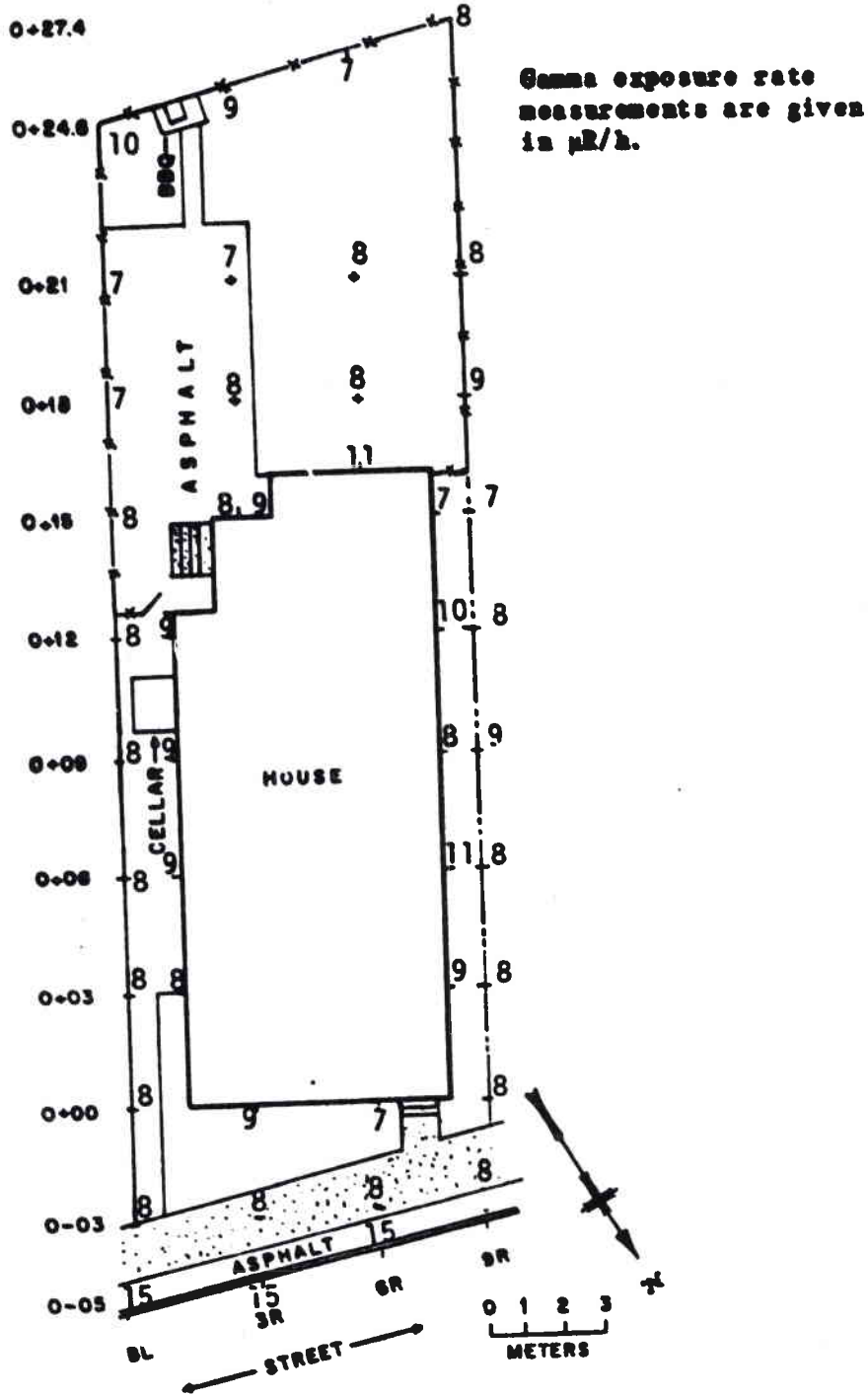

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 5 Yardboro Avenue, Albany, New York (AL031).

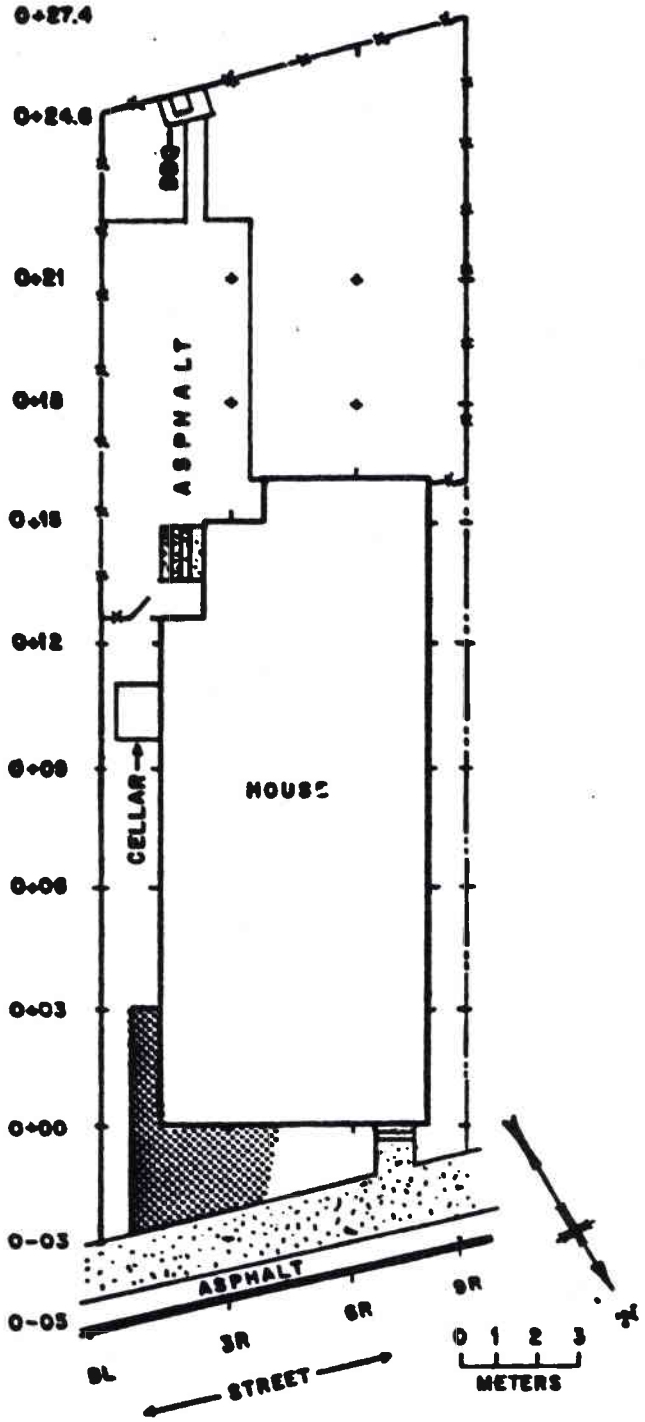

Fig. 6. Estimated area with contamination exceeding guidelines on the property at 5 Yardboro Avenue, Albany, New York (A1031).

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 5 Yardboro Avenue, Albany, New York (AL031)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0-05, BL	7	15	8-15
0-03, BL	7	8	8-10
0+00, BL	7	8	7-11
0+03, BL	8	8	8-9
0+06, BL	8	8	7-10
0+09, BL	8	8	8-10
0+12, BL	7	8	7-9
0+15, BL	7	8	7-9
0+18, BL	8	7	7-9
0+21, BL	7	7	7-14
0+24.6, BL	9	10	-
0+03, 1.5R	7	8	-
0+06, 1.5R	7	9	-
0+9, 1.5R	7	9	-
0+12, 1.5R	7	9	-
0-04.5, 3R	8	15	8-16
0-03, 3R	7	8	8-11
0+00, 3R	7	9	-
0+03, 3R	e	e	-
0+06, 3R	e	e	-
0+09, 3R	e	e	-
0+12, 3R	e	e	-
0+15, 3R	7	8	8-11
0+18, 3R	7	8	8-11
0+21, 3R	8	7	7-9
0+25.5, 3R	9	9	-
0+15, 4R	8	9	-
0-04, 6R	7	15	9-15
0-03, 6R	7	8	7-11
0+00, 6R	6	7	7-12
0+03, 6R	e	e	8-10
0+06, 6R	e	e	9-10
0+09, 6R	e	e	9-10
0+12, 6R	e	e	8-10
0+15, 6R	e	e	8-12
0+16, 6R	7	11	-
0+18, 6R	8	8	8-10
0+21, 6R	8	8	8-10
0+26.5, 6R	8	7	-
0+03, 8R	7	9	-
0+06, 8R	9	11	-

Table 3. Results of soil sample analysis on the property at 5 Yardboro Avenue, Albany, New York (AL031)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
			Systematic samples[d]	
AL31S1A	0+00, 8R	0-5	0.95 ± 0.07	13
AL31S1B	0+00, 8R	5-15	-	9.6
AL31S2A	0+00, 3R	0-5	-	13
AL31S2B	0+00, 3R	5-15	-	3.9
AL31S3A	0+00, 1.5R	0-5	-	70
AL31S3B	0+00, 1.5R	5-15	-	37
AL31S4A	0+06, BL	0-5	-	33
AL31S4B	0+06, BL	5-15	-	17
AL31S5A	0+16, 6R	0-5	-	28
AL31S5B	0+16, 6R	5-15	-	12
AL31S6A	0+24, BL	0-5	-	14
AL31S6B	0+24, BL	5-15	-	7.1
AL31S7A	0+21, 9R	0-5	-	14
AL31S7B	0+21, 9R	5-15	-	2.5
AL31S8A	0+18, 6R	0-5	-	28
AL31S8B	0+18, 6R	5-15	-	4.8
AL31S9A	0+06, 8R	0-5	-	0.80
AL31S9B	0+06, 8R	5-15	-	0.77
AL31S10A	0+12, 9R	0-5	-	12
AL31S10B	0+12, 9R	5-15	-	5.0

[a]Locations of soil samples are shown on Fig. 5.

[b]Indicated counting error is at the 95% confidence level ($\pm 2\sigma$).

[c]Analytical error of measurement results is $< \pm 5\%$ (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

Table 5. Summary of outdoor measurements and sample results on the property at 5 Yardboro Avenue, Albany, New York (AL031)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	45	6-9	8
Gamma exposure rate at surface (μR/h)[a]	45	7-15	9
Scan, gamma exposure rate near surface (μR/h)[b]	-	7-16	-
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	20	0.77-70	16
Concentration of ^{226}Ra in surface soil (pCi/g), systematic locations[c]	1	-	0.95
Estimated area with contamination exceeding guidelines (m^2)	-	-	9.4
<u>Surface measurements</u>[d]			
Alpha activity (dpm/100 cm^2)	7	<7-56	27
Beta-gamma activity (mrad/h)	9	0.03-0.07	0.05

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Surface measurements, Table 4.

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INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 22 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period September 4-13, 1984. The property at 1185 Central Avenue in Colonie, New York (AL032) was the subject of a radiological investigation on September 6, 1984.

This property consisted of a two-story house with composition shingle exterior and a garage located on a large lot. The area closely surrounding and to the front of the house was covered by lawn and landscaping plants. Most of the area to the rear was tree and brush covered. An asphalt driveway connected with the street. A diagram of the property showing the approximate property boundaries and the grid network established for measurements outside the residence is shown in Fig. 1. The rectangular lot included in the radiological survey was approximately 31 m wide by 55 m deep. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha and beta-gamma activity from surfaces of structures outdoors on the property. A comprehensive description of the survey methods and instrumentation has been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. The data is 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/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 6 to 10 μR/h (microroentgens* per hour) and averaged 8 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 6 to 13 μR/h and averaged 8 μR/h. The maximum gamma exposure rate measured on the property was 17 μR/h at location 0+12.5, 23.8R. All other readings were 13 μR/h or less.

Soil Sampling

Thirty-five soil samples were taken at this property. Thirty-two of these at sixteen locations [denoted as systematic samples (AL32S)] were taken without regard to gamma exposure rates at the sampling points. Three samples from one location [denoted biased samples (AL32B)] were selected from a position having an elevated gamma exposure rate. The locations of the samples are shown in Fig. 5, and the results of analysis are presented in Table 3.

---

*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 systematic soil samples were taken at 0 to 5 cm and at 5 to 15 cm depths at each location. Concentrations of ^{238}U in the systematic soil samples ranged from 0.40 to 42 pCi/g (picocuries* per gram) and averaged 11 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 17 pCi/g and averaged 4.5 pCi/g in the 5 to 15 cm depth samples. The ratio of concentration at 0 to 5 cm to concentration at 5 to 15 cm is 3.65. This data shows that the strata of highest concentrations on the property are near the surface, with decreasing concentrations at increasing depths from the surface. It is noted that the highest values from systematic samples, 42 and 38 pCi/g (samples AL32S5A and AL32S6A, respectively) were from locations along the dripline of the house. The highest concentration found on the property, 120 pCi/g, was from bias sample AL32B1, showing that uranium is present at concentrations above background to more than 30 cm depths. It is believed that the uranium has migrated primarily as a result of natural processes such as freezing and thawing, melting snow, and washing by rain. Sample AL32B1, from 0+12.5, 23.8R, a location appearing to be below a drainage path from the roof of the house, is probably an excellent example of the effect of rain washing the ^{238}U from the roof to the ground where the uranium is absorbed and retained in the soil. It is also probable that the uranium will be further diffused, become less concentrated with time, as the above processes continue to disperse the uranium. These areas of probable excessive absorption, i.e., the areas above guidelines are shown in Fig. 6 and include an area of approximately 30 m^2.

Radium was measured in samples AL32S1A and AL32B1B. The concentrations of ^{226}Ra were 0.53 and 0.70 pCi/g, averaging 0.62 pCi/g.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the roof of the house, garage, and on the asphalt walkway and driveway. The results of these measurements are listed in Table 4. Alpha activity ranged from <7 to 42 dpm/100 cm^2 and averaged 21 dpm/100 cm^2. Beta-gamma activity ranged from 0.02 to 0.07 mrad/h and averaged 0.04 mrad/h.

A summary of the outdoor measurement results is provided in Table 5.

---

*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.

SIGNIFICANCE OF FINDINGS

Measurements of the gamma exposure levels outdoors on the property determined that the exposure rate at 1 m above the ground surface ranged from 6 to 10 μR/h and averaged 8 μR/h, a level less than the background for the Albany area. For comparison, the typical background for the Albany area is 9 μR/h; and the background for the state of New York[8,9] averages 9.5 μR/h and ranges from 6.8 to 13 μR/h (one standard deviation) based on 51 measurements. Based on this information, there is no indication of risk to health caused by gamma exposure rates outdoors on the property.

The results of ^{238}U analysis establish the presence of uranium at concentrations significantly above background on the property. The average concentration of 11 pCi/g of ^{238}U in the systematic samples is approximately 11 times the normal background of 0.96 pCi/g for the Albany area. However, the average concentration is below the DOE guideline[10] of 35 pCi/g ^{238}U. The maximum concentration of ^{238}U measured, 120 pCi/g in sample AL32B1A, was approximately 3.4 times the DOE guideline.

The area exceeding the guideline for allowable concentrations of ^{238}U in soil is estimated at 30 m^2.

The 0.62 pCi/g average concentration of ^{226}Ra measured in the soil compares favorably with the Albany area background of 0.85 pCi/g of radium-226.

The average alpha activity of 21 dpm/100 cm^2 obtained by measurements on the roofs of the buildings and walkways is well below the DOE criterion of 5000 dpm/100 cm^2 for alpha activity from natural uranium, uranium-235, or uranium-238.

The average and maximum beta-gamma activities of 0.04 and 0.07 mrad/h are less than the DOE criteria of 0.20 and 1.0 mrad/h at 1 cm, respectively.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindekin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. Environmental Research Division, Action Description Memorandum. "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

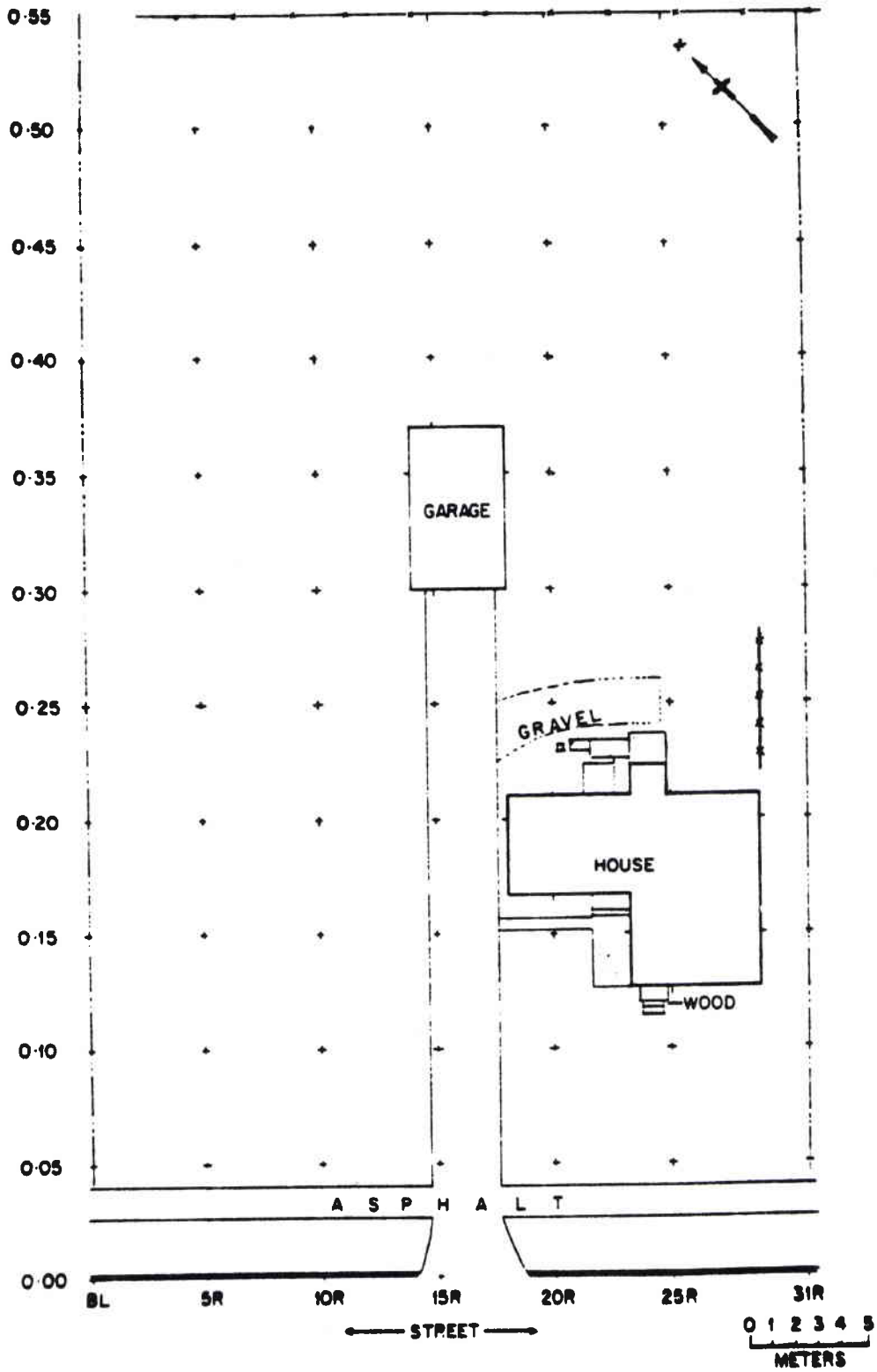

Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 1158 Central Avenue, Colonie, New York (AL032).

Fig. 2. Front view of the property at 1185 Central Avenue, Colonie, New York (AL032) looking northeast.

Fig. 3. Rear view of the property at 1185 Central Avenue, Colonie, New York (AL032) looking south.

Gamma exposure rate measurements are given in μR/h.

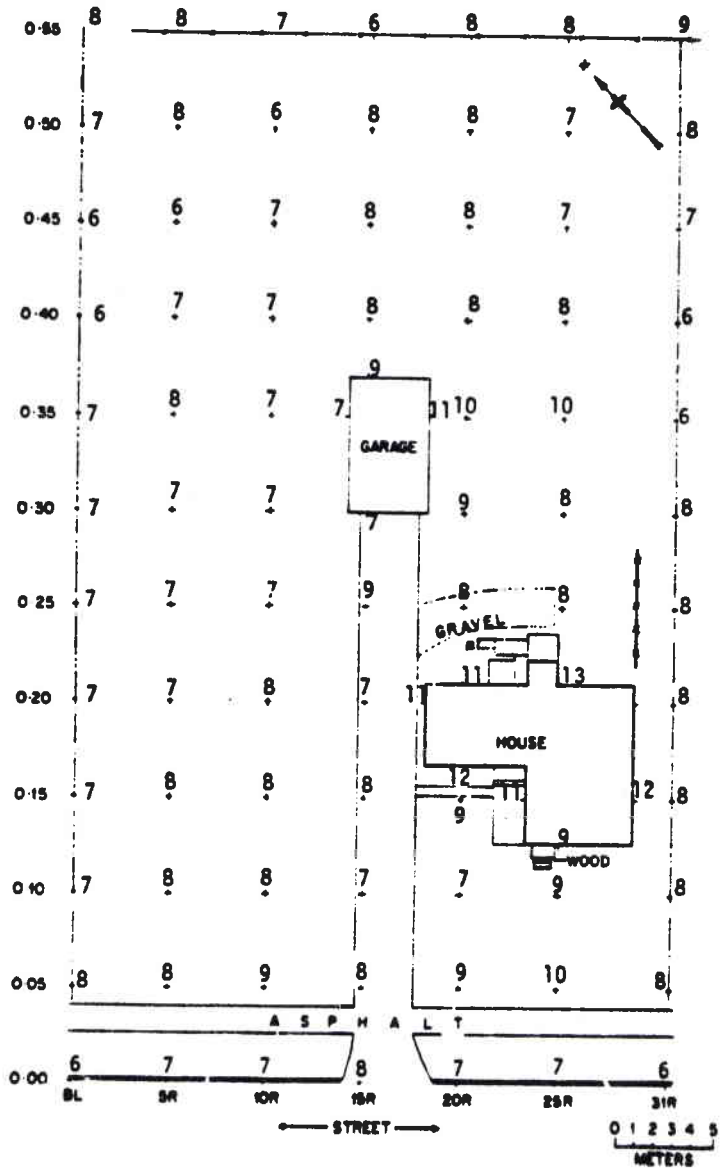

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 1185 Central Avenue, Colonie, New York (AL032).

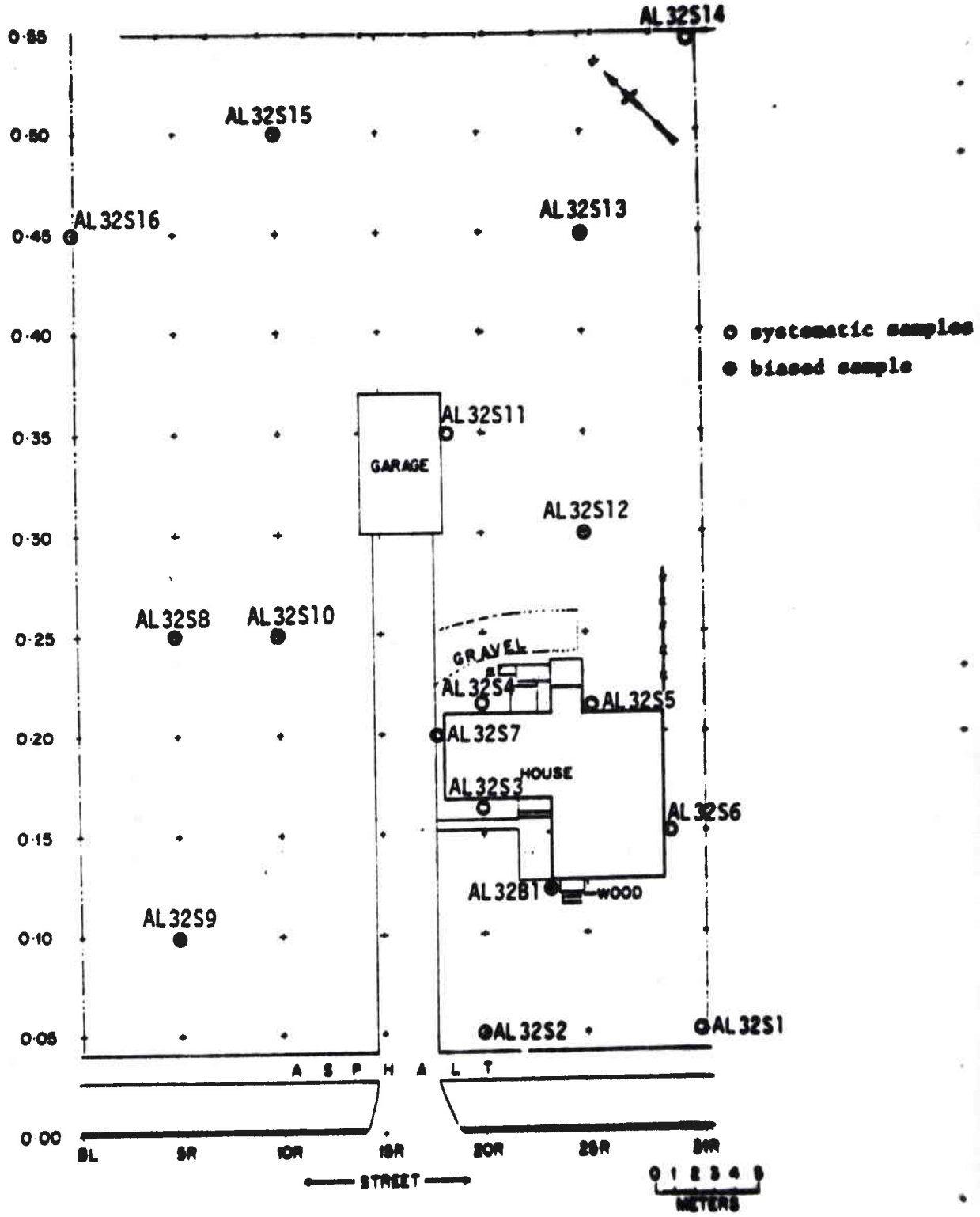

Fig. 5. Locations of soil samples on the property at 1185 Central Avenue, Colonie, New York (AL032).

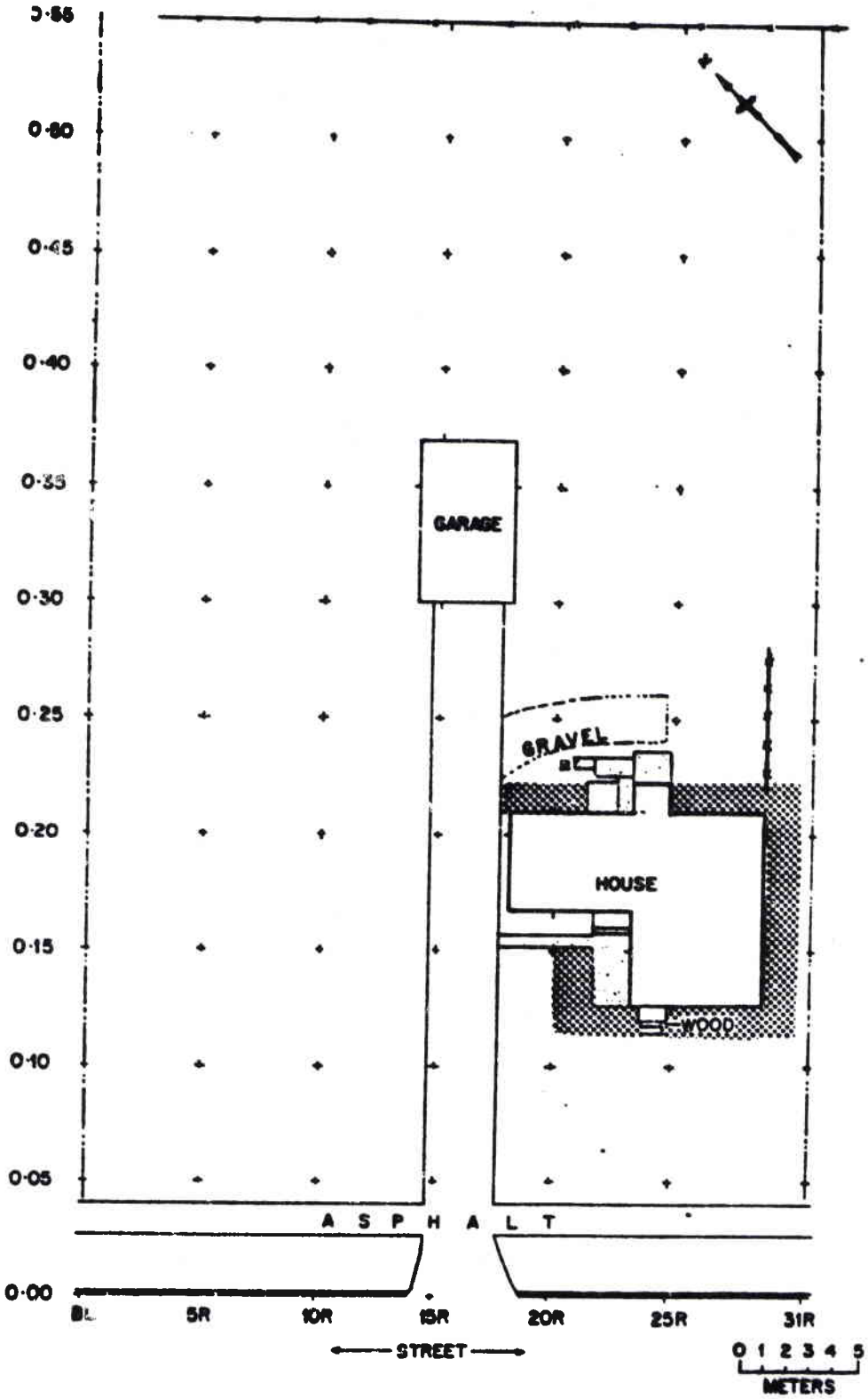

Fig. 6. Estimated area with contamination exceeding guidelines on the property at 1185 Central Avenue, Colonie, New York (AL032).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 1185 Central Avenue, Colonie, New York (AL032)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	7	6	6-10
0+05, BL	8	8	7-10
0+10, BL	8	7	7-10
0+15, BL	8	7	7-10
0+20, BL	8	7	7-10
0+25, BL	8	7	7-9
0+30, BL	8	7	7-10
0+35, BL	8	7	7-10
0+40, BL	7	6	6-10
0+45, BL	6	6	6-9
0+50, BL	8	7	6-9
0+55, BL	6	8	-
0+00, 5R	8	7	6-8
0+05, 5R	9	8	6-8
0+10, 5R	8	8	6-9
0+15, 5R	8	8	6-8
0+20, 5R	8	7	6-9
0+25, 5R	8	7	6-8
0+30, 5R	7	7	6-8
0+35, 5R	8	8	6-8
0+40, 5R	7	7	6-8
0+45, 5R	6	6	6-8
0+50, 5R	8	8	6-8
0+55, 5R	7	8	-
0+00, 10R	8	7	6-10
0+05, 10R	8	9	7-10
0+10, 10R	7	8	7-9
0+15, 10R	8	8	7-9
0+20, 10R	7	8	6-10
0+25, 10R	7	7	6-8
0+30, 10R	6	7	7-8
0+35, 10R	8	7	7-9
0+40, 10R	7	7	7-9
0+45, 10R	7	7	7-9
0+50, 10R	6	6	6-9
0+55, 10R	6	7	-
0+35, 14R	6	7	-
0+00, 15R	8	8	6-9
0+05, 15R	7	8	7-9
0+10, 15R	8	7	7-10
0+15, 15R	8	8	7-11

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+20, 15R	8	7	7-12
0+25, 15R	8	9	7-10
0+30, 15R	8	7	7-12
0+35, 15R	e	e	9-13
0+37, 15R	8	9	-
0+40, 15R	8	8	7-9
0+45, 15R	8	8	6-9
0+50, 15R	8	8	7-10
0+55, 15R	6	6	-
0+20, 17.5R	9	11	-
0+35, 18R	8	11	-
0+00, 20R	6	7	6-10
0+05, 20R	8	9	9-12
0+10, 20R	8	7	7-17
0+15, 20R	8	9	9-12
0+16.8, 20R	8	12	-
0+20, 20R	e	e	8-10
0+21, 20R	10	11	-
0+25, 20R	8	8	8-9
0+30, 20R	8	9	8-12
0+35, 20R	10	10	8-12
0+40, 20R	8	8	8-9
0+45, 20R	6	8	8-9
0+50, 20R	7	8	8-9
0+55, 20R	6	8	-
0+15, 23.6R	7	11	-
0+00, 25R	6	7	6-10
0+05, 25R	9	10	7-10
0+10, 25R	8	9	8-13
0+12, 25R	8	9	-
0+15, 25R	e	e	8-13
0+20, 25R	e	e	7-13
0+21, 25R	8	13	-
0+25, 25R	8	8	8-9
0+30, 25R	8	8	7-10
0+35, 25R	10	10	6-11
0+40, 25R	9	8	6-9
0+45, 25R	6	7	6-9
0+50, 25R	6	7	6-10
0+55, 25R	8	8	-
0+15, 29R	9	12	-
0+00, 31R	6	6	-
0+05, 31R	8	8	-

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+10, 31R	7	8	-
0+15, 31R	8	8	-
0+20, 31R	9	8	-
0+25, 31R	8	8	-
0+30, 31R	8	8	-
0+35, 31R	6	6	-
0+40, 31R	6	6	-
0+45, 31R	8	7	-
0+50, 31R	8	8	-
0+55, 31R	8	9	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analysis on the property at 1185 Central Avenue, Colonie, New York (AL032)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
			Systematic samples[d]	
AL32S1A	0+05, 31R	0-5	0.53 ± 0.06	12
AL32S1B	0+05, 31R	5-15	-	3.4
AL32S2A	0+05, 20R	0-5	-	16
AL32S2B	0+05, 20R	5-15	-	1.8
AL32S3A	0+16.8, 20R	0-5	-	28
AL32S3B	0+16.8, 20R	5-15	-	3.2
AL32S4A	0+21, 20R	0-5	-	33
AL32S4B	0+21, 20R	5-15	-	7.7
AL32S5A	0+21, 25R	0-5	-	42
AL32S5B	0+21, 25R	5-15	-	6.7
AL32S6A	0+15, 29R	0-5	-	38
AL32S6B	0+15, 29R	5-15	-	16
AL32S7A	0+20, 17.5R	0-5	-	12
AL32S7B	0+20, 17.5R	5-15	-	4.0
AL32S8A	0+25, 5R	0-5	-	6.9
AL32S8B	0+25, 5R	5-15	-	3.8
AL32S9A	0+10, 5R	0-5	-	17
AL32S9B	0+10, 5R	5-15	-	0.83
AL32S10A	0+25, 10R	0-5	-	12
AL32S10B	0+25, 10R	5-15	-	2.0
AL32S11A	0+35, 18R	0-5	-	30
AL32S11B	0+35, 18R	5-15	-	12
AL32S12A	0+30, 25R	0-5	-	12
AL32S12B	0+30, 25R	5-15	-	4.6
AL32S13A	0+45, 25R	0-5	-	0.47
AL32S13B	0+45, 25R	5-15	-	0.40
AL32S14A	0+55, 31R	0-5	-	0.97
AL32S14B	0+55, 31R	5-15	-	0.87
AL32S15A	0+50, 10R	0-5	-	0.43
AL32S15B	0+50, 10R	5-15	-	0.50
AL32S16A	0+45, BL	0-5	-	6.3
AL32S16B	0+45, BL	5-15	-	4.1

Table 3 (continued)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
			Biased samples[e]	
AL32B1A	0+12.5, 23.8R	0-5	-	120
AL32B1B	0+12.5, 23.8R	5-15	0.70 ± 0.13	39
AL32B1C	0+12.5, 23.8R	15-30	-	3.9

[a]Locations of soil samples are shown on Fig. 5.

[b]Indicated counting error is at the 95% confidence level (± 2σ).

[c]Analytical error of measurement results is < ± 5% (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Results of surface analysis of structures at 1185 Central Avenue, Colonie, New York (AL032)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity					
Roof of house	4	28,14,24,28	-	28	-
Roof of garage	4	14,14,42,28	-	25	-
Drive and walkways	8	14,<7,28,42, <7,14,<7,14	-	17	-
Total	16	<7-42	-	21	-
Beta-Gamma					
Roof of house	4	-	0.02,0.02,0.03,0.02	-	0.02
Roof of garage	4	-	0.03,0.04,0.04,0.02	-	0.03
Drive and walkways	8	-	0.03,0.03,0.02,0.03, 0.05,0.03,0.03,0.07	-	0.04
Total	16	-	0.02-0.07	-	0.03

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 erg per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

Table 5. Summary of outdoor measurements and sample results on the property at 1185 Central Avenue, Colonie, New York (AL032)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	90	6–10	8
Gamma exposure rate at surface (μR/h)[a]	90	6–13	8
Scan, gamma exposure rate near surface (μR/h)[b]	–	6–17	–
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	32	0.40–42	11
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	3	3.9–120	54
Estimated area with contamination exceeding guidelines (m^2)	–	–	30
Concentration of ^{226}Ra in surface soil (pCi/g), systematic locations[c]	2	0.53–0.70	0.62
<u>Surface measurements</u>[e]			
Alpha activity (dpm/100 cm^2)	16	<7–42	21
Beta-gamma activity (mrad/h)	16	0.02–0.07	0.03

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Biased samples, Table 3.
[e]Surface measurements, Table 4.

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1147 CENTRAL AVENUE, COLONIE, NEW YORK (AL034)

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(AL034)

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J. L. Marley, B. A. Berven, and W. D. Cottrell

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1147 CENTRAL AVENUE, COLONIE, NEW YORK (AL034)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 22 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period September 4-13, 1984. The property at 1147 Central Avenue in Colonie, New York (AL034) was the subject of a radiological investigation on September 7, 1984.

This commercial property consisted of a two-story frame house with a garage to the rear. The area to the front of the house is asphalt paved, apparently for customer parking. A gravel driveway to the side of the house leads to the garage, and a concrete walk parallels the house. A diagram of the property showing the approximate property boundaries and the grid network established for measurements outside the house is shown in Fig. 1. The rectangular lot included in the radiological survey was approximately 15 m wide by 47.8 m deep. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha and beta-gamma activity from surfaces of structures outdoors on the property. A comprehensive description of the survey methods and instrumentation have been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. The data is 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/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 7 to 13 μR/h (microroentgens* per hour) and averaged 9 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 6 to 17 μR/h and averaged 10 μR/h. The maximum gamma exposure rate measured at the propety was 19 μR/h along the dripline near the side of the house approximating grid locations 0+20, 10R and 0+40, 10R.

Soil Sampling

Thirty-three soil samples were taken at this property. Twenty-two of these at ten locations [denoted as systematic samples (AL34S)] were taken without regard to gamma exposure levels at the sampling points. Seven samples at five locations [denoted biased samples (AL34B)] were selected at positions having elevated gamma exposure levels. The locations of samples are shown in Fig. 5, and the results of analysis are presented in Table 3.

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*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.

Samples were taken at 0 to 5 cm and at 5 to 15 cm depths from each location and from 15 to 30 cm where elevated gamma rates were measured. Concentrations of ^{238}U in the systematic soil samples ranged from 2.1 to 87 pCi/g (picocuries* per gram) and averaged 11 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 17 pCi/g and averaged 6.6 pCi/g in the 5 to 15 cm depth samples. The ratio of concentration at 0 to 5 cm to concentration at 5 to 15 cm is 2.97, indicating that the higher concentrations are located near the surface. The sample from grid location 0+23, 5R (AL34S5A) having the maximum concentration found on the property (87 pCi/g), and all others exceeding the DOE guidelines concerning ^{238}U in soil, were from depths of 0 to 5 cm. Elevated gamma was observed associated with cinders, e.g., AL34S4C, sampled from 15 to 30 cm contained 6.4 pCi/g ^{238}U and measured 39 μR/h gamma activity. The estimated area exceeding guidelines is 60 m^2. The location on the property is shown in Fig. 6.

Radium was measured in six samples from four locations. The concentrations of ^{226}Ra ranged from 1.2 to 2.7 pCi/g and averaged 1.8 pCi/g. The elevated gamma and radium levels are believed to be associated with the cinders. It is known that cinders or ash resulting from the burning of coal can contain trace elements including the naturally occurring radioactive isotopes of potassium, radium, thorium, and uranium. The presence of sufficient quantities of these elements may be observed as an increase in the gamma exposure level in the area with the cinders.

Surface Measurements

Alpha and beta-gamma activities were measured at selected locations on the roof of the house, the garage, and on the paved surfaces. The results of these measurements are listed in Table 4. The alpha activity ranged from <7 to 200 dpm/100 cm^2 and averaged 63 dpm/100 cm^2. Beta-gamma activity ranged from 0.02 to 0.06 mrad/h and averaged 0.04 mrad/h.

A summary of the outdoor measurement results is provided in Table 5.

---

*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.

SIGNIFICANCE OF FINDINGS

Measurements of the gamma exposure levels outdoors on the property determined that the exposure rate at 1 m above the ground surface ranged from 7 to 13 μR/h and averaged 9 μR/h; a level the same as the background for the Albany area. For comparison, the typical background for the Albany area is 9 μR/h; and the background for the state of New York[8,9] averages 9.5 μR/h and ranges from 6.8 to 13 μR/h (one standard deviation) based on 51 measurements. Based on this information, there is no indication of risk to health caused by gamma exposure rates outdoors on the property.

The results of ^{238}U analysis establish the presence of uranium at concentrations significantly above background on the property. The average concentration of 11 pCi/g of ^{238}U in the systematic samples is approximately 11 times the normal background of 0.96 pCi/g for the Albany area. However, the average is below the DOE guideline[10] of 35 pCi/g ^{238}U. The maximum concentration of ^{238}U measured, 87 pCi/g in sample AL34S5A, was approximately 2.5 times the DOE guideline. The area exceeding the guideline for allowable concentrations of ^{238}U in soil is estimated at 60 m^2.

The 1.8 pCi/g average concentration of ^{226}Ra measured in the soil is almost 2 times the Albany area background of 0.85 pCi/g of radium-226 and well below the DOE criterion of 5 pCi/g for ^{226}Ra in soil.

The average alpha activity of 63 dpm/100 cm^2 obtained by measurements on the roof of the house is well below the DOE criterion of 5000 dpm/100 cm^2 for alpha activity from natural uranium, uranium-235, or uranium-238.

The average and maximum beta-gamma activities of 0.04 and 0.06 mrad/h are less than the DOE criteria of 0.20 and 1.0 mrad/h at 1 cm, respectively.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindekin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. Environmental Research Division, Action Description Memorandum. "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

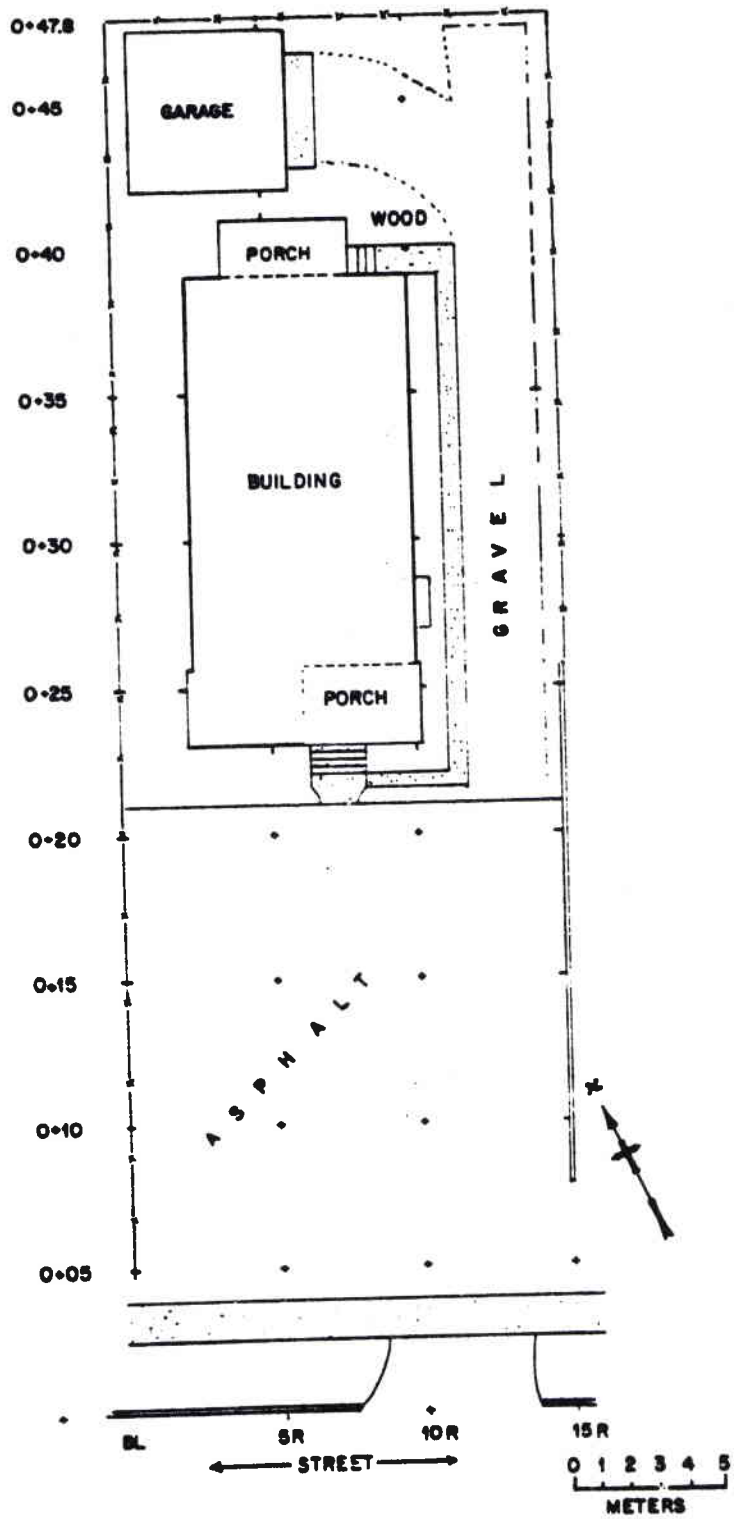


Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 1147 Central Avenue, Colonie, New York (AL034).

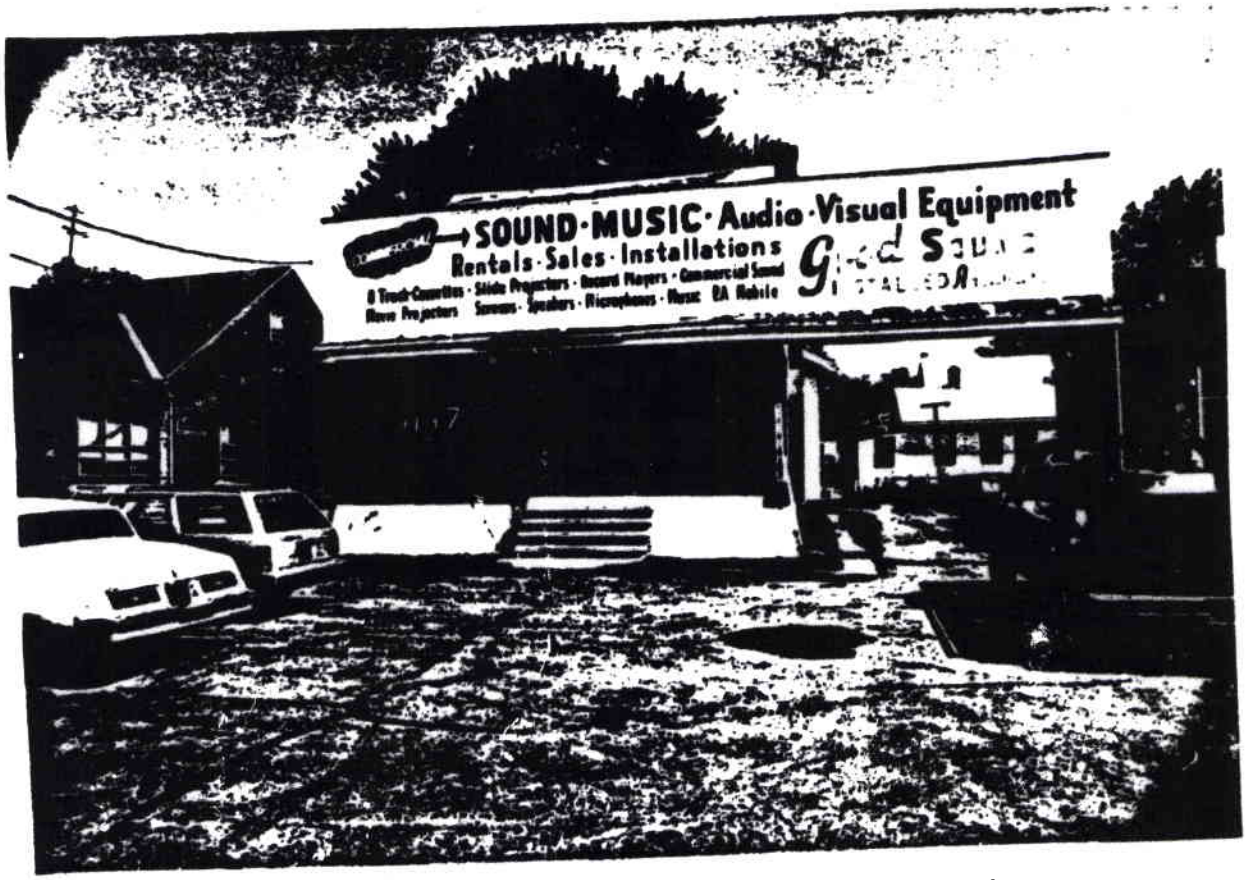
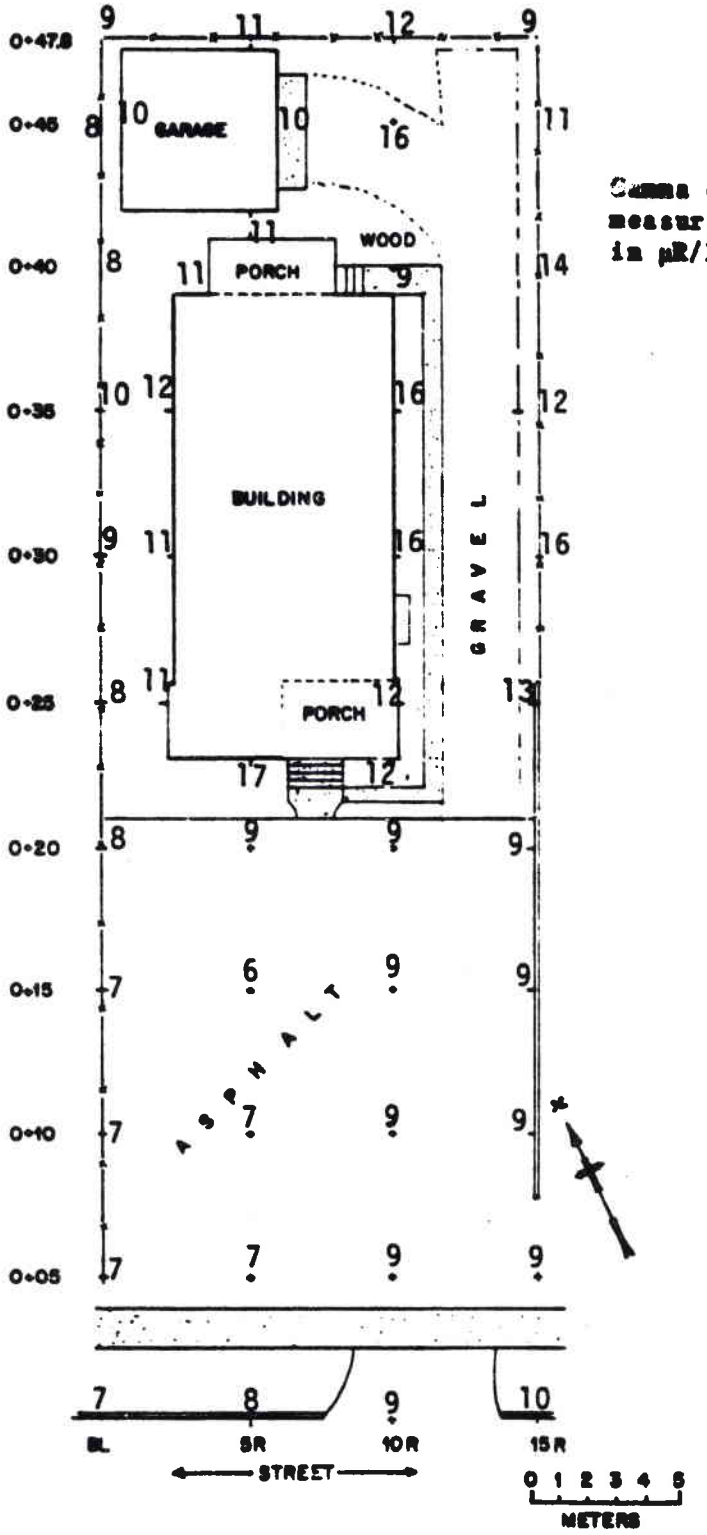


Fig. 2. Front view of the property at 1147 Central Avenue, Colonie, New York (AL034) looking northeast.

Fig. 3. Rear view of the property at 1147 Central Avenue, Colonie, New York (AL034) looking southwest.



Gamma exposure rate measurements are given in μR/h.

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 1147 Central Avenue, Colonie, New York (AL034).

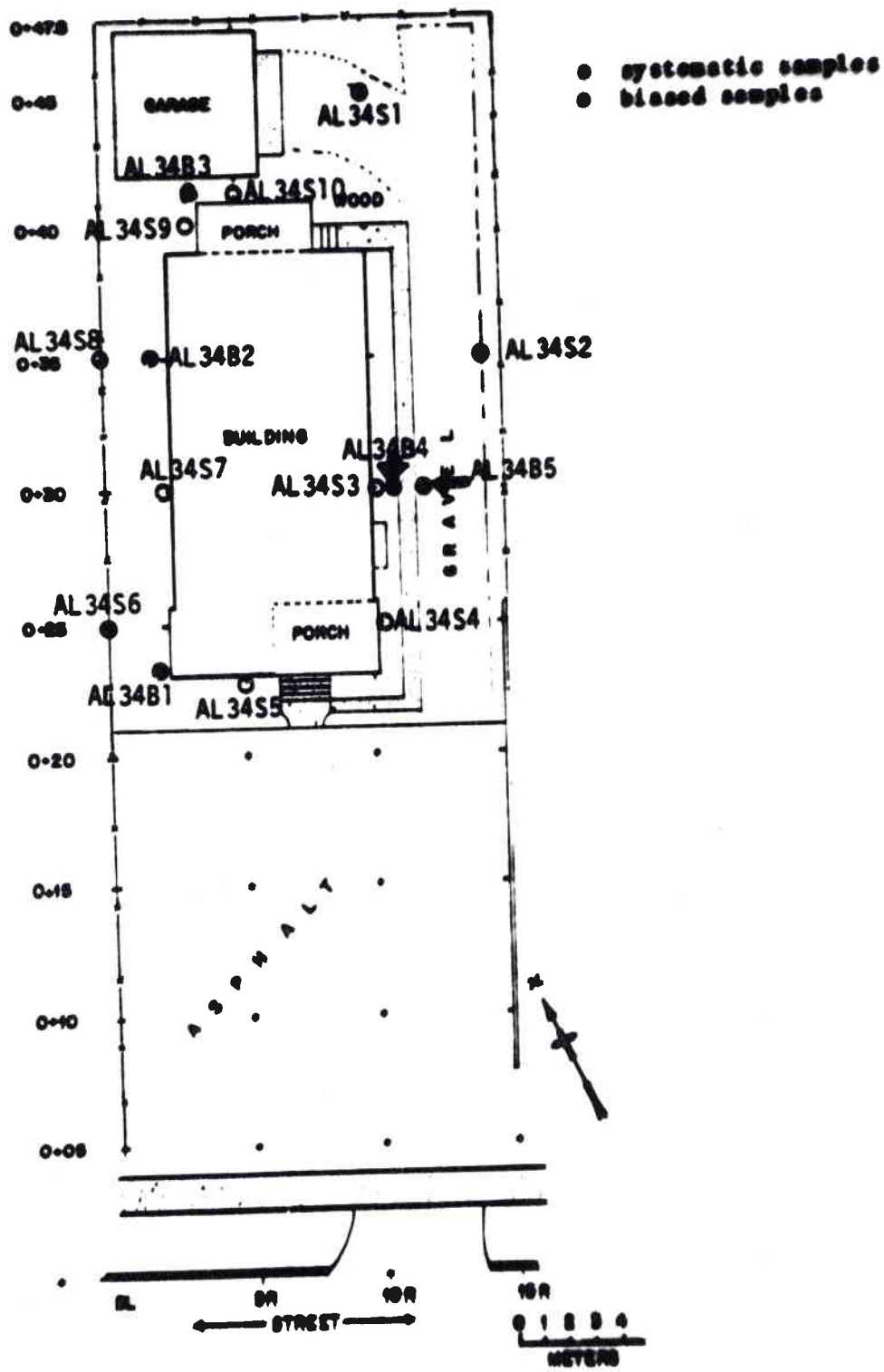


Fig. 5. Locations of soil samples on the property at 1147 Central Avenue, Colonie, New York (AL034).

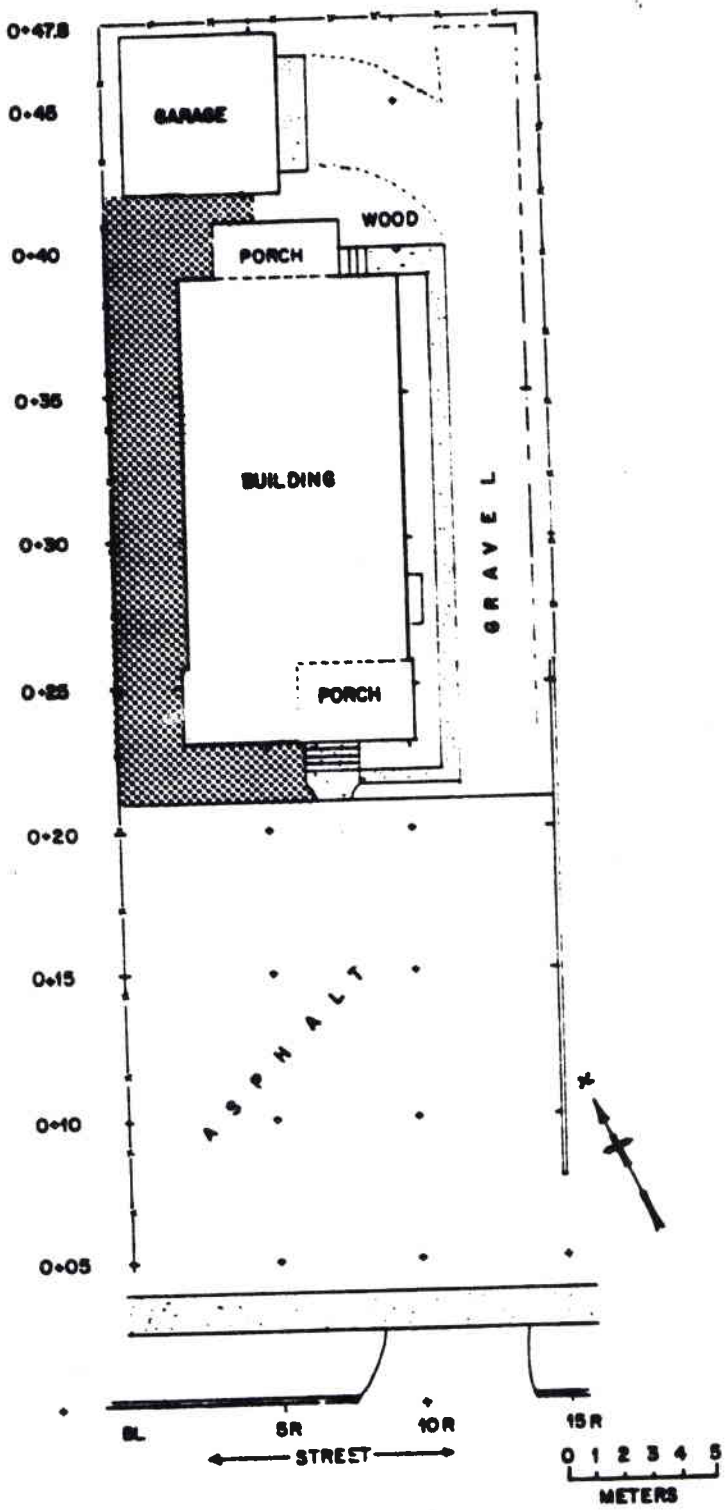


Fig. 6. Estimated area with contamination exceeding guidelines on the property at 1147 Central Avenue, Colonie, New York (AL034).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 1147 Central Avenue, Colonie, New York (AL034)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	7	7	7-9
0+05, BL	7	7	7-9
0+10, BL	7	7	6-9
0+15, BL	7	7	7-9
0+20, BL	9	8	8-19
0+25, BL	9	8	8-12
0+30, BL	9	9	9-17
0+35, BL	8	10	10-16
0+40, BL	9	8	8-13
0+45, BL	8	8	8-13
0+47.8, BL	8	9	-
0+45, .7R	9	10	10-17
0+25, 2.5R	9	11	-
0+30, 2.5R	9	11	-
0+35, 2.5R	9	12	-
0+40, 4R	9	11	10-18
0+00, 5R	8	8	7-9
0+05, 5R	8	7	7-8
0+10, 5R	7	7	7-8
0+15, 5R	7	6	6-8
0+20, 5R	9	9	8-18
0+23, 5R	10	17	-
0+25, 5R	e	e	-
0+30, 5R	e	e	-
0+35, 5R	e	e	-
0+40, 5R	e	e	-
0+41, 5R	9	11	-
0+45, 5R	e	e	-
0+47.3, 5R	8	11	-
0+47.8, 5R	8	11	-
0+45, 6R	9	10	-
0+00, 10R	7	9	6-11
0+05, 10R	10	9	8-11
0+10, 10R	9	9	9-10
0+15, 10R	8	9	9-11
0+20, 10R	9	9	9-18
0+23, 10R	10	12	-
0+25, 10R	10	12	12-16
0+30, 10R	11	16	13-18
0+35, 10R	11	16	13-19

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+40, 10R	9	9	9-19
0+45, 10R	13	16	11-17
0+47.8, 10R	11	12	-
0+00, 15R	9	10	-
0+05, 15R	9	9	-
0+10, 15R	9	9	-
0+15, 15R	9	9	-
0+20, 15R	8	9	-
0+25, 15R	10	13	-
0+30, 15R	8	16	-
0+35, 15R	11	12	-
0+40, 15R	10	14	-
0+45, 15R	9	11	-
0+47.8, 15R	9	9	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analysis on the property at 1147 Central Avenue, Colonie, New York (AL034)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
		Systematic samples[d]		
AL34S1A	0+45, 10R	0-5	1.4 ± 0.07	12
AL34S1B	0+45, 10R	5-15	2.3 ± 0.16	9.5
AL34S1C	0+45, 10R	15-30	1.6 ± 0.12	3.5
AL34S2A	0+35, 15R	0-5	-	19
AL34S2B	0+35, 15R	5-15	-	5.6
AL34S3A	0+30, 10R	0-5	-	10
AL34S3B	0+30, 10R	5-15	-	7.5
AL34S4A	0+25, 10R	0-5	-	14
AL34S4B	0+25, 10R	5-15	2.7 ± 0.14	8.9
AL34S4C	0+25, 10R	15-30	-	6.4
AL34S5A	0+23, 5R	0-5	1.2 ± 0.12	87
AL34S5B	0+23, 5R	5-15	-	26
AL34S6A	0+25, BL	0-5	-	9.9
AL34S6B	0+25, BL	5-15	-	2.2
AL34S7A	0+30, 2.5R	0-5	-	4.4
AL34S7B	0+30, 2.5R	5-15	-	2.1
AL34S8A	0+35, BL	0-5	-	7.7
AL34S8B	0+35, BL	5-15	-	0.87
AL34S9A	0+40, 4R	0-5	-	0.83
AL34S9B	0+40, 4R	5-15	-	0.83
AL34S10A	0+41, 5R	0-5	-	5.2
AL34S10B	0+41, 5R	5-15	-	2.2
		Biased samples[e]		
AL34B1A	0+23, 2.5R	0-5	-	55
AL34B1B	0+23, 2.5R	5-15	1.4 ± 0.03	23
AL34B1C	0+23, 2.5R	15-30	-	3.3
AL34B2A	0+35, 2R	0-5	-	58
AL34B2B	0+35, 2R	5-15	-	14
AL34B3A	0+41.5, 4R	0-5	-	50
AL34B3B	0+41.5, 4R	5-15	-	6.8

Table 3 (continued)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
AL34B4A	0+30, 11R	0-5	-	15
AL34B4B	0+30, 11R	5-15	-	4.7
AL34B5A	0+30, 12R	0-5	-	7.3
AL34B5B	0+30, 12R	5-15	-	3.2

[a]Locations of soil samples are shown on Fig. 5.

[b]Indicated counting error is at the 95% confidence level ($\pm 2\sigma$).

[c]Analytical error of measurement results is $< \pm 5\%$ (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Results of surface analysis of structures at 1147 Central Avenue, Colonie, New York (AL034)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity					
Roof of house	13	39,39,200,120,<7, <7,39,79,39,79,<7, <7,39,120	-	63	-
Total	13	<7-200	-	63	-
Beta-Gamma					
Roof of house	4	-	0.03,0.02,0.02,0.03	-	0.03
Roof of garage	2	-	0.04,0.02	-	0.03
Drive and walkways	14	-	0.02,0.05,0.04,0.03,0.06, 0.02,0.05,0.04,0.04,0.04, 0.03,0.04,0.03,0.03	-	0.04
Total	20	-	0.02-0.06	-	0.03

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 erg per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

Table 5. Summary of outdoor measurements and sample results on the property at 1147 Central Avenue, Colonie, New York (AL034)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	50	7-13	9
Gamma exposure rate at surface (μR/h)[a]	50	6-17	10
Scan, gamma exposure rate near surface (μR/h)[b]	-	6-19	-
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	22	2.1-87	11
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	11	3.2-55	22
Concentration of ^{226}Ra in surface soil (pCi/g), systematic locations[c]	6	1.2-2.7	1.8
Estimated area of contamination exceeding guidelines (m^2)	-	-	60
<u>Surface measurements</u>[e]			
Alpha activity (dpm/100 cm^2)	13	<7-200	63
Beta-gamma activity (mrad/h)	20	0.02-0.06	0.03

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 4.
[d]Biased samples, Table 3.
[e]Surface measurements, Table 4.

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1100 CENTRAL AVENUE, COLONIE, NEW YORK (AL041)

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1100 CENTRAL AVENUE, COLONIE, NEW YORK (AL041)

J. L. Marley, B. A. Berven, and W. D. Cottrell

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J. L. Marley - Field Survey Supervisor

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Typical background radiation levels for the Albany area are presented in Table 1. The data is 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/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 5 to 13 μR/h (microroentgens* per hour) and averaged 8 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 6 to 15 μR/h and averaged 9 μR/h. The maximum gamma exposure rate measured, 21 μR/h, was in the area between the building and the property line, and extending from approximately 0+13, BL to the rear at 0+53, BL. For this survey the property line was assumed to be that line extending parallel to the building and coinciding with the edge of the platform and steps at the side of the building of the 1104 Central Avenue property.

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*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.

RESULTS OF THE RADIOLOGICAL SURVEY AT 1100 CENTRAL AVENUE, COLONIE, NEW YORK (AL041)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 22 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period September 13, 1984. The property at 1100 Central Avenue in Colonie, New York (AL041) was the subject of a radiological investigation on September 9, 1984.

This commercial property consisted a concrete block and cement finish building located on an irregular triangular parcel of land. The area facing to the front of the building is grass covered. The area to the side and rear of the building is paved with asphalt. A diagram of the property showing the approximate property boundaries and the grid network established for measurements outside the building is shown in Fig. 1. The irregular lot included in the radiological survey was approximately 73 m wide at the front facing Central Avenue and 53 m deep on the wide side. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

Soil Sampling

Twenty-eight systematic soil samples were taken at fourteen locations on the property. Systematic denotes samples that were taken at grid locations irrespective of the gamma exposure level at the point of sampling. The locations of the samples are shown in Fig. 4, and the results of analysis are presented in Table 3.

Samples were taken at 0 to 5 cm and at 5 to 15 cm depths from each location. Concentrations of ^{238}U in the systematic soil samples ranged from 0.73 to 130 pCi/g (picocuries* per gram) and averaged 22 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 31 pCi/g and averaged 12 pCi/g in the 5 to 15 cm depth samples. The ratio of concentration at 0 to 5 cm to concentration at 5 to 15 cm depths was 2.65, indicating that the higher concentrations are located near the surface. The sample from grid location 0+32, BL (AL41S14A) having the maximum concentration found on the property (130 pCi/g) and the three others exceeding the DOE guidelines concerning ^{238}U in the soil were from depths of 0 to 5 cm. The 5 to 15 cm sample with 51 pCi/g at location 0+32, BL indicates that the ^{238}U has migrated further into the soil at this location. It is believed that the uranium has migrated primarily as a result of natural processes such as freezing and thawing, melting snow, and washing by rain. It is also probable that the uranium will be further diffused, become less concentrated with time, as the above processes continue to disperse the uranium. The areas on the property with significant concentrations of ^{238}U are shown in Fig. 6. The total area with contamination exceeding the guideline is estimated at 70 to 90 m^2.

Radium was measured in sample AL41S1A. The concentration of ^{226}Ra was 1.0 pCi/g.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the roof of the building and on asphalt-paved areas. The results of these measurements are listed in Table 4. The alpha activity ranged from <6 to 42 dpm/100 cm^2 and averaged 18 dpm/100 cm^2. Beta-gamma activity ranged from 0.02 to 0.17 mrad/h and averaged 0.07 mrad/h.

A summary of the outdoor measurement results is provided in Table 5.

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*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.

SIGNIFICANCE OF FINDINGS

Measurements of the gamma exposure levels outdoors on the property determined that the exposure rate at 1 m above the ground surface ranged from 5 to 13 μR/h and averaged 8 μR/h; a level less than the background for the Albany area. For comparison, the typical background for the Albany area is 9 μR/h; and the background for the state of New York[8,9] averages 9.5 μR/h and ranges from 6.8 to 13 μR/h (one standard deviation) based on 51 measurements. Based on this information, there is no indication of risk to health caused by gamma exposure rates outdoors on the property.

The results of ^{238}U analysis establish the presence of uranium at concentrations significantly above background on the property. The average concentration of 22 pCi/g of ^{238}U in the systematic samples is approximately 23 times the normal background of 0.96 pCi/g for the Albany area. However, the average is below the DOE guideline[10] of 35 pCi/g ^{238}U. The maximum concentration of ^{238}U measured, 130 pCi/g in sample AL41S14A, was approximately 3.7 times the DOE guideline.

The 1.0 pCi/g of ^{226}Ra measured in the soil compares favorably with the Albany area background of 0.85 pCi/g of radium-226.

The estimated area of the property with ^{238}U in the soil exceeding the DOE guideline is 70 to 90 m^2.

The average alpha activity of 18 dpm/100 cm^2 obtained by measurements on the roof of the building and the asphalt paving is well below the DOE criterion of 5000 dpm/100 cm^2 for alpha activity from natural uranium, uranium-235, or uranium-238.

The average and maximum beta-gamma activities of 0.07 and 0.17 mrad/h are less than the DOE criteria of 0.20 and 1.0 mrad/h at 1 cm, respectively.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindekin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. Environmental Research Division, Action Description Memorandum. "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

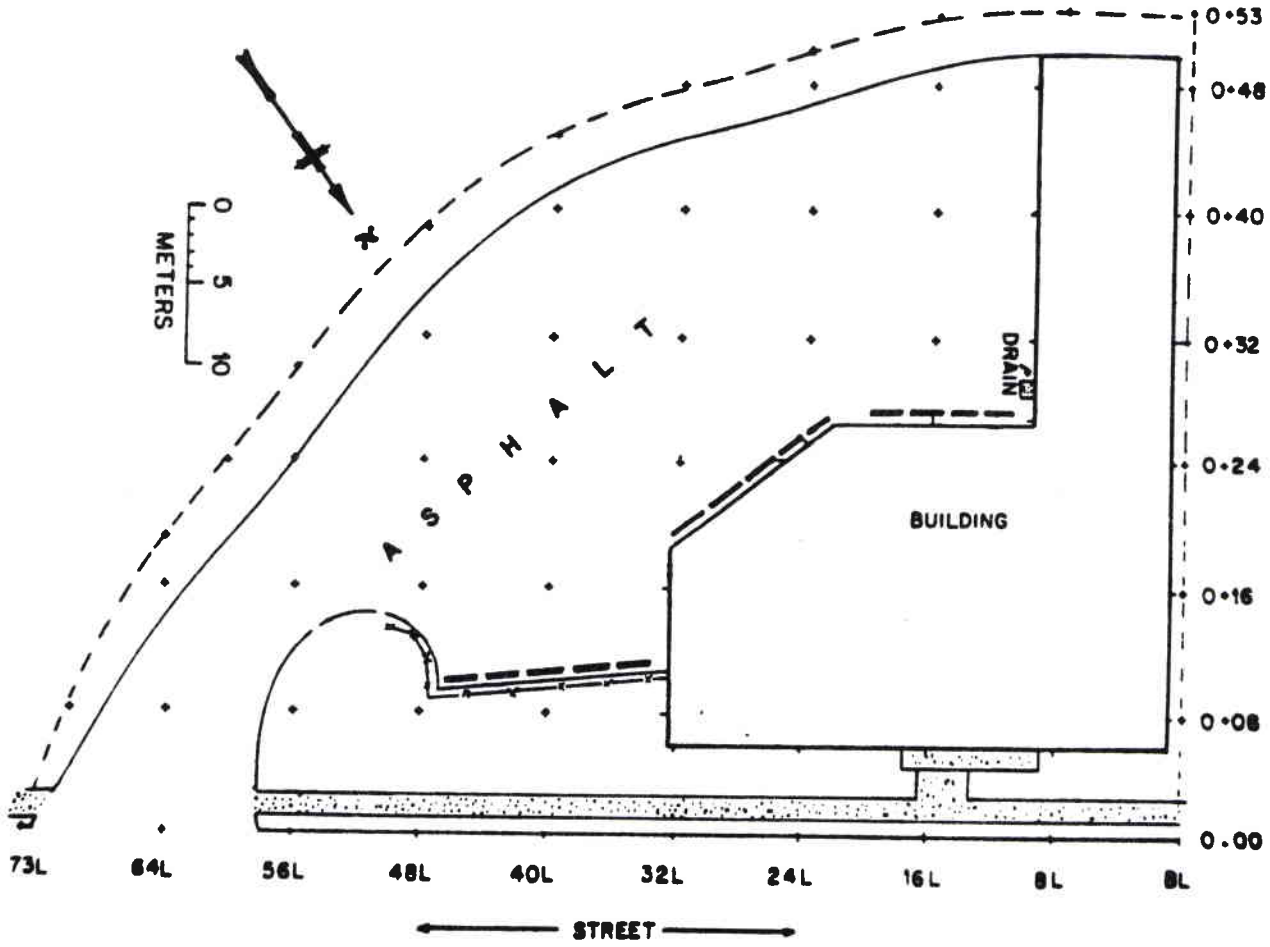

Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 1100 Central Avenue, Colonie, New York (AL041).

Fig. 2. Front view of the property at 1100 Central Avenue, Colonie, New York (AL041) looking west.

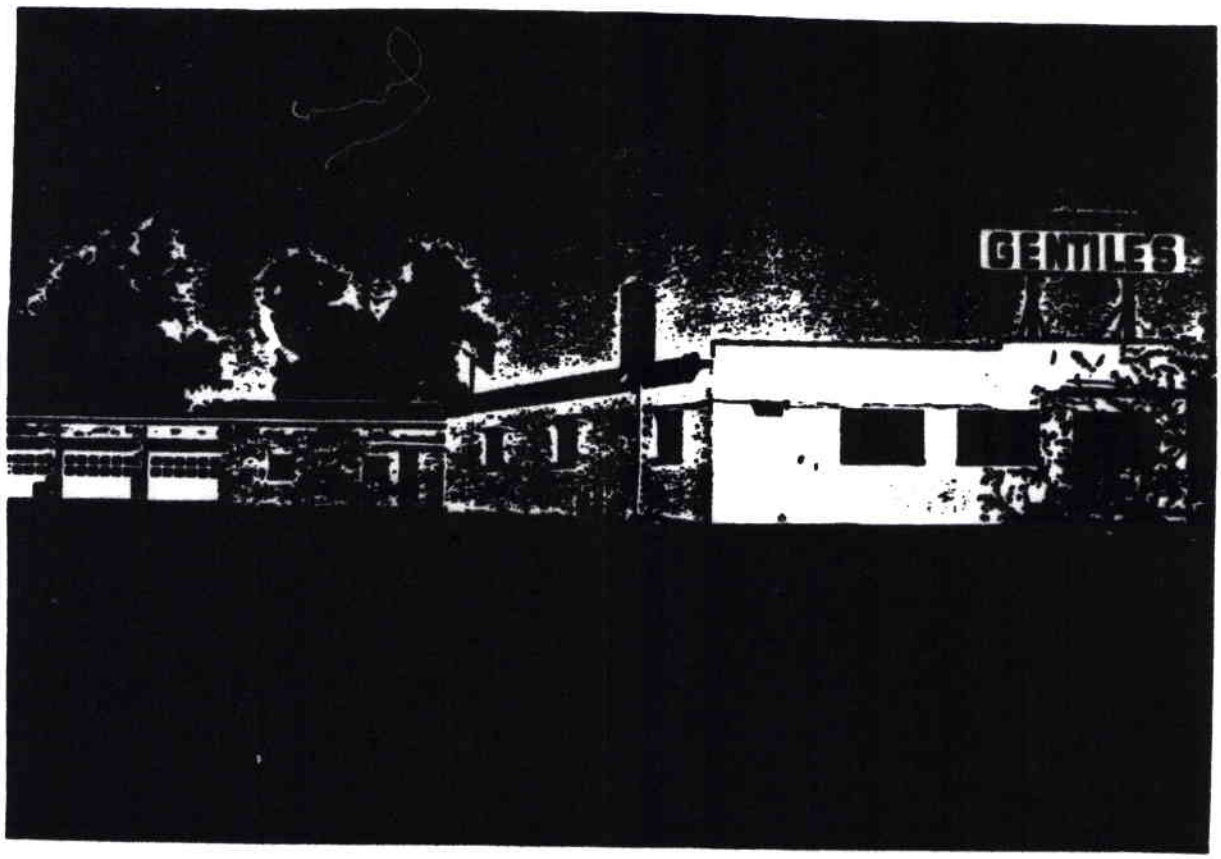

Fig. 3. Rear view of the property at 1100 Central Avenue, Colonie, New York (AL041) looking north.

Gamma exposure rate measurements are given in μR/h.

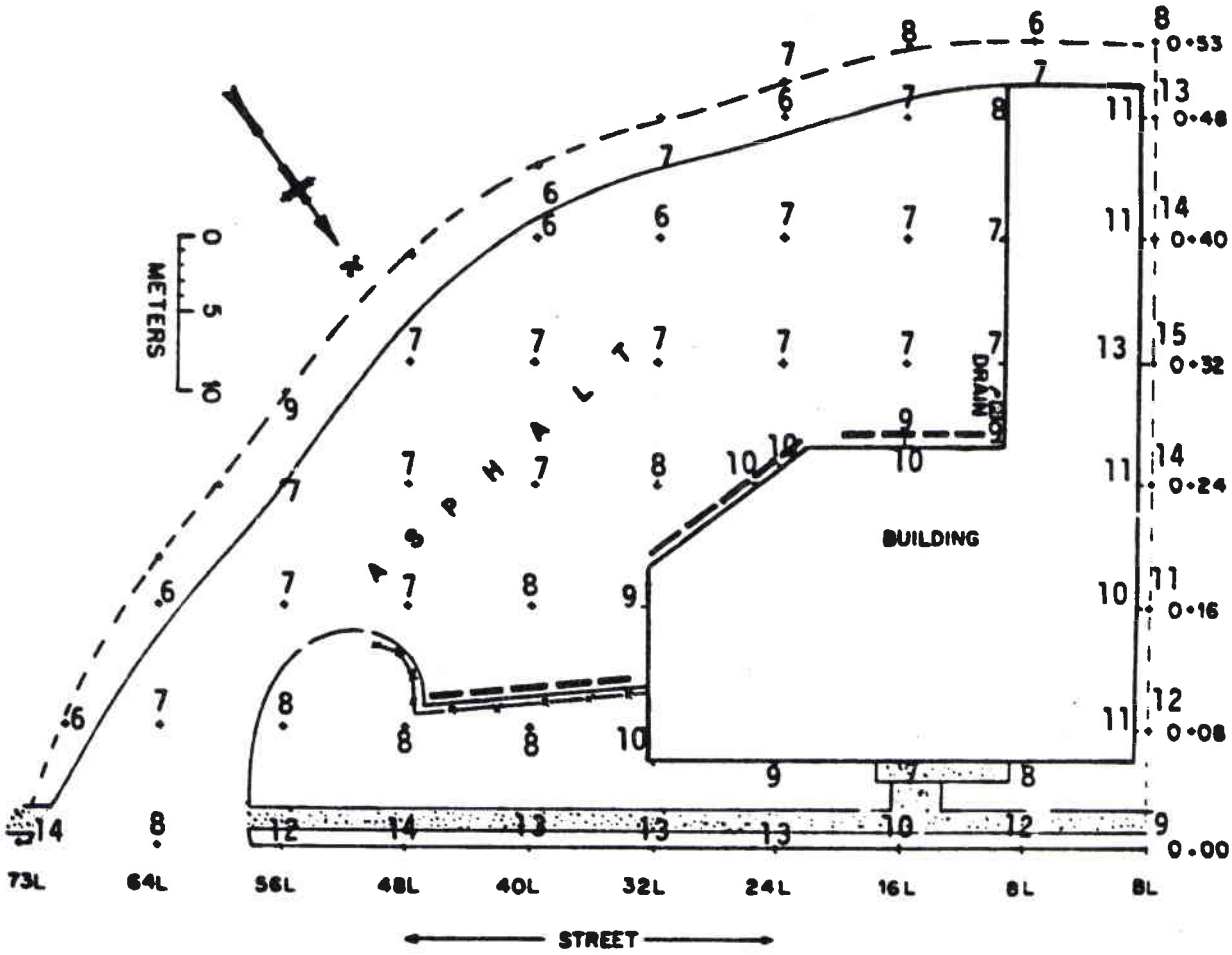

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 1100 Central Avenue, Colonie, New York (AL041).

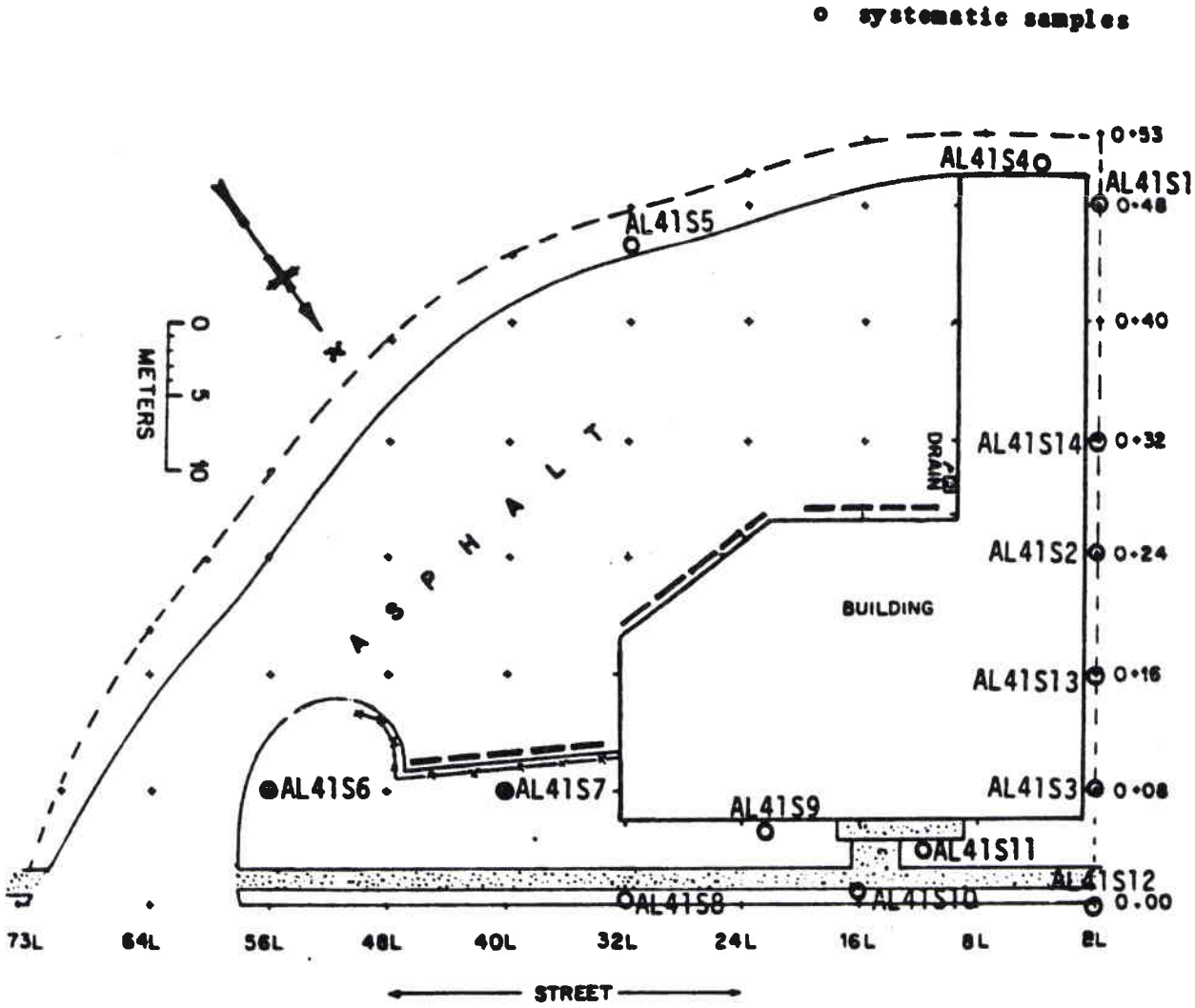

Fig. 5. Locations of soil samples on the property at 1100 Central Avenue, Colonie, New York (AL041).

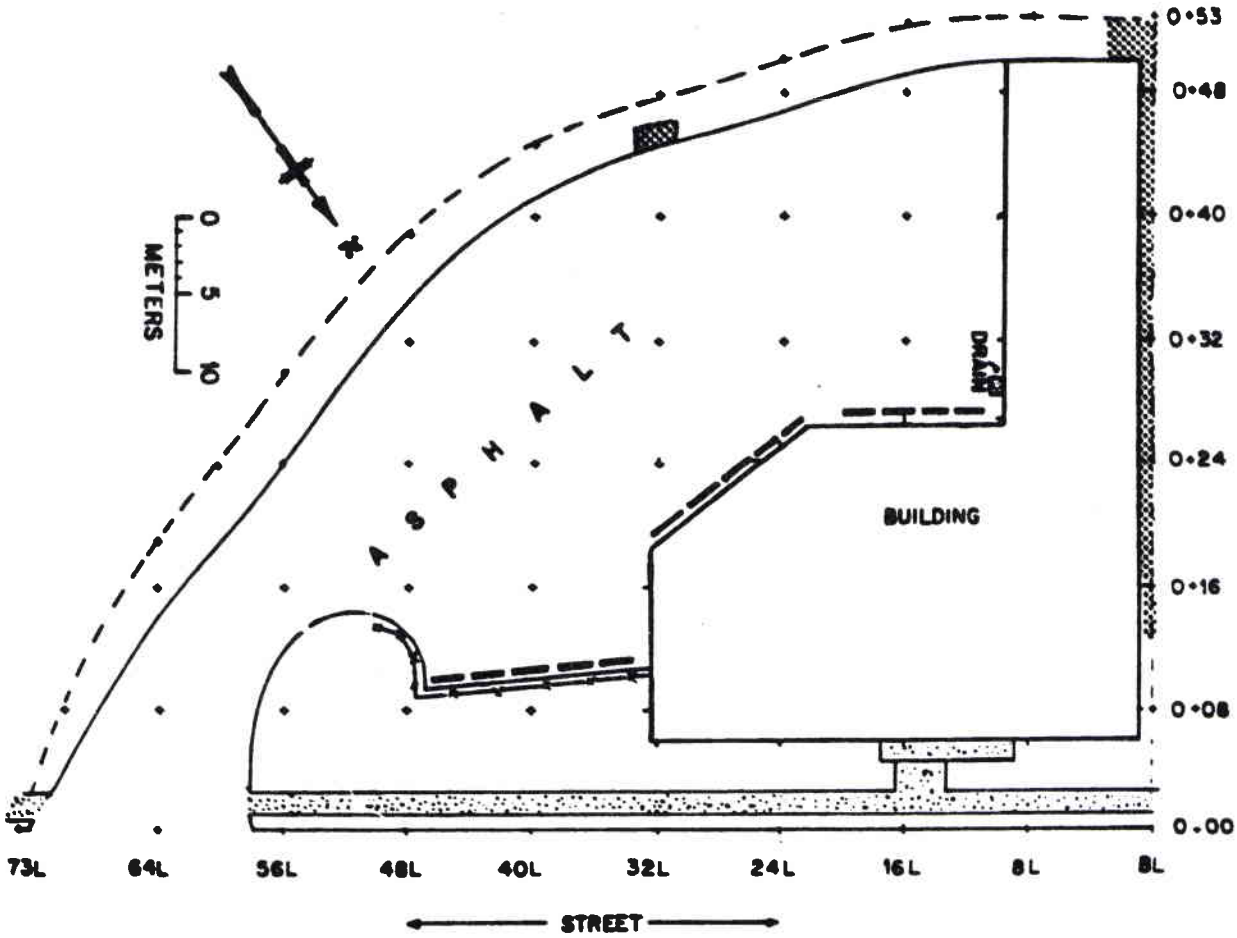

Fig. 6. Estimated area with contamination on the property at 1100 Central Avenue, Colonie, New York (AL041).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 1100 Central Avenue, Colonie, New York (AL041)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	9	9	8-11
0+08, BL	10	12	11-15
0+16, BL	10	11	11-16
0+24, BL	13	14	13-19
0+32, BL	12	15	13-24
0+40, BL	10	14	12-17
0+48, BL	9	13	12-17
0+53, BL	9	8	-
0+08, 1L	11	11	-
0+16, 1L	11	10	-
0+24, 1L	11	11	-
0+32, 1L	11	13	-
0+40, 1L	9	11	-
0+48, 1L	9	11	-
0+00, 8L	10	12	9-12
0+06, 8L	8	8	-
0+08, 8L	e	e	-
0+16, 8L	e	e	-
0+24, 8L	e	e	9-10
0+32, 8L	e	e	8-9
0+40, 8L	e	e	8-9
0+48, 8L	e	e	7-8
0+50.5, 8L	6	7	-
0+53, 8L	7	6	-
0+26.5, 9.5L	9	9	-
0+32, 9.5L	7	7	-
0+40, 9.5L	8	7	-
0+48, 9.5L	7	8	-
0+00, 16L	9	10	7-12
0+06, 16L	7	7	-
0+08, 16L	e	e	-
0+16, 16L	e	e	-
0+24, 16L	7	10	-
0+26.5, 16L	10	9	-
0+32, 16L	7	7	7-9
0+40, 16L	7	7	6-8
0+48, 16L	7	7	-
0+52.5, 16L	8	8	-
0+00, 24L	9	13	9-13
0+06, 24L	9	9	9-10
0+08, 24L	e	e	-

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+16, 24L	e	e	-
0+24, 24L	e	e	7-8
0+24.8, 24L	9	10	-
0+32, 24L	7	7	7-8
0+40, 24L	7	7	7-8
0+48, 24L	7	6	-
0+50, 24L	8	7	-
0+24, 25L	9	10	-
0+00, 32L	9	13	7-13
0+08, 32L	9	10	8-10
0+16, 32L	9	9	8-10
0+24, 32L	8	8	7-9
0+32, 32L	8	7	7-9
0+40, 32L	5	6	6-9
0+46, 32L	7	7	-
0+00, 40L	8	13	7-13
0+08, 40L	8	8	7-10
0+16, 40L	7	8	7-9
0+24, 40L	8	7	6-8
0+32, 40L	7	7	6-8
0+40, 40L	7	6	6-8
0+42, 40L	7	6	-
0+00, 48L	9	14	8-14
0+08, 48L	8	8	8-10
0+16, 48L	7	7	7-8
0+24, 48L	7	7	7-8
0+32, 48L	7	7	-
0+00, 56L	8	12	7-12
0+08, 56L	7	8	7-9
0+16, 56L	7	7	6-8
0+24, 56L	5	7	-
0+30, 56L	8	9	-
0+00, 64L	9	8	8-10
0+08, 64L	7	7	7-9
0+16, 64L	7	6	-
0+08, 70L	7	6	-
0+00, 73L	7	14	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analysis on the property at 1100 Central Avenue, Colonie, New York (AL041)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
			Systematic samples[d]	
AL41S1A	0+48, BL	0-5	1.0 ± 0.11	82
AL41S1B	0+48, BL	5-15	-	16
AL41S2A	0+24, BL	0-5	-	94
AL41S2B	0+24, BL	5-15	-	27
AL41S3A	0+08, BL	0-5	-	3.6
AL41S3B	0+08, BL	5-15	-	1.1
AL41S4A	0+50.5, 4L	0-5	-	1.7
AL41S4B	0+50.5, 4L	5-15	-	12
AL41S5A	0+46, 32L	0-5	-	54
AL41S5B	0+46, 32L	5-15	-	15
AL41S6A	0+08, 56LR	0-5	-	1.3
AL41S6B	0+08, 56L	5-15	-	7.7
AL41S7A	0+08, 40L	0-5	-	9.1
AL41S7B	0+08, 40L	5-15	-	15
AL41S8A	0+00, 32L	0-5	-	0.73
AL41S8B	0+00, 32L	5-15	-	2.2
AL41S9A	0+06, 22L	0-5	-	22
AL41S9B	0+06, 22L	5-15	-	9.3
AL41S10A	0+0.5, 16L	0-5	-	11
AL41S10B	0+0.5, 16L	5-15	-	1.4
AL41S11A	0+06, 12L	0-5	-	18
AL41S11B	0+06, 12L	5-15	-	5.8
AL41S12A	0+00, BL	0-5	-	1.1
AL41S12B	0+00, BL	5-15	-	1.4
AL41S13A	0+16, BL	0-5	-	10
AL41S13B	0+16, BL	5-15	-	2.7
AL41S14A	0+32, BL	0-5	-	130
AL41S14B	0+32, BL	5-15	-	51

[a]Locations of soil samples are shown on Fig. 5.
[b]Indicated counting error is at the 95% confidence level (± 2σ).
[c]Analytical error of measurement results is < ± 5% (95% confidence level).
[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

Table 4. Results of surface analysis of structures at 1100 Central Avenue, Colonie, New York (AL041)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity					
Roof of building	12	12,6,<6,12,6,12, <6,<6,<6,6,12,18	-	9	-
Asphalt paving and sidewalk	24	7,35,35,21,21,21, 21,7,21,42,35,21, 42,7,14,21,7,21, <7,35,35,14,28,14	-	22	-
Total	36	<6-42	-	18	-
Beta-Gamma					
Roof of building	14	-	0.03,0.02,0.02,0.03,0.05,0.08, 0.04,0.10,0.06,0.06,0.11,0.07, 0.03,0.07	-	0.06
Asphalt paving and sidewalk	24	-	0.06,0.07,0.06,0.05,0.05,0.03, 0.04,0.07,0.10,0.11,0.09,0.07, 0.11,0.11,0.11,0.10,0.07,0.09, 0.12,0.08,0.05,0.10,0.12,0.17	-	0.08
Total	38	-	0.02-0.17	-	0.07

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 erg per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

Table 5. Summary of outdoor measurements and sample results on the property at 1100 Central Avenue, Colonie, New York (AL041)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	67	5-13	8
Gamma exposure rate at surface (μR/h)[a]	67	6-15	9
Scan, gamma exposure rate near surface (μR/h)[b]	-	6-24	-
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	28	0.73-130	22
Concentration of ^{226}Ra in surface soil (pCi/g), systematic locations[c]	1	-	1.0
Estimated area of contamination exceeding guidelines (m^2)	-	-	70
<u>Surface measurements</u>[d]			
Alpha activity (dpm/100 cm^2)	36	<6-42	18
Beta-gamma activity (mrad/h)	38	0.02-0.17	0.07

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Surface measurements, Table 4.

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1104 CENTRAL AVENUE, COLONIE, NEW YORK (AL042)

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1104 CENTRAL AVENUE, COLONIE, NEW YORK (AL042)

J. L. Marley, B. A. Berven, and W. D. Cottrell

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1104 CENTRAL AVENUE, COLONIE, NEW YORK (AL042)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 22 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period September 4-13, 1984. The property at 1104 Central Avenue in Colonie, New York (AL042) was the subject of a radiological investigation on September 9, 1984.

This commercial property consisted of a single story brick structure with an asphalt driveway leading from the street to the building. A grassed entrance area and the vehicle entrance area are provided at the front. A diagram of the property showing the approximate property boundaries and the grid network established for measurements outside the building is shown in Fig. 1. The quadrilateral lot included in the radiological survey was approximately 23 m wide by 43 m deep along the baseline (the left side) and 55 m deep on the righthand side when facing the building. The limits of the property outside the building, for survey purposes, are 1.0 m along the baseline side of the building, 1.5 m along the rear of the building, and 1.0 m along the right side of the building (22 to 23R). Front and rear views of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha and beta-gamma activity from surfaces of structures outdoors on the property. A comprehensive description of the survey methods and instrumentation has been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. The data is 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/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 7 to 15 μR/h (microroentgens* per hour) and averaged 11 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 7 to 16 μR/h and averaged 13 μR/h. The maximum gamma exposure rate, 21 μR/h, was measured at three locations: grid blocks 0+40, BL, 0+16, 8R, and 0+26, 23R.

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*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.

Soil Sampling

Thirty-four soil samples were taken at this property. Twenty-six of these at thirteen locations [denoted as systematic samples (AL42S)] were taken without regard to gamma exposure levels at the sampling points. Eight samples at four locations [denoted biased samples (AL42B)] were selected at positions having elevated gamma exposure levels. The locations of the samples are shown in Fig. 5, and the results of analysis are presented in Table 3.

Samples were taken at 0 to 5 cm and at 5 to 15 cm depths from each location. Concentrations of ^{238}U in the systematic soil samples ranged from 0.67 to 206 pCi/g (picocuries* per gram) and averaged 30 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 50 pCi/g and averaged 16 pCi/g in the 5 to 15 cm depth samples. The ratio of concentration at 0 to 5 cm to concentration at 5 to 15 cm depths was 3.40, indicating that the higher concentrations are located near the surface. Bias sample AL42B3A from grid location 0+51, 12R, having the maximum concentration found on the property (220 pCi/g), and three others exceeding the DOE guidelines concerning ^{238}U in soil are above the guidelines in the samples taken at 5 to 15 cm depth. The values indicate the uranium has migrated into the soil below the depths samples. It is believed that the uranium has migrated primarily as a result of natural processes such as freezing and thawing, melting snow, and washing by rain. It is also probable that the uranium will be further diffused, become less concentrated with time, as the above processes continue to disperse the uranium. The areas on the property with significant contamination with ^{238}U are shown in Fig. 6. The total area is estimated at 130 m^2.

Radium was measured in sample AL42S1A. The concentration of ^{226}Ra was 0.53 pCi/g.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the roof of the building and on the asphalt parking area at the front. The results of these measurements are listed in Table 4. The alpha activity ranged from <14 to 100 dpm/100 cm^2 and averaged 32 dpm/100 cm^2. Beta-gamma activity ranged from 0.03 to 2.2 mrad/h and averaged 0.23 mrad/h.

A summary of the outdoor measurement results is provided in Table 5.

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*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.

SIGNIFICANCE OF FINDINGS

Measurements of the gamma exposure levels outdoors on the property determined that the exposure rate at 1 m above the ground surface ranged from 7 to 15 μR/h and averaged 11 μR/h; a level slightly above the background for the Albany area. For comparison, the typical background for the Albany area is 9 μR/h; and the background for the state of New York[8,9] averages 9.5 μR/h and ranges from 6.8 to 13 μR/h (one standard deviation) based on 51 measurements. Based on this information, there is no indication of significant risk to health caused by gamma exposure rates outdoors on the property.

The results of ^{238}U analysis establish the presence of uranium at concentrations significantly above background on the property. The average concentration of 30 pCi/g of ^{238}U in the systematic samples is approximately 31 times the normal background of 0.96 pCi/g for the Albany area. However, the average concentration is below the DOE guideline[10] of 35 pCi/g ^{238}U. The maximum concentration of ^{238}U measured, 220 pCi/g in sample AL42B3A, was approximately 6.3 times the DOE guideline.

The estimated area of the property with ^{238}U in the soil exceeding the DOE guideline is 130 m^2.

The 0.53 pCi/g average for ^{226}Ra measured in the soil compares favorably with the Albany area background of 0.85 pCi/g of radium-226.

The average alpha activity of 32 dpm/100 cm^2 obtained by measurements on the roof of the building is well below the DOE criterion of 5000 dpm/100 cm^2 for alpha activity from natural uranium, uranium-235, or uranium-238.

The 0.34 mrad/h average beta-gamma activity from the roof measured at 1 cm from the surface, exceeds the DOE criterion of 0.2 mrad/h; the 0.06 mrad/h average from the paved surfaces does not exceed the DOE criterion.

The 2.2 mrad/h maximum from the roof is more than two times the DOE criterion of 1.0 mrad/h maximum, beta-gamma activity; the 0.10 mrad/h maximum from the paving is well below the DOE criterion.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindekin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. Environmental Research Division, Action Description Memorandum. "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

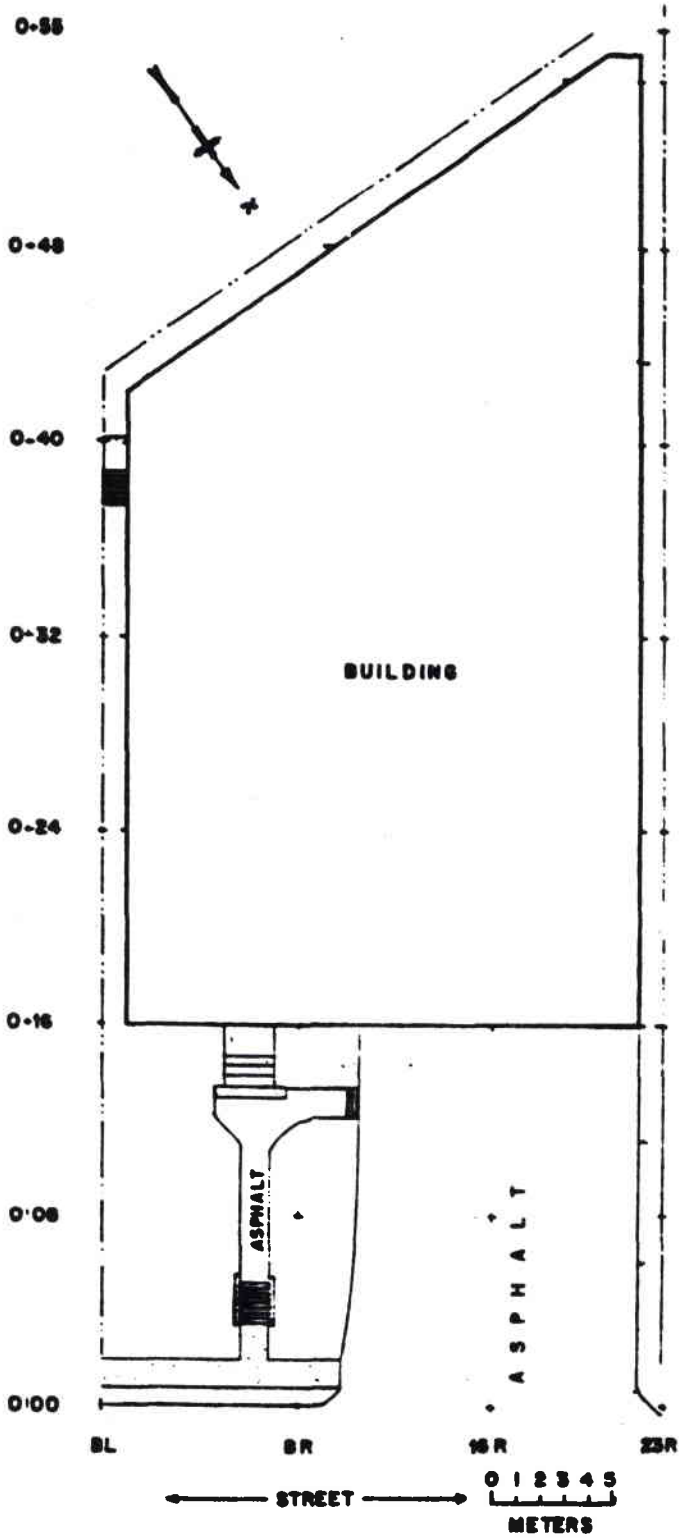

Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 1104 Central Avenue, Colonie, New York (AL042).

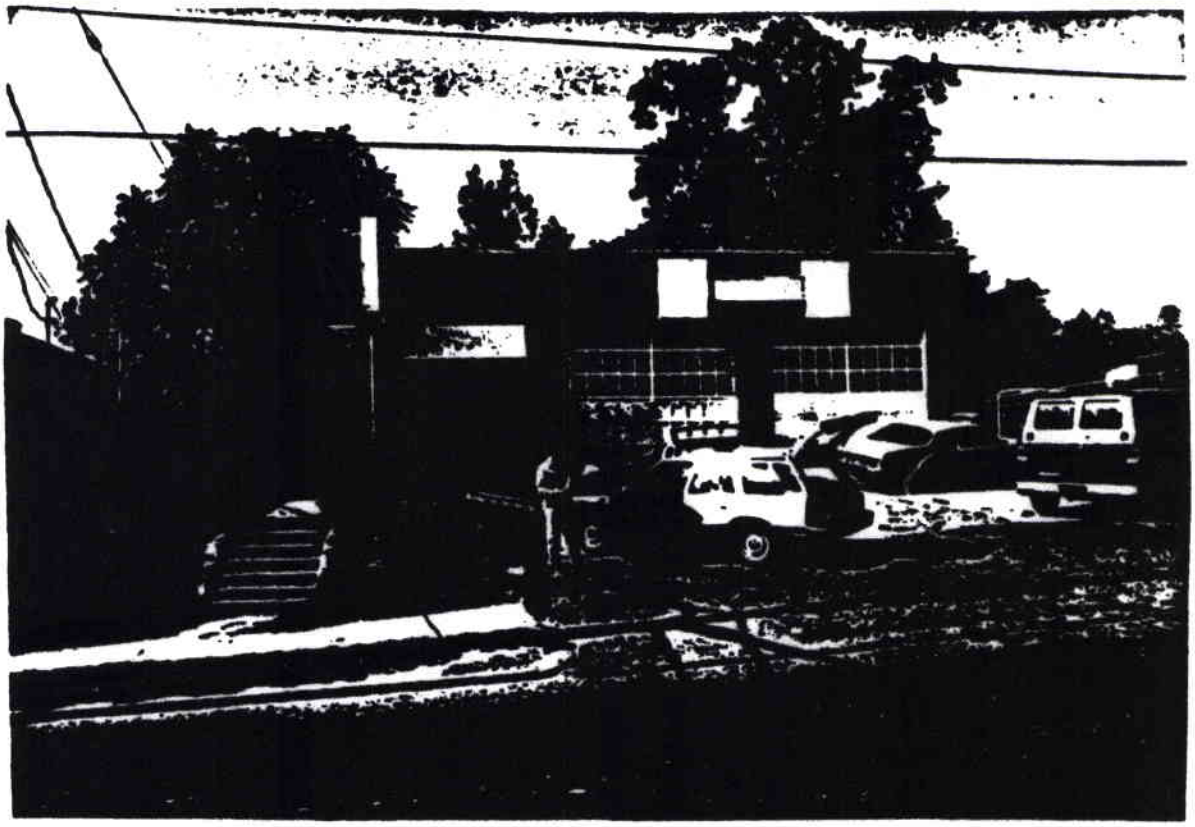

Fig. 2. Front view of the property at 1104 Central Avenue, Colonie, New York (A1042) looking southwest.

Fig. 3. Rear view of the property at 1104 Central Avenue, Colonie, New York (A1042) looking east.

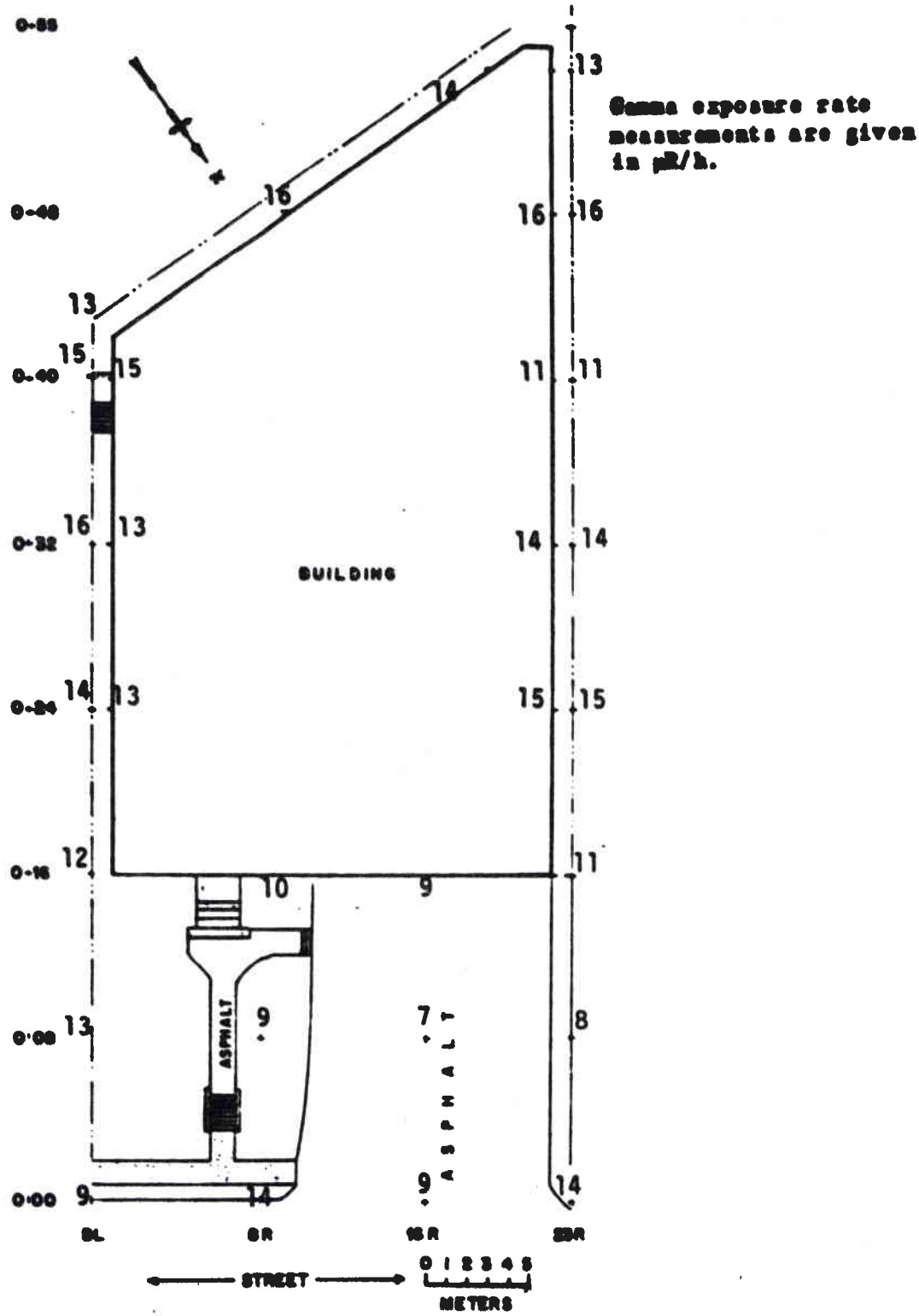

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 1104 Central Avenue, Colonie, New York (AL042).

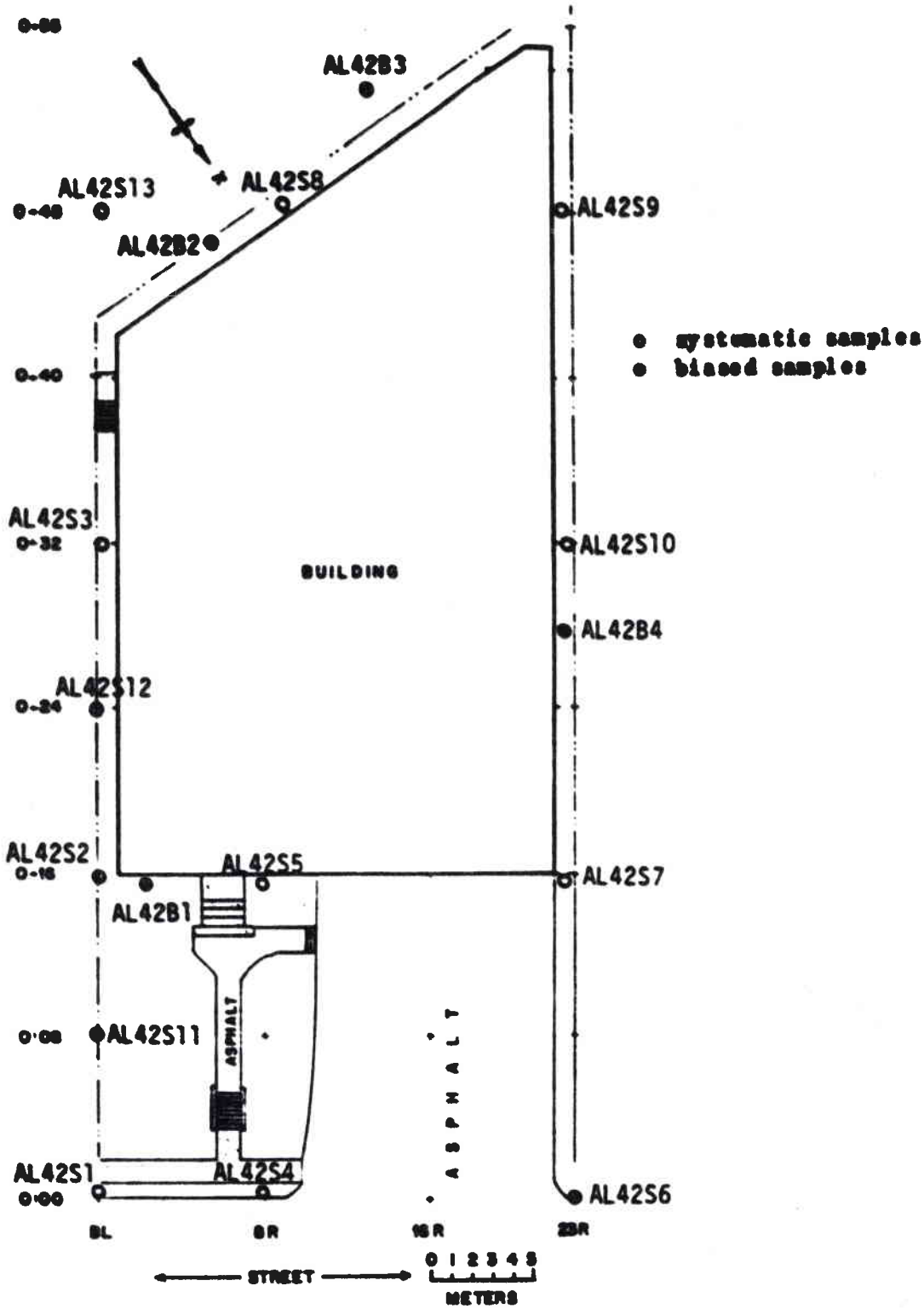

Fig. 5. Locations of soil samples on the property at 1104 Central Avenue, Colonie, New York (AL042).

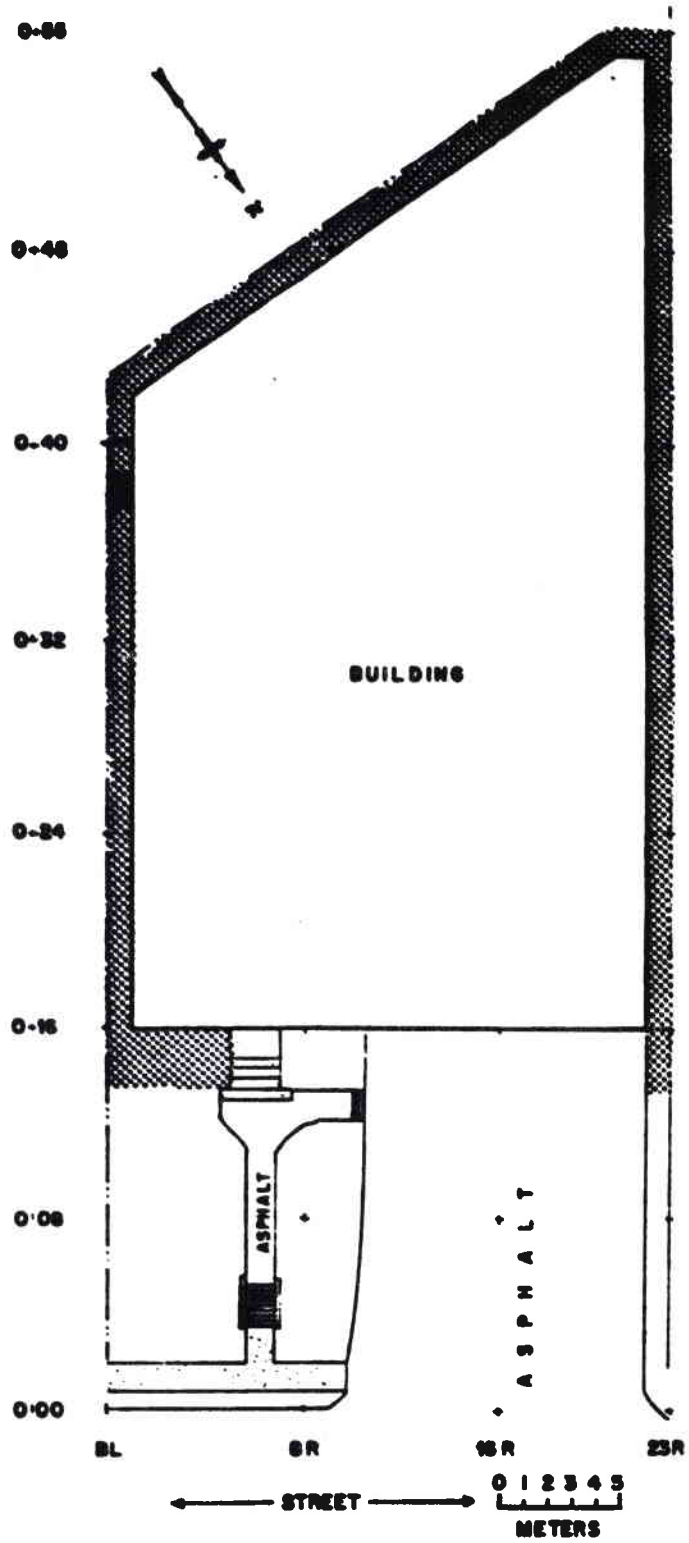

Fig. 6. Estimated area with contamination exceeding guidelines on the property at 1104 Central Avenue, Colonie, New York (AL042).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 1104 Central Avenue, Colonie, New York (AL042)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	10	9	9-11
0+08, BL	10	13	10-13
0+16, BL	11	12	11-19
0+24, BL	13	14	13-17
0+32, BL	12	16	13-18
0+40, BL	10	15	14-27
0+42, BL	11	13	-
0+24, 1R	11	13	-
0+32, 1R	13	13	-
0+40, 1R	13	15	-
0+00, 8R	9	14	8-15
0+08, 8R	9	9	8-11
0+16, 8R	10	10	10-27
0+24, 8R	e	e	-
0+32, 8R	e	e	-
0+40, 8R	e	e	-
0+48, 8R	14	16	-
0+00, 16R	10	9	7-9
0+08, 16R	7	7	7-15
0+16, 16R	9	9	9-15
0+24, 16R	e	e	11-27
0+32, 16R	e	e	11-14
0+40, 16R	e	e	11-14
0+48, 16R	e	e	-
0+53, 16R	11	14	-
0+24, 22R	15	15	-
0+32, 22R	14	14	-
0+40, 22R	10	11	-
0+48, 22R	14	16	-
0+00, 23R	9	14	-
0+08, 23R	8	8	-
0+16, 23R	10	11	-

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+24, 23R	15	15	-
0+32, 23R	14	14	-
0+40, 23R	10	11	-
0+48, 23R	14	16	-
0+53, 23R	11	13	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analysis on the property at 1104 Central Avenue, Colonie, New York (AL042)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
		Systematic samples[d]		
AL42S1A	0+00, BL	0-5	-	1.1
AL42S1B	0+00, BL	5-15	-	1.4
AL42S2A	0+16, BL	0-5	-	10
AL42S2B	0+16, BL	5-15	-	2.7
AL42S3A	0+32, BL	0-5	-	130
AL42S3B	0+32, BL	5-15	-	51
AL42S4A	0+00, 8R	0-5	-	0.77
AL42S4B	0+00, 8R	5-15	-	1.5
AL42S5A	0+16, 8R	0-5	-	21
AL42S5B	0+16, 8R	5-15	-	9.0
AL42S6A	0+00, 23R	0-5	-	0.67
AL42S6B	0+00, 23R	5-15	-	0.73
AL42S7A	0+16, 23R	0-5	-	62
AL42S7B	0+16, 23R	5-15	-	5.5
AL42S8A	0+48, 8R	0-5	-	200
AL42S8B	0+48, 8R	5-15	-	43
AL42S9A	0+48, 23R	0-5	-	11
AL42S9B	0+48, 23R	5-15	-	43
AL42S10A	0+32, 23R	0-5	-	32
AL42S10B	0+32, 23R	5-15	-	5.9
AL42S11A	0+08, BL	0-5	-	3.6
AL42S11B	0+08, BL	5-15	-	1.1
AL42S12A	0+24, BL	0-5	-	94
AL42S12B	0+24, BL	5-15	-	27
AL42S13A	0+48, BL	0-5	-	82
AL42S13B	0+48, BL	5-15	-	16
		Biased samples[e]		
AL42B1A	0+16, 2R	0-5	-	100
AL42B1B	0+16, 2R	5-15	-	20
AL42B2A	0+47, 5R	0-5	-	52
AL42B2B	0+47, 5R	5-15	-	150

Table 3 (continued)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
AL42B3A	0+51, 12R	0-5	-	220
AL42B3B	0+51, 12R	5-15	-	61
AL42B4A	0+27, 23R	0-5	-	100
AL42B4B	0+27, 23R	5-15	-	58

[a]Locations of soil samples are shown on Fig. 5.

[b]Indicated counting error is at the 95% confidence level ($\pm 2\sigma$).

[c]Analytical error of measurement results is < ± 5% (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Results of surface analysis of structures at 1104 Central Avenue, Colonie, New York (AL042)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity					
Roof of building	6	30,30,30,30,56,100	-	46	-
Paving	10	14,42,28,14,21, 21,21,42,14,21 [redacted]	-	24	-
Total	16	14-100	-	32	-
Beta-Gamma					
Roof of building	16	-	2.2,0.31,0.31,0.19,0.72,0.11, 0.05,0.43,0.04,0.13,0.21, 0.04,0.18,0.09,0.33,0.04	-	0.34
Paving	10	-	0.09,0.10,0.09,0.04,0.06, 0.06,0.04,0.03,0.03,0.09	-	0.06
Total	26	-	0.03-2.2 [redacted]	-	0.23

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 ergs per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

Table 5. Summary of outdoor measurements and sample results on the property at 1104 Central Avenue, Colonie, New York (AL042)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	30	7-15	11
Gamma exposure rate at surface (μR/h)[a]	30	7-16	13
Scan, gamma exposure rate near surface (μR/h)[b]	-	7-27	-
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	26	0.67-200	30
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	8	20-220	95
Concentration of ^{226}Ra in surface soil (pCi/g), systematic locations[c]	1	-	0.53
Estimated area of contamination exceeding guidelines (m^2)	-	-	130
Surface measurements[e]			
Alpha activity (dpm/100 cm^2)	16	<14-100	32
Beta-gamma activity (mrad/h)	26	0.03-2.2	0.23

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Biased samples, Table 3.
[e]Surface measurements, Table 4.

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1129 CENTRAL AVENUE, COLONIE, NEW YORK (AL043)

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ORNL/RASA-84/295
(AL043)

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 1129 CENTRAL AVENUE, COLONIE, NEW YORK (AL043)

J. L. Marley, B. A. Berven, and W. D. Cottrell

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1129 CENTRAL AVENUE, COLONIE, NEW YORK (AL043)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 22 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period September 4-13, 1984. The property at 1129 Central Avenue in Colonie, New York (AL043) was the subject of a radiological investigation on September 10, 1984.

This property consisted of a two-story frame house with composition siding. The lot is lawn-covered to the front and to the rear. A gravel driveway extends from the street to a garage located to the rear of the lot. A diagram of the property showing the approximate property boundaries and the grid network established for measurements outside the building is shown in Fig. 1. The rectangular lot included in the radiological survey was approximately 15 m wide by 54 m deep. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha and beta-gamma activity from surfaces of structures outdoors on the property. A comprehensive description of the survey methods and instrumentation has been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. The data is 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/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 6 to 11 μR/h (microroentgens* per hour) and averaged 9 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 7 to 15 μR/h and averaged 9 μR/h. The maximum gamma exposure rate at the property was 15 μR/h along a strip extending about 0+20 to 0+36, near 1.5R.

Soil Sampling

Thirty soil samples were taken at this property. Twenty-eight of these at fourteen locations [denoted as systematic samples (AL43S)] were taken without regard to gamma exposure levels at the sampling points. Two samples at one location [denoted biased samples (AL43B)] were selected at a position having an elevated gamma exposure level. The locations of the samples are shown in Fig. 5, and the results of analysis are presented in Table 3.

---

*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.

Samples were taken at 0 to 5 cm and at 5 to 15 cm depths from each location. Concentrations of ^{238}U in the systematic soil samples ranged from 0.60 to 42 pCi/g (picocuries* per gram) and averaged 6.9 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 10 pCi/g and averaged 3.5 pCi/g in the 5 to 15 cm depth samples. The ratio of concentration at 0 to 5 cm to concentration at 5 to 15 cm depths was 3.35, indicating that the higher concentrations are located near the surface. The sample from grid location 0+28, 1.5R (AL43S5A) having the maximum concentration found on the property (42 pCi/g) and exceeding the DOE guidelines concerning ^{238}U in soil was from depths of 0 to 5 cm. The estimated area of soil with contamination exceeding guidelines for ^{238}U is 24 m^2 is shown in Fig. 6.

Radium was measured in sample AL43S1A. The concentration of ^{226}Ra was 0.79 pCi/g.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the roof of the building, the garage, and on the asphalt paving and walkway. The results of these measurements are listed in Table 4. The alpha activity ranged from <7 to 42 dpm/100 cm^2 and averaged 16 dpm/100 cm^2. The beta-gamma activity ranged from 0.02 to 0.04 mrad/h and averaged 0.03 mrad/h.

A summary of the outdoor measurement results is provided in Table 5.

SIGNIFICANCE OF FINDINGS

Measurements of the gamma exposure levels outdoors on the property determined that the exposure rate at 1 m above the ground surface ranged from 6 to 11 μR/h and averaged 9 μR/h, the same as the background for the Albany area. For comparison, the typical background for the Albany area is 9 μR/h; and the background for the state of New York[8,9] averages 9.5 μR/h and ranges from 6.8 to 13 μR/h (one standard deviation) based on 51 measurements. Based on this information, there is no indication of risk to health caused by gamma exposure rates outdoors on the property.

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*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.

The results of ^{238}U analysis establish the presence of uranium at concentrations significantly above background on the property. The average concentration of 6.9 pCi/g of ^{238}U in the systematic samples is approximately 7 times the normal background of 0.96 pCi/g for the Albany area. However, the average concentration is below the DOE guideline[10] of 35 pCi/g ^{238}U. The maximum concentration of ^{238}U measured, 42 pCi/g in sample AL43S5A, was approximately 1.2 times the DOE guideline. The estimated area on the property that may contain uranium in excess of the DOE guideline is 24 m^2.

The 0.79 pCi/g average for ^{226}Ra measured in the soil compares favorably with the Albany area background of 0.85 pCi/g of radium-226.

The average alpha activity of 16 dpm/100 cm^2 obtained by measurements on the roofs of the buildings and on paving is well below the DOE criterion of 5000 dpm/100 cm^2 for alpha activity from natural uranium, uranium-235, or uranium-238.

The average and maximum beta-gamma activities of 0.03 and 0.04 mrad/h are less than the DOE criteria of 0.20 and 1.0 mrad/h at 1 cm, respectively.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindekin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. Environmental Research Division, Action Description Memorandum, "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

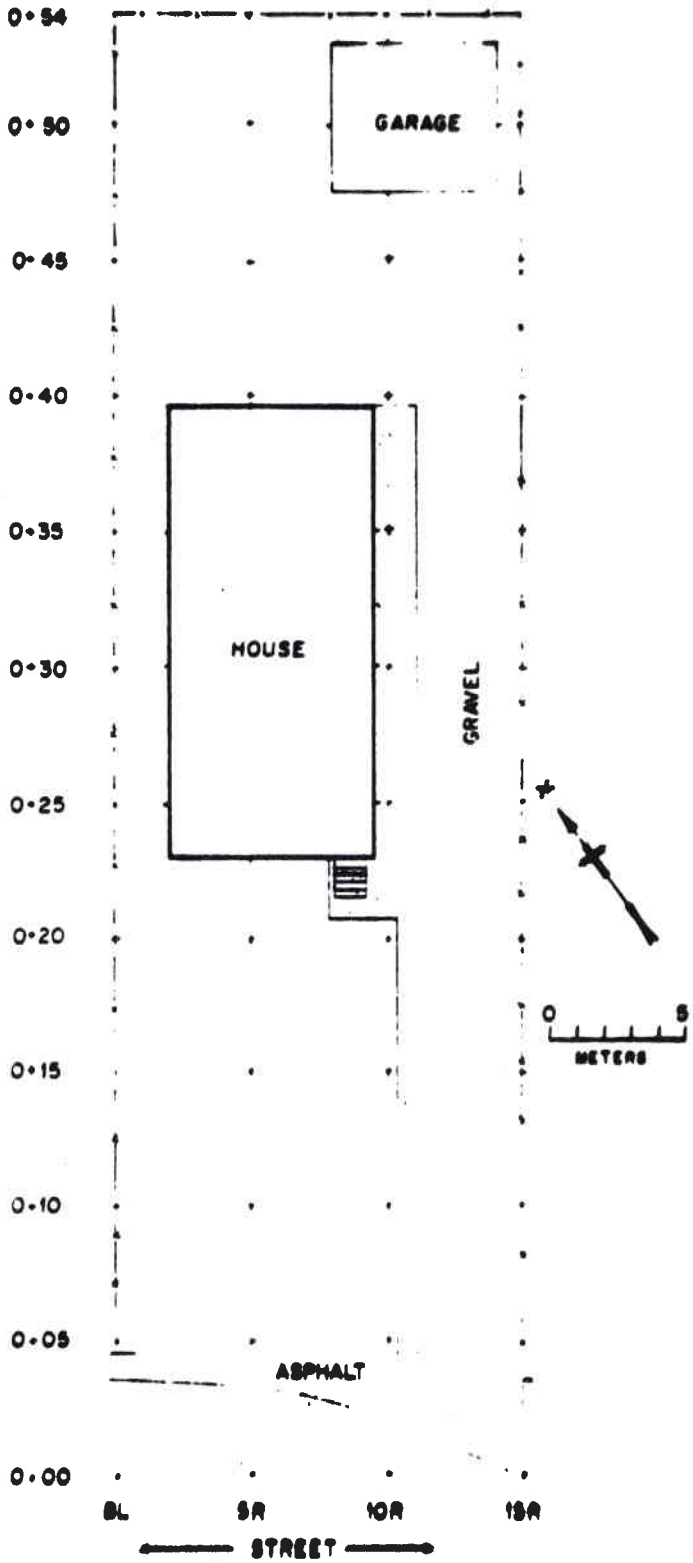

Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 1139 Central Avenue, Colonie, New York (AL048).

Fig. 2. Front view of the property at 1129 Central Avenue, Colonie, New York (AL043) looking northeast.

Fig. 3. Rear view of the property at 1129 Central Avenue, Colonie, New York (AL043) looking southwest.

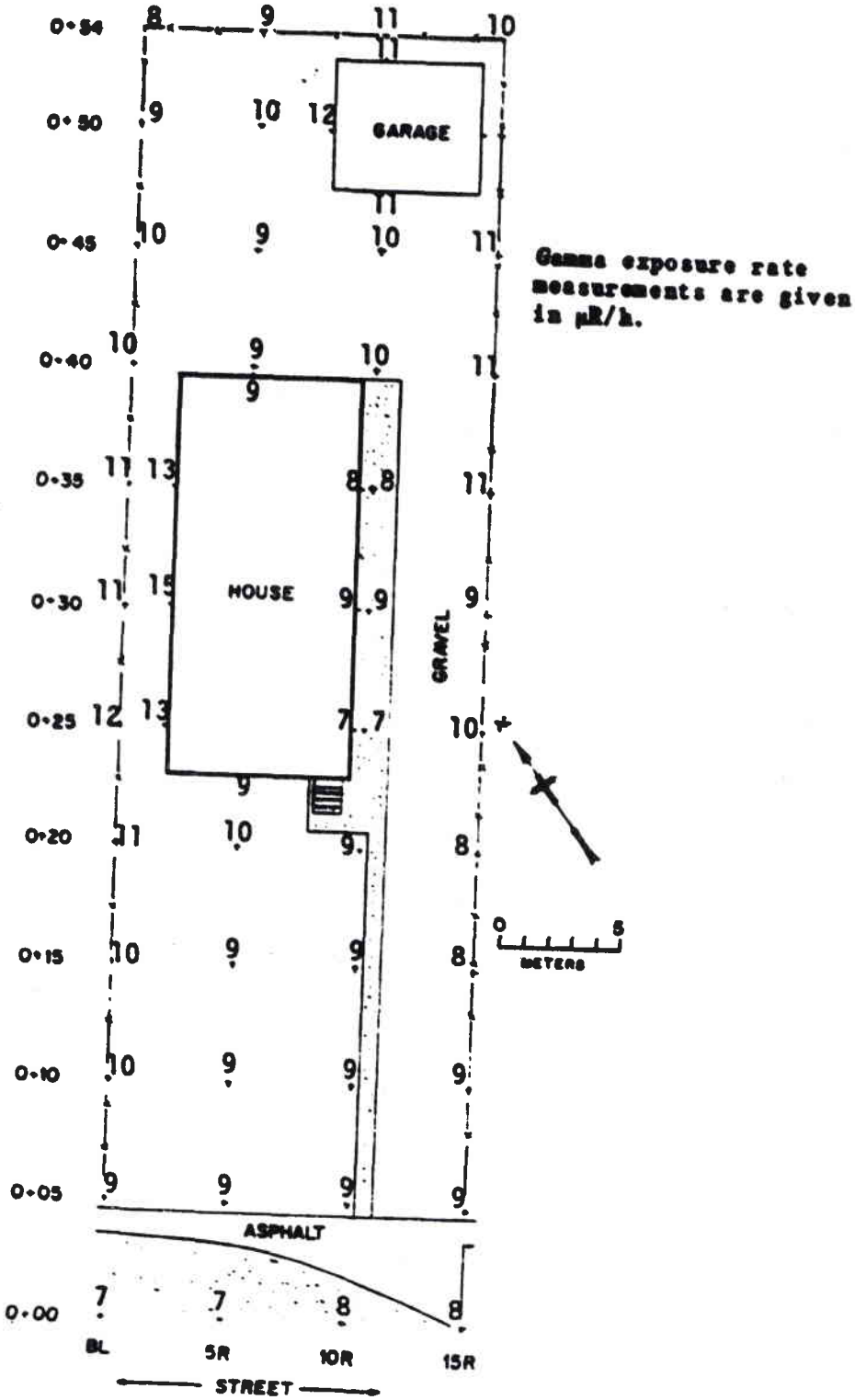

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 1129 Central Avenue, Colonie, New York (AL043).

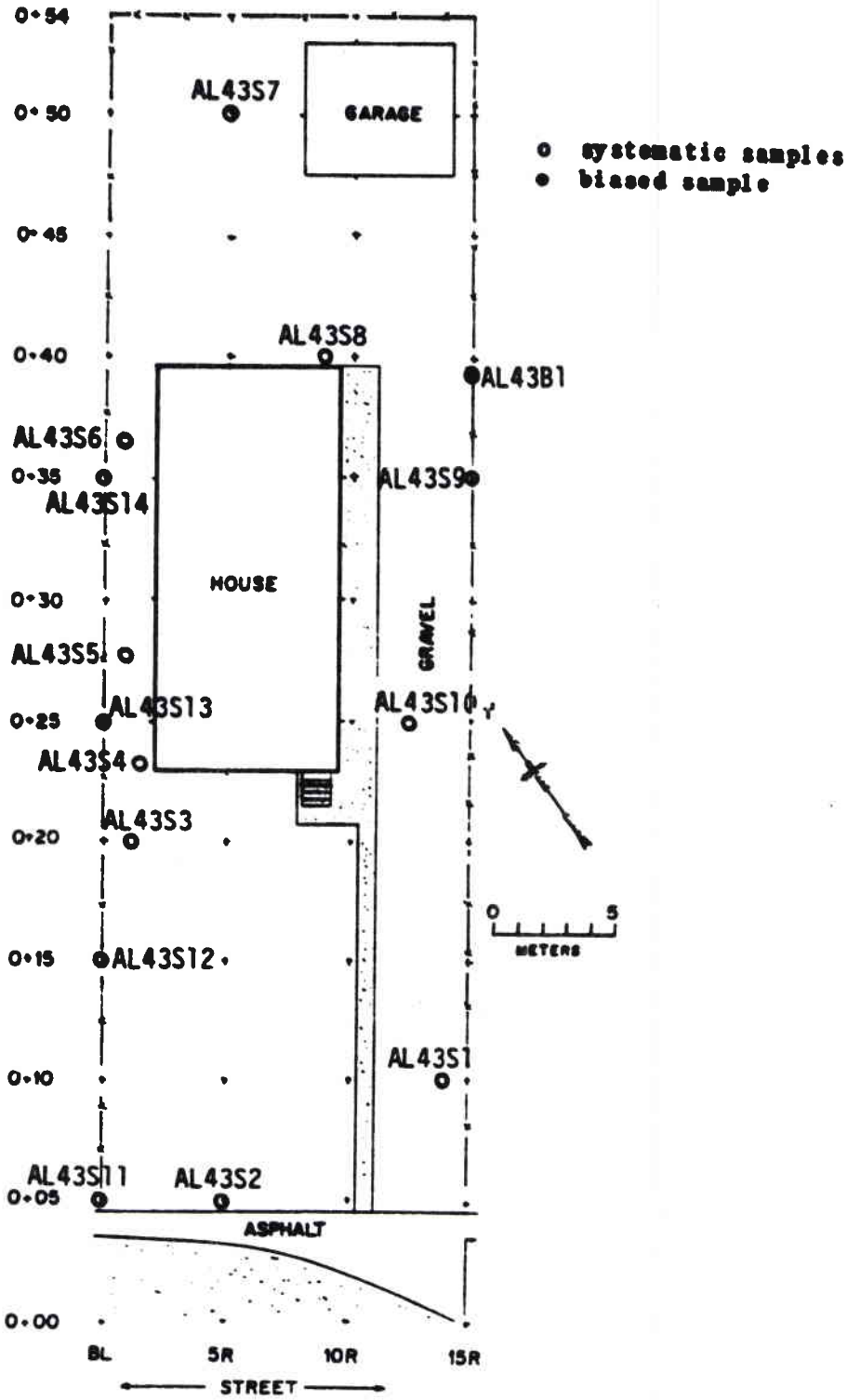

Fig. 5. Locations of soil samples on the property at 1129 Central Avenue, Colonie, New York (AL043).

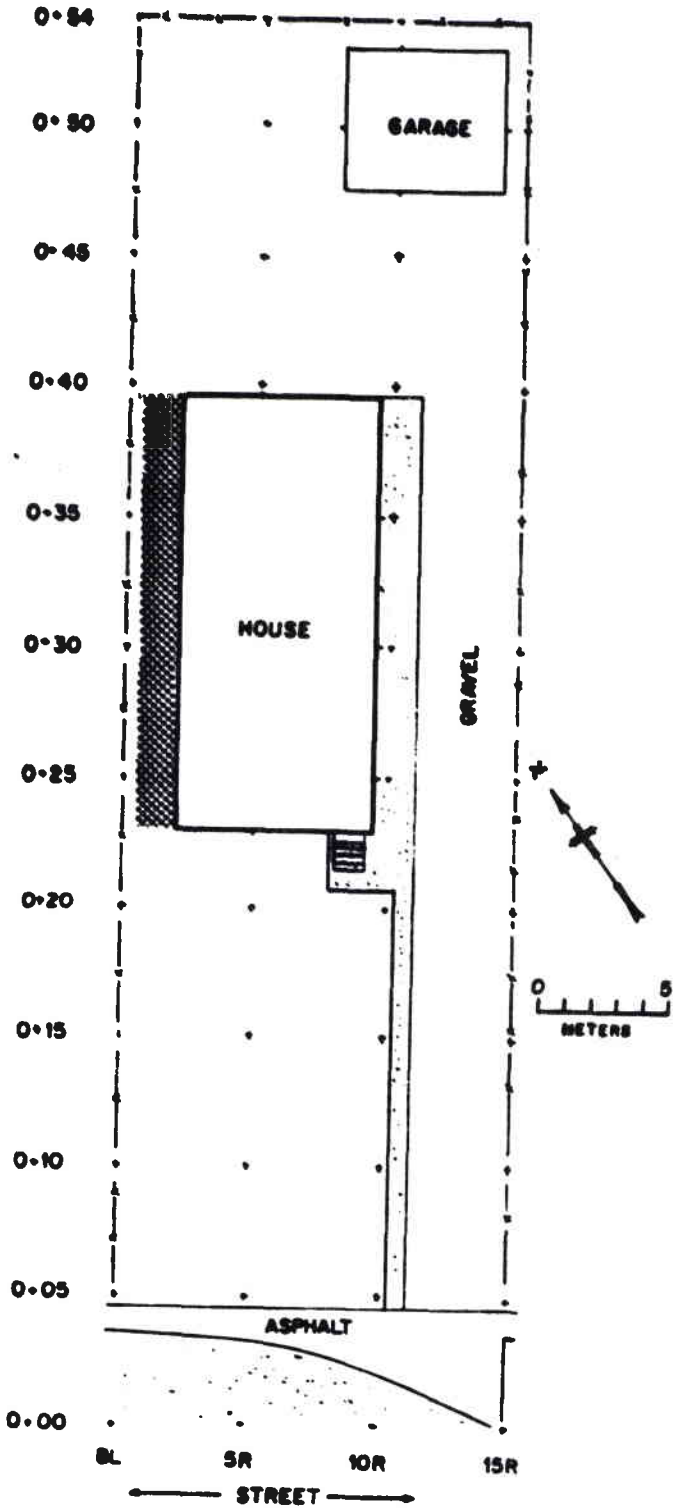

Fig. 6. Estimated area with contamination exceeding guidelines on the property at 1129 Central Avenue, Colonie, New York (AL043).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 1129 Central Avenue, Colonie, New York (AL043)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	6	7	6-10
0+05, BL	8	9	8-10
0+10, BL	9	10	8-10
0+15, BL	8	10	8-10
0+20, BL	10	11	9-15
0+25, BL	11	12	11-14
0+30, BL	11	11	10-15
0+35, BL	11	11	10-14
0+40, BL	9	10	9-10
0+45, BL	9	10	8-10
0+50, BL	9	9	7-10
0+54, BL	8	8	-
0+25, 2R	11	13	-
0+30, 2R	11	15	-
0+35, 2R	11	13	-
0+00, 5R	7	7	7-9
0+05, 5R	9	9	8-9
0+10, 5R	8	9	8-9
0+15, 5R	9	9	8-9
0+20, 5R	9	10	8-10
0+22.5, 5R	10	9	-
0+25, 5R	e	e	-
0+30, 5R	e	e	-
0+35, 5R	e	e	9-10
0+39.5, 5R	10	9	-
0+40, 5R	10	9	8-10
0+45, 5R	10	9	9-10
0+50, 5R	9	10	9-11
0+54, 5R	8	9	-
0+50, 8R	9	12	-
0+25, 9.6R	8	7	-
0+30, 9.6R	8	9	-
0+35, 9.6R	8	8	-
0+00, 10R	8	8	6-9
0+05, 10R	9	9	8-10
0+10, 10R	9	9	8-11
0+15, 10R	8	9	8-10
0+20, 10R	8	9	8-11
0+25, 10R	8	7	7-10
0+30, 10R	8	9	8-10
0+35, 10R	8	8	8-11

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+40, 10R	9	10	8-11
0+45, 10R	9	10	8-11
0+47.5, 10R	10	11	-
0+50, 10R	e	e	9-11
0+53, 10R	10	11	-
0+54, 10R	10	11	-
0+00, 15R	8	8	-
0+05, 15R	9	9	-
0+10, 15R	8	9	-
0+15, 15R	8	8	-
0+20, 15R	8	8	-
0+25, 15R	9	10	-
0+30, 15R	9	9	-
0+35, 15R	10	11	-
0+40, 15R	10	11	-
0+45, 15R	11	11	-
0+50, 15R	e	e	-
0+54, 15R	9	10	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analysis on the property at 1129 Central Avenue, Colonie, New York (AL043)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
		Systematic samples[d]		
AL43S1A	0+10, 14R	0-5	0.79 ± 0.13	0.87
AL43S1B	0+10, 14R	5-15	-	0.60
AL43S2A	0+05, 5R	0-5	-	8.0
AL43S2B	0+05, 5R	5-15	-	3.4
AL43S3A	0+20, 1.5R	0-5	-	4.3
AL43S3B	0+20, 1.5R	5-15	-	0.67
AL43S4A	0+23, 2R	0-5	-	29
AL43S4B	0+23, 2R	5-15	-	12
AL43S5A	0+28, 1.5R	0-5	-	42
AL43S5B	0+28, 1.5R	5-15	-	12
AL43S6A	0+36, 1.5R	0-5	-	29
AL43S6B	0+36, 1.5R	5-15	-	6.6
AL43S7A	0+50, 5R	0-5	-	5.0
AL43S7B	0+50, 5R	5-15	-	0.90
AL43S8A	0+40, 9R	0-5	-	3.0
AL43S8B	0+40, 9R	5-15	-	1.8
AL43S9A	0+35, 15R	0-5	-	7.7
AL43S9B	0+35, 15R	5-15	-	0.70
AL43S10A	0+25, 12R	0-5	-	0.80
AL43S10B	0+25, 12R	5-15	-	0.53
AL43S11A	0+05, BL	0-5	-	0.87
AL43S11B	0+05, BL	5-15	-	0.60
AL43S12A	0+15, BL	0-5	-	4.9
AL43S12B	0+15, BL	5-15	-	2.1
AL43S13A	0+25, BL	0-5	-	5.3
AL43S13B	0+25, BL	5-15	-	3.8
AL43S14A	0+35, BL	0-5	-	4.2
AL43S14B	0+35, BL	5-15	-	3.0
		Biased samples[e]		
AL43B1A	0+39, 15R	0-5	-	18
AL43B1B	0+39, 15R	5-15	-	2.7

[a]Locations of soil samples are shown on Fig. 5.

[b]Indicated counting error is at the 95% confidence level (± 2σ).

[c]Total analytical error of measurement results is < ± 5% (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Results of surface analysis of structures at 1129 Central Avenue, Colonie, New York (AL043)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity					
Roof of house	4	14,28,14,<7	-	16	-
Roof of garage	2	<7,14	-	11	-
Paving and walkway	10	<7,<7,<7,14,14,14,42,28,28,14	-	18	-
Total	16	<7-42	-	16	-
Beta-Gamma					
Roof of house	4	-	0.03,0.02,0.02,0.02	-	0.02
Roof of garage	2	-	0.04,0.03	-	0.04
Paving and walkway	10	-	0.02,0.03,0.02,0.03,0.04,0.03,0.04,0.02,0.03,0.03	-	0.03
Total	16	-	0.02-0.04	-	0.03

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 erg per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

Table 5. Summary of outdoor measurements and sample results on the property at 1129 Central Avenue, Colonie, New York (AL043)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	54	6–11	9
Gamma exposure rate at surface (μR/h)[a]	54	7–15	9
Scan, gamma exposure rate near surface (μR/h)[b]	–	6–15	–
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	28	0.60–42	6.9
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	2	2.7–18	10
Concentration of ^{226}Ra in surface soil (pCi/g), systematic locations[c]	1	–	0.79
Estimated area with contamination exceeding guidelines (m^2)	–	–	53
<u>Surface measurements</u>[e]			
Alpha activity (dpm/100 cm^2)	16	<7–42	16
Beta-gamma activity (mrad/h)	16	0.02–0.04	0.03

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Biased samples, Table 3.
[e]Surface measurements, Table 4.

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1170 CENTRAL AVENUE, COLONIE, NEW YORK (AL051)

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(AL051)

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 1170 CENTRAL AVENUE, COLONIE, NEW YORK (AL051)

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1170 CENTRAL AVENUE, COLONIE, NEW YORK (AL051)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 16 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period October 23-November 2, 1984. The property at 1170 Central Avenue in Colonie, New York (AL051) was the subject of a radiological investigation on October 24, 1984.

There are two buildings on this property. The residence on Central Avenue is a two-story frame house with surrounding lawn and garden areas. The adjoining parking lot has been covered with gravel. Building 2 on Kraft Avenue is a buisness on the first floor and a residence on the second floor. Both buildings share the same backyard which is partially covered with grass and shrubs. A diagram of the property showing the approximate property boundaries and grid network established for measurements outside the buildings is shown in Fig. 1. The rectangular lot included in the radiological survey was ~40.3 m deep by 28 m wide. Front and side views of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha and beta-gamma activity from surfaces of structures outdoors on the property. A comprehensive description of the survey methods and instrumentation has been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. The data is 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/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 6 to 13 μR/h (microroentgens* per hour) and averaged 9 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 6 to 15 μR/h and averaged 10 μR/h. The maximum gamma exposure rate measured was 18 μR/h along the dripline at the side of Building 1 at approximately grid location 0+20, 3R.

Soil Sampling

Fifty-seven soil samples were taken at this property. Thirty-four of these at sixteen locations [denoted as systematic samples (AL51S)] were taken without regard to gamma exposure rates at the sampling points. Twenty-three samples at ten locations [denoted biased samples (AL51B)] were selected at positions having elevated gamma exposure levels. The locations of samples are shown in Fig. 5, and the results of analysis are presented in Table 3.

---

*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.

Systematic soil samples were taken at 0 to 5 cm and at 5 to 15 cm depths from each location. Concentrations of ^{238}U in the soil samples ranged from 0.37 to 55 pCi/g (picocuries* per gram) and averaged 14 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 19 pCi/g and averaged 9 pCi/g for the 5 to 15 cm depth samples. The ratio of concentration at 0 to 5 cm to concentration at 5 to 15 cm is 2.8. The sample from grid location 0+24, 3R (AL51B1A) had the maximum concentration found on the property (87 pCi/g) was in the area at the side of Building 1.

The estimated area with contamination exceeding guidelines on the property is aproximately 15 m^2 as shown in Fig. 6.

Radium concentration in the soil ranged from 0.58 to 1.7 pCi/g and averaged 1.0 pCi/g.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the roof of the buildings and on the porches and concrete walkway. The results of these measurements are listed in Table 4. The alpha activity ranged from 19 to 46 dpm/100 cm^2 and averaged 27 dpm/100 cm^2. Beta-gamma activity ranged from 0.39 to 0.052 mrad/h and averaged 0.044 mrad/h.

A summary of the outdoor measurement results is provided in Table 5.

SIGNIFICANCE OF FINDINGS

Measurements of the gamma exposure levels outdoors on the property determined that the exposure rate at 1 m above the ground surface ranged from 6 to 13 μR/h and averaged 9 μR/h. For comparison, the typical background for the Albany area is 9 μR/h, and the background for the state of New York[8,9] averages 9.5 μR/h and ranges from 6.8 to 13 μR/h (one standard deviation) based on 51 measurements. Based on this information, there is no indication of risk to health caused by gamma exposure rates outdoors on the property.

---

*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.

The results of ^{238}U analysis establish the presence of uranium at concentrations somewhat above background on the property. The average concentration of 14 pCi/g of ^{238}U in the systematic samples is approximately 15 times the background of 0.96 pCi/g for the Albany area. However, it is below the DOE guideline[10] of 35 pCi/g of ^{238}U. The maximum concentration of ^{238}U (55 pCi/g) is approximately 1 1/2 times the DOE guideline. Approximately 15 m^2 contaminated area exceeds the DOE guideline.

The 1.0 pCi/g average for ^{226}Ra measured in the soil compares favorably with the Albany area background of 0.85 pCi/g of same element.

The average alpha activity of 27 dpm/100 cm^2 obtained by measurements on several different surface areas and roofs surveyed is well below the DOE criterion of 5000 dpm/100 cm^2 for alpha activity from natural uranium, uranium-235, or uranium-238.

The average and maximum beta-gamma activities of 0.044 mrad/h and 0.052 mrad/h are less than the DOE criteria of 0.20 and 1.0 mrad/h at 1 cm, respectively.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindekin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. Environmental Research Division, Action Description Memorandum. "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

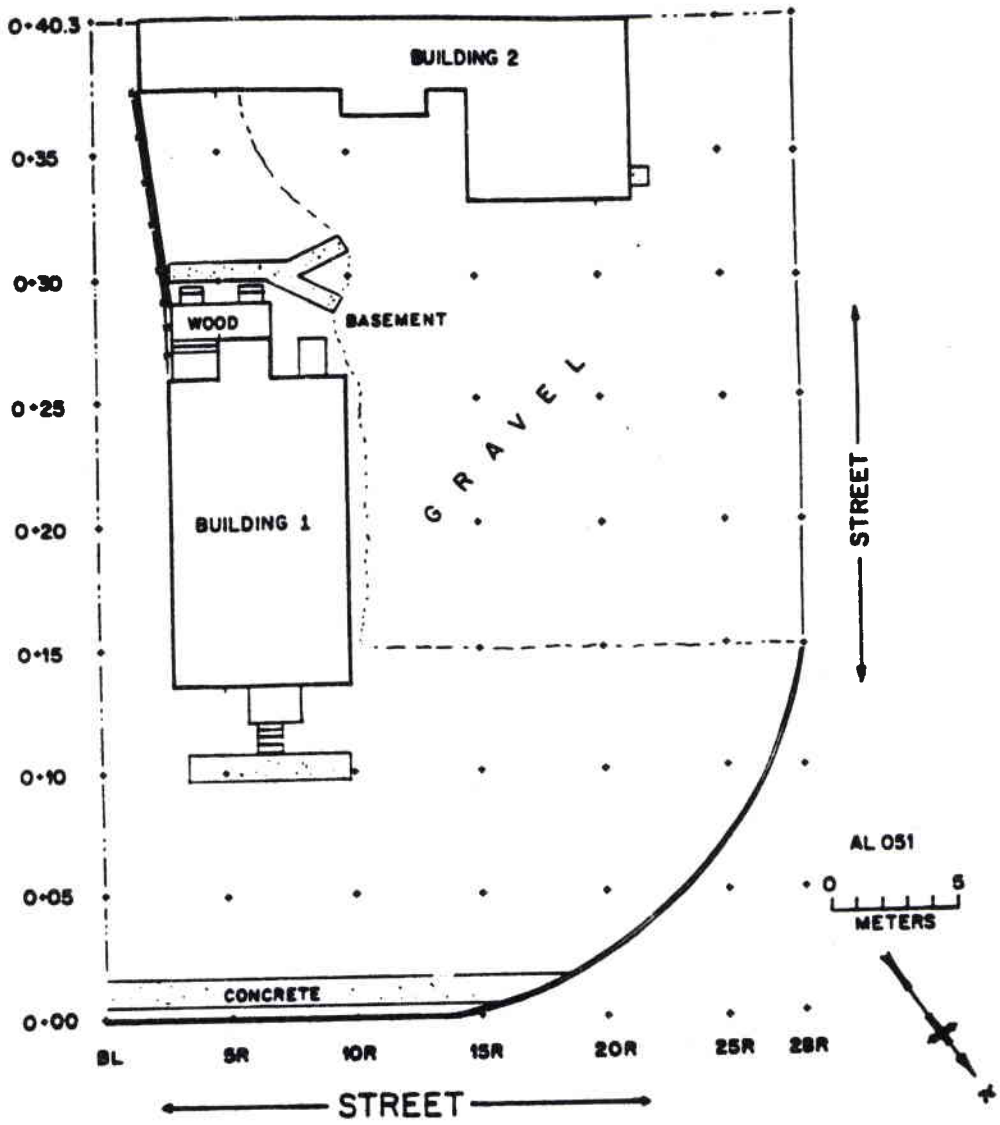

Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 1170 Central Avenue, Colonie, New York (AL051).

Fig. 2. Front view of the property at 1170 Central Avenue, Colonie, New York (AL051) looking southwest.

Fig. 3. Side view of the property at 1170 Central Avenue, Colonie, New York (AL051) looking southeast.

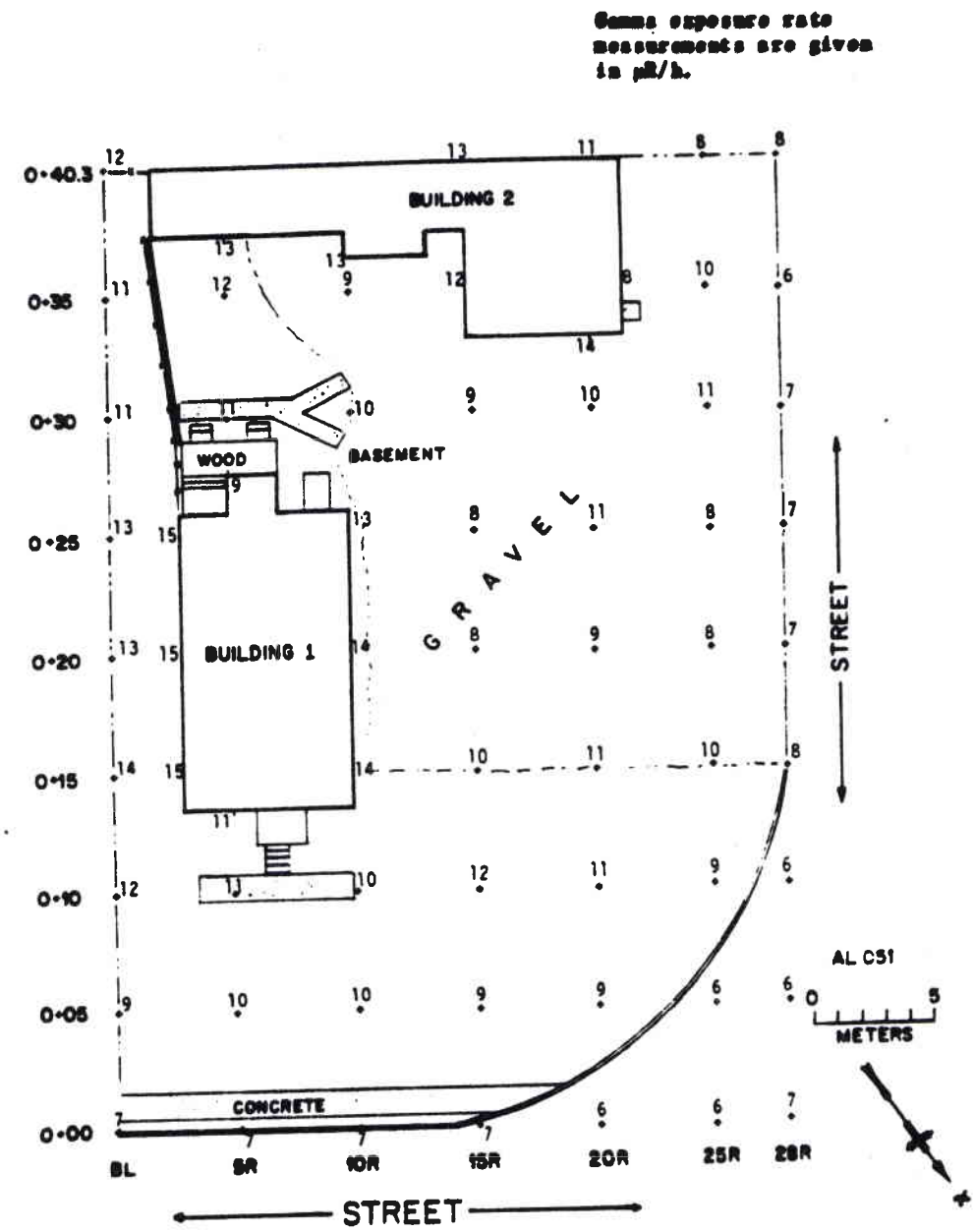

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 1170 Central Avenue, Colonie, New York (AL051).

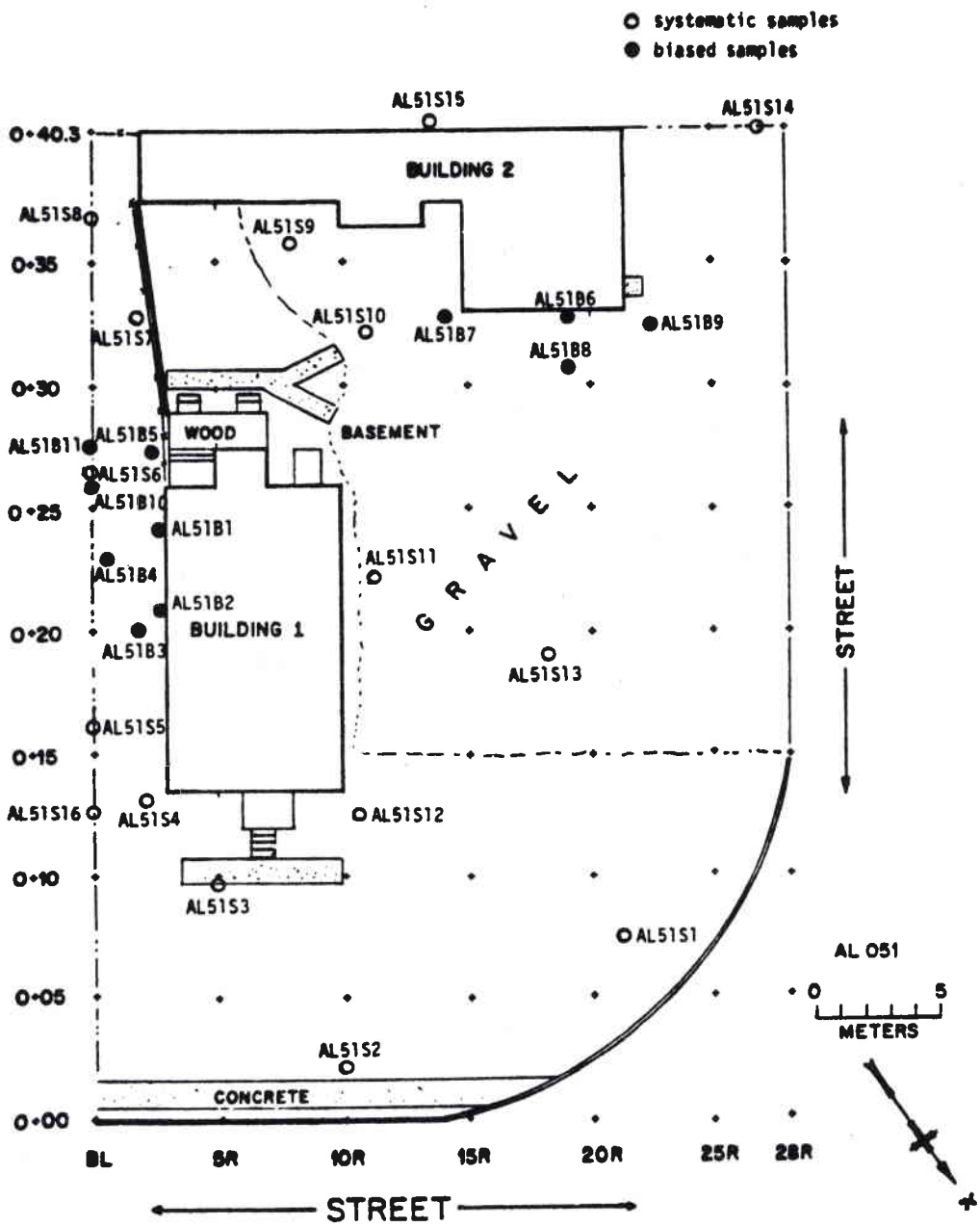

Fig. 5. Locations of soil samples on the property at 1170 Central Avenue, Colonie, New York (AL051).

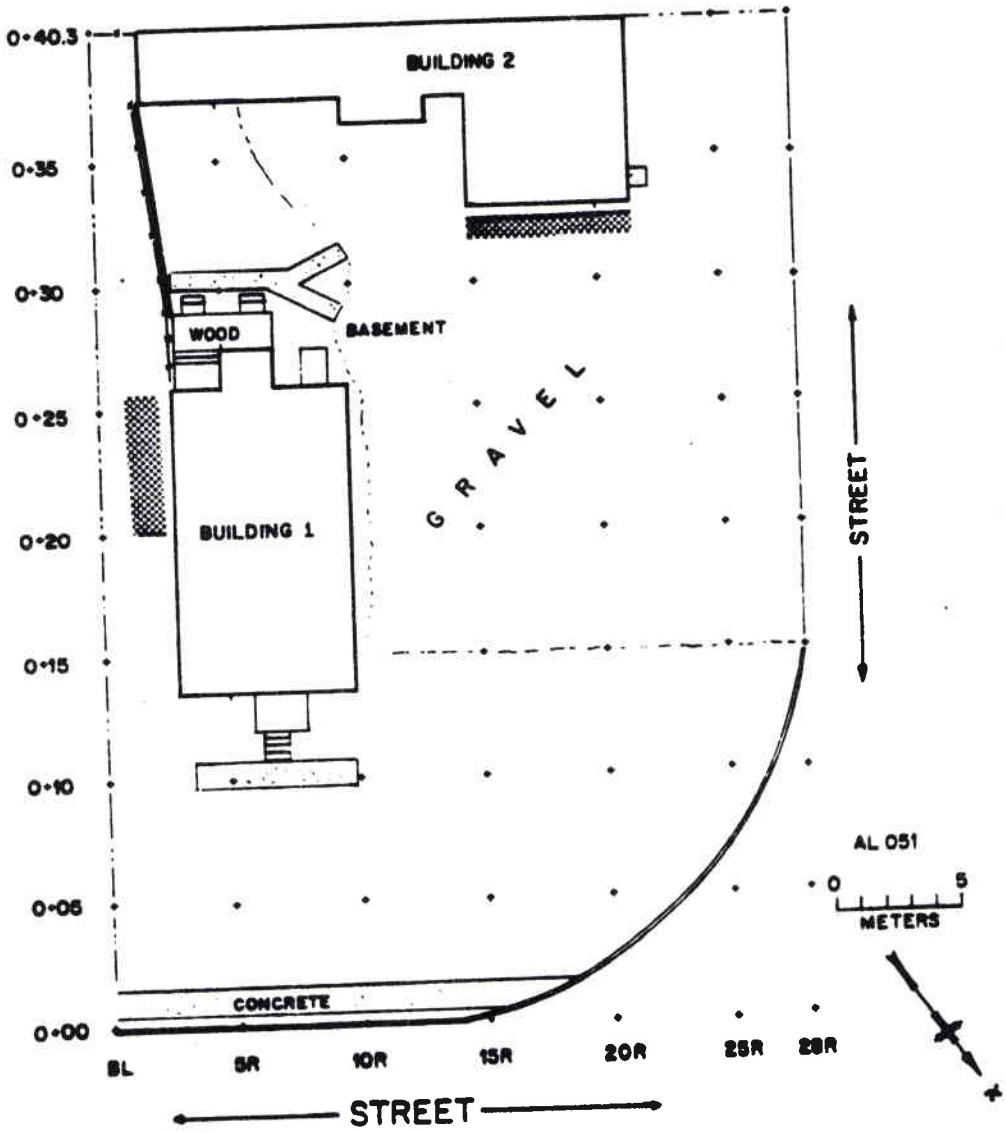

Fig. 6. Estimated area with contamination exceeding guidelines on the property at 1170 Central Avenue, Colonie, New York (AL051).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 1170 Central Avenue, Colonie, New York (AL051)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	8	7	7-13
0+05, BL	8	9	9-15
0+10, BL	11	12	11-15
0+15, BL	12	14	13-16
0+20, BL	13	13	13-18
0+25, BL	12	13	13-17
0+30, BL	11	11	11-15
0+35, BL	10	11	11-15
0+40.3, BL	11	12	-
0+15, 3R	12	15	-
0+20, 3R	13	15	-
0+25, 3R	13	15	-
0+00, 5R	8	7	6-10
0+05, 5R	9	10	8-10
0+10, 5R	11	11	8-14
0+12.5, 5R	10	11	-
0+15, 5R	e	e	-
0+20, 5R	e	e	-
0+25, 5R	e	e	8-14
0+27, 5R	9	9	-
0+30, 5R	10	11	9-12
0+35, 5R	11	12	10-12
0+37.5, 5R	11	13	-
0+40.3, 5R	e	e	-
0+00, 10R	7	7	7-11
0+05, 10R	9	10	9-14
0+10, 10R	9	10	9-16
0+15, 10R	11	14	8-15
0+20, 10R	10	14	8-14
0+25, 10R	10	13	8-13
0+30, 10R	10	10	8-13
0+35, 10R	10	9	11-15
0+37.5, 10R	11	13	-
0+40.3, 10R	e	e	-
0+00, 15R	7	7	7-13
0+05, 15R	8	9	9-13
0+10, 15R	11	12	11-13
0+15, 15R	10	10	8-11
0+20, 15R	8	8	7-11
0+25, 15R	8	8	7-10
0+30, 15R	8	9	9-17

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+35, 15R	11	12	-
0+40.3, 15R	11	13	-
0+00, 20R	6	6	6-11
0+05, 20R	8	9	9-13
0+10, 20R	10	11	9-12
0+15, 20R	11	11	7-11
0+20, 20R	8	9	7-9
0+25, 20R	11	11	6-11
0+30, 20R	10	10	10-15
0+33, 20R	12	14	-
0+35, 20R	e	e	-
0+40.3, 20R	10	11	-
0+35, 21.5R	8	8	-
0+00, 25R	6	6	6-7
0+05, 25R	6	6	6-10
0+10, 25R	8	9	6-11
0+15, 25R	9	10	8-10
0+20, 25R	8	8	8-10
0+25, 25R	8	8	8-10
0+30, 25R	10	11	8-11
0+35, 25R	8	10	-
0+40.3, 25R	8	8	-
0+00, 28R	6	7	-
0+05, 28R	6	6	-
0+10, 28R	7	6	-
0+15, 28R	8	8	-
0+20, 28R	8	7	-
0+25, 28R	8	7	-
0+30, 28R	8	7	-
0+35, 28R	7	6	-
0+40.3, 28R	8	8	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analysis on the property at 1170 Central Avenue, Colonie, New York (AL051)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
			Systematic samples[d]	
AL51S1A	0+07, 21R	0-5	0.58 ± 0.07	17
AL51S1B	0+07, 21R	5-15	-	3.2
AL51S2A	0+02, 10R	0-5	-	0.37
AL51S2B	0+02, 10R	5-15	-	0.77
AL51S3A	0+10, 5R	0-5	-	17
AL51S3B	0+10, 5R	5-15	-	9.7
AL51S4A	0+13, 2R	0-5	-	22
AL51S4B	0+13, 2R	5-15	-	6.3
AL51S5A	0+16, BL	0-5	-	12
AL51S5B	0+16, BL	5-15	-	4.7
AL51S6A	0+26, BL	0-5	-	36
AL51S6B	0+26, BL	5-15	-	9.7
AL51S7A	0+33, 2R	0-5	-	16
AL51S7B	0+33, 2R	5-15	-	16
AL51S7C	0+33, 2R	15-30	-	5.0
AL51S8A	0+37, BL	0-5	-	20
AL51S8B	0+37, BL	5-15	-	13
AL51S9A	0+35.5, 8R	0-5	-	9.3
AL51S9B	0+35.5, 8R	5-15	-	3.7
AL51S10A	0+32, 11R	0-5	-	0.67
AL51S10B	0+32, 11R	5-15	-	0.70
AL51S11A	0+22, 11R	0-5	-	14
AL51S11B	0+22, 11R	5-15	-	1.4
AL51S12A	0+13, 10.5R	0-5	-	23
AL51S12B	0+13, 10.5R	5-15	-	19
AL51S13A	0+19, 18R	0-5	-	0.67
AL51S13B	0+19, 18R	5-15	-	0.60
AL51S14A	0+40.3, 27R	0-5	-	13
AL51S14B	0+40.3, 27R	5-15	-	5.0
AL51S15A	0+40.3, 13.5R	0-5	-	45
AL51S15B	0+40.3, 13.5R	5-15	-	44
AL51S16A	0+12.5, BL	0-5	1.7 ± 0.11	55
AL51S16B	0+12.5, BL	5-15	-	10
AL51S16C	0+12.5, BL	15-30	-	8

Table 3 (continued)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
		Biased samples[e]		
AL51B1A	0+24, 3R	0-5	-	87
AL51B1B	0+24, 3R	5-15	-	12
AL51B2A	0+21, 3R	0-5	-	52
AL51B2B	0+21, 3R	5-15	-	21
AL51B3A	0+20, 2R	0-5	-	13
AL51B3B	0+20, 2R	5-15	-	5.3
AL51B3C	0+20, 2R	15-30	-	0.77
AL51B4A	0+23, 1R	0-5	1.2 ± 0.08	17
AL51B4B	0+23, 1R	5-15	-	5.0
AL51B4C	0+23, 1R	35-40	0.80 ± 0.06	0.93
AL51B5A	0+27, 2.5R	0-5	-	21
AL51B5B	0+27, 2.5R	5-15	-	7.0
AL51B6A	0+33, 19R	0-5	-	50
AL51B6B	0+33, 19R	5-15	-	6.7
AL51B6C	0+33, 19R	28-35	-	2.9
AL51B7A	0+32.5, 14R	0-5	-	1.9
AL51B7B	0+32.5, 14R	5-15	-	1.9
AL51B8A	0+31, 19R	0-5	-	1.3
AL51B8B	0+31, 19R	5-15	-	1.2
AL51B9A	0+33, 23R	0-5	-	3.3
AL51B9B	0+33, 23R	5-15	-	0.90
AL51B10A	0+26, BL	0-5	-	22
AL51B10B	0+26, BL	5-15	-	16

[a]Locations of soil samples are shown on Fig. 5.

[b]Indicated counting error is at the 95% confidence level (± 2σ).

[c]Analytical error of measurement results is < ± 5% (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Results of surface analysis of structures at 1170 Central Avenue, Colonie, New York (AL051)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity					
Roof of house	5	25,32,19,19,45	-	28	-
Concrete walkway	1	19	-	19	-
Total	6	19-45	-	26.5	-
Beta-Gamma					
Roof of house	-	-	0.039,0.044,0.048, 0.053,0.042,0.039	-	0.045
Concrete walkway	-	-	0.039	-	0.039
Total	-	-	0.039-0.053	-	0.044

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 ergs per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

Table 5. Summary of outdoor measurements and sample results on the property at 1170 Central Avenue, Colonie, New York (AL051)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	66	6–13	9
Gamma exposure rate at surface (μR/h)[a]	66	6–15	10
Scan, gamma exposure rate near surface (μR/h)[b]	–	6–18	–
Concentration of ^{238}U in soil (pCi/g), systematic locations[c]	34	0.37–55	14
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	23	0.77–0.9	15.2
Concentration of ^{226}Ra in soil (pCi/g), systematic locations[c]	4	0.58–1.7	1.0
Estimated area of contamination exceeding guidelines (m^2)	–	–	15
<u>Surface measurements</u>[e]			
Alpha activity (dpm/100 cm^2)			
Roof of house	6	19–45	26.5
Concrete walkway	1	19	19
Beta-gamma activity (mrad/h)			
Roof of house	6	0.039–0.053	0.044
Concrete walkway	1	0.039	0.039

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Biased samples, Table 3.
[e]Surface measurements, Table 4.

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(AL052)

RESULTS OF THE RADIOLOGICAL SURVEY AT 1168 CENTRAL AVENUE, COLONIE, NEW YORK (AL052)

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(AL052)

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 1168 CENTRAL AVENUE, COLONIE, NEW YORK (AL052)

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1168 CENTRAL AVENUE, COLONIE, NEW YORK (AL052)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 16 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period October 23-November 2, 1984. The property at 1168 Central Avenue in Colonie, New York (AL052) was the subject of a radiological investigation on October 25, 1984.

The building on this property is an unoccupied two-story frame house. The surrounding lawn and garden area are in poor condition. The gutters are torn off and part of the roofing was missing. A diagram of the property showing the approximate property boundaries and grid network established for measurements outside the building is shown in Fig. 1. The rectangular lot included in the radiological survey was ~42 m deep by 11 m wide. Front and back views of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha and beta-gamma activity from surfaces of structures outdoors on the property. A comprehensive description of the survey methods and instrumentation has been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. The data is 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/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 7 to 14 μR/h (microroentgens* per hour) and averaged 12 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 7 to 20 μR/h and averaged 13 μR/h. The maximum gamma exposure rate measured was 20 μR/h along the dripline at the side of the house at approximately grid location 0+24, BL.

Soil Sampling

Thirty-six soil samples were taken at this property. Twenty-five of these at twelve locations [denoted as systematic samples (AL52S)] were taken without regard to gamma exposure rates at the sampling points. Eleven samples at six locations [denoted biased samples (AL51B)] were selected at positions having elevated gamma exposure levels. The locations of samples are shown in Fig. 5, and the results of analysis are presented in Table 3.

---

*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.

Samples were taken at 0 to 5 cm and at 5 to 15 cm depths from each location. Concentrations of ^{238}U in the systematic soil samples ranged from 0.90 to 60 pCi/g (picocuries* per gram) and averaged 22 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 31 pCi/g and averaged 14 pCi/g in the 5 to 15 cm depth samples. The ratio of concentration at 0 to 5 cm to concentration at 5 to 15 cm is 3.74. The sample from grid location 0+22.5, 1.2R (AL52B1A) had the maximum concentration found on the property (410 pCi/g) on the southeast side of the house.

Estimated approximately 86 m^2 area with contamination exceeding guidelines on the property is shown in Fig. 6.

Radium concentration in the soil ranged from 0.86 to 1.7 pCi/g and averaged 1.1 pCi/g. The average background concentration for the Albany area is 0.85 pCi/g ^{226}Ra.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the roof of the house. The alpha activity ranged from 54 to 163 dpm/100 cm^2 and averaged 95 dpm/100 cm^2. Beta-gamma activity ranged from 0.03 to 0.12 mrad/h and averaged 0.06 mrad/h. The data is presented in Table 4.

A summary of the outdoor measurement results is provided in Table 5.

SIGNIFICANCE OF FINDINGS

Measurements of the gamma exposure levels outdoors on the property determined that the exposure rates at 1 m above the ground surface ranged from 7 to 14 μR/h and averaged 12 μR/h; a level slightly greater than the background for the Albany area. For comparison, the background for the Albany area is 9 μR/h; and the background for the state of New York[8,9] averages 9.5 μR/h and ranges from 6.8 to 13 μR/h (one standard deviation) based on 51 measurements. Based on this information, there is no indication of risk to health caused by gamma exposure rates outdoors on the property.

---

*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.

The results of ^{238}U analysis establish the presence of uranium at concentrations above background on the property. The average concentration of 22 pCi/g of ^{238}U in the systematic samples is approximately 23 times the normal background of 0.96 pCi/g for the Albany area. However, this value is below the DOE guideline[10] of 35 pCi/g of ^{238}U. The maximum concentration of ^{238}U (410 pCi/g) is approximately 12 times the DOE guideline. Approximately 15 m^2 contaminated area exceeds the DOE guideline.

The 1.0 pCi/g average for ^{226}Ra measured in the soil compares favorably with the Albany area background of 0.85 pCi/g of same element.

The average alpha activity of 95 dpm/100 cm^2 obtained by measurements on several different surface areas and roof surveyed is well below the DOE criterion of 5000 dpm/100 cm^2 for alpha activity from natural uranium, uranium-235, or uranium-238. The average and maximum beta-gamma activities of 0.06 mrad/h and 0.12 mrad/h are less than the DOE criteria of 0.20 and 1.0 mrad/h at 1 cm, respectively.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindekin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. Environmental Research Division, Action Description Memorandum. "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

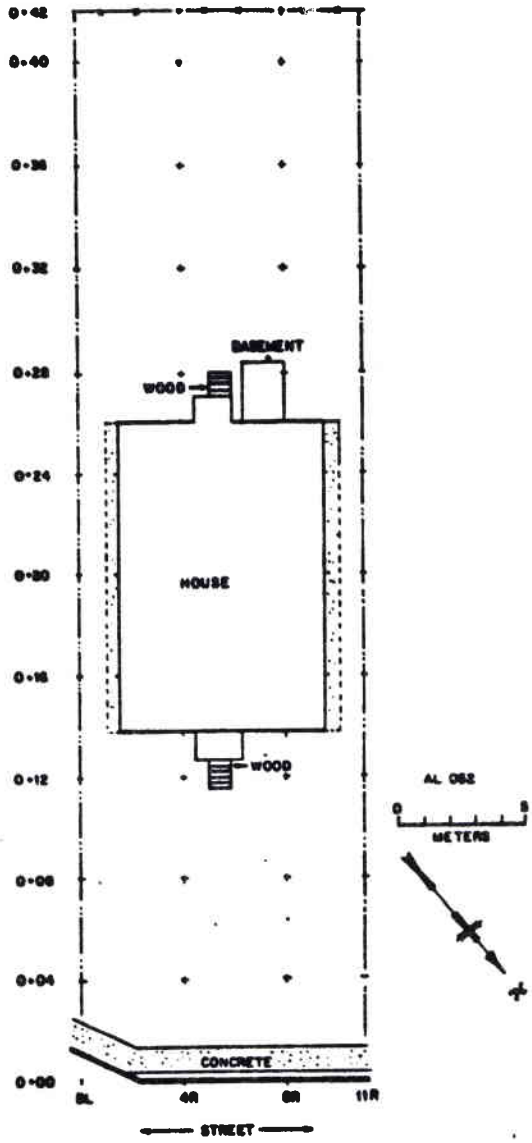

Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 1168 Central Avenue, Colonie, New York (AL052).

Fig. 2. Front view of the property at 1168 Central Avenue, Colonie, New York (AL052) looking southwest.

Fig. 3. Back view of the property at 1168 Central Avenue, Colonie, New York (AL052) looking northeast.

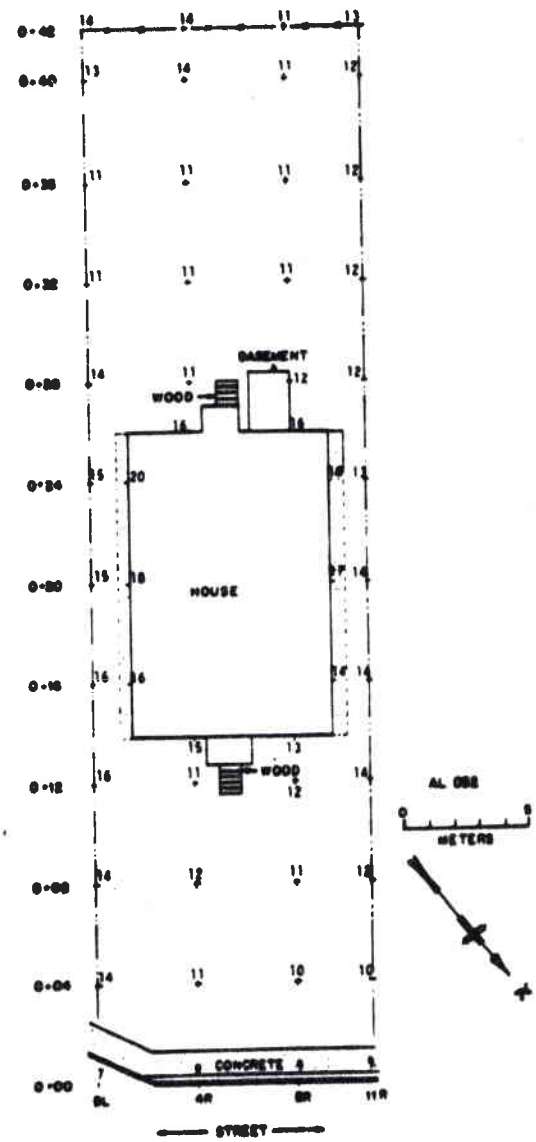

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 1168 Central Avenue, Colonie, New York (AL052).

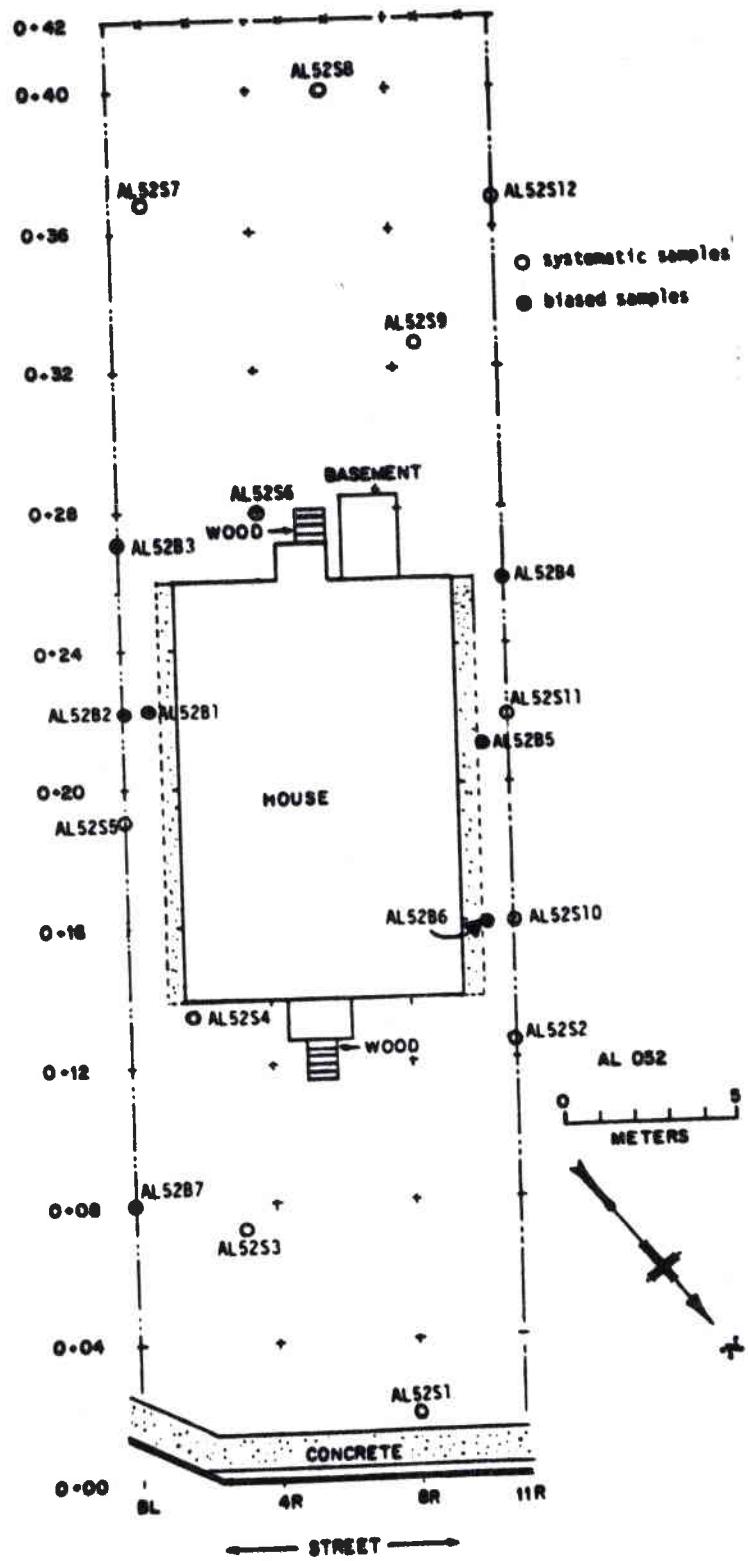

Fig. 5. Locations of soil samples on the property at 1168 Central Avenue, Colonie, New York (AL052).

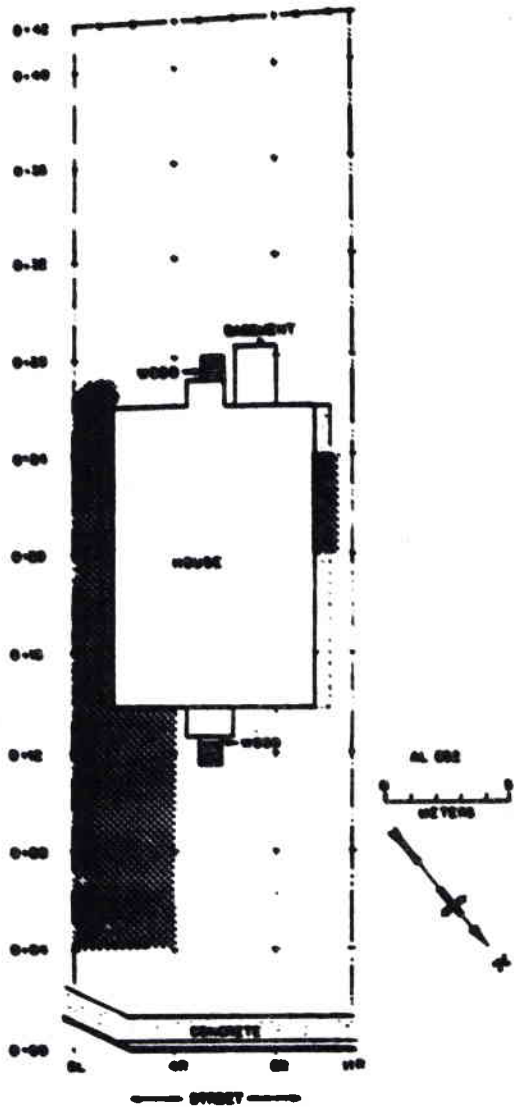

Fig. 6. Estimated area with contamination exceeding guidelines on the property at 1168 Central Avenue, Colonie, New York (AL052).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 1168 Central Avenue, Colonie, New York (AL052)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	7	7	7-12
0+04, BL	11	14	11-15
0+08, BL	13	14	11-15
0+12, BL	14	16	11-16
0+16, BL	13	16	12-18
0+20, BL	14	15	15-19
0+24, BL	14	15	15-20
0+28, BL	13	14	11-15
0+32, BL	10	11	11-15
0+36, BL	11	11	11-15
0+40, BL	12	13	11-15
0+42, BL	13	14	-
0+16, 1.5R	12	16	-
0+20, 1.5R	14	18	-
0+24, 1.5R	14	20	-
0+00, 4R	8	9	7-11
0+04, 4R	11	11	9-12
0+08, 4R	11	12	10-13
0+12, 4R	11	11	10-12
0+13.8, 4R	11	15	-
0+16, 4R	e	e	-
0+20, 4R	e	e	-
0+24, 4R	e	e	11-14
0+26, 4R	12	16	-
0+28, 4R	11	11	11-14
0+32, 4R	11	11	10-12
0+36, 4R	11	11	10-13
0+40, 4R	11	14	9-14
0+42, 4R	11	14	-
0+00, 8R	8	9	8-10
0+04, 8R	8	10	10-13
0+08, 8R	10	11	10-15
0+12, 8R	11	12	11-15
0+13.8, 8R	11	13	-
0+16, 8R	e	e	12-16
0+20, 8R	e	e	13-18
0+24, 8R	e	e	11-14
0+26, 8R	12	16	-
0+28, 8R	11	12	11-13
0+32, 8R	12	11	10-13
0+36, 8R	11	11	10-12

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+40, 8R	10	11	10-12
0+42, 8R	11	11	-
0+16, 9.5R	14	14	-
0+20, 9.5R	14	17	-
0+24, 9.5R	14	16	-
0+00, 11R	8	9	-
0+04, 11R	8	10	-
0+08, 11R	11	12	-
0+12, 11R	13	14	-
0+16, 11R	12	14	-
0+20, 11R	13	14	-
0+24, 11R	12	13	-
0+28, 11R	12	12	-
0+32, 11R	11	12	-
0+36, 11R	11	12	-
0+40, 11R	11	12	-
0+42, 11R	11	13	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analysis on the property at 1168 Central Avenue, Colonie, New York (AL052)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
		Systematic samples[d]		
AL52S1A	0+02, 8R	0-5	-	1.0
AL52S1B	0+02, 8R	5-15	-	0.90
AL52S2A	0+12.5, 11R	0-5	0.86 ± 0.13	55
AL52S2B	0+12.5, 11	5-15	-	10
AL52S2C	0+12.5, 11	15-30	1.7 ± 0.11	8.0
AL52S3A	0+07, 3R	0-5	-	37
AL52S3B	0+07, 3R	5-15	-	12
AL52S4A	0+13, 1.5R	0-5	-	8.2
AL52S4B	0+13, 1.5R	5-15	-	49
AL52S5A	0+19, BL	0-5	-	60
AL52S5B	0+19, BL	5-15	-	23
AL52S6A	0+28, 4R	0-5	-	40
AL52S6B	0+28, 4R	5-15	-	2.7
AL52S7A	0+37, 1R	0-5	-	52
AL52S7B	0+37, 1R	5-15	-	30
AL52S8A	0+40, 6R	0-5	-	24
AL52S8B	0+40, 6R	5-15	-	9.7
AL52S9A	0+33, 9R	0-5	-	28
AL52S9B	0+33, 9R	5-15	-	5.0
AL52S10A	0+16, 11R	0-5	-	12
AL52S10B	0+16, 11R	5-15	-	4.7
AL52S11A	0+26, 11R	0-5	-	36
AL52S11B	0+26, 11R	5-15	-	9.7
AL52S12A	0+37, 11R	0-5	-	24
AL52S12B	0+37, 11R	5-15	-	13
		Biased samples[e]		
AL52B1A	0+22.5, 1.2R	0-5	0.85 ± 0.12	410
AL52B2A	0+22.5, BL	0-5	-	48
AL52B2B	0+22.5, BL	5-15	-	13
AL52B2C	0+22.5, BL	15-30	-	5.0
AL52B2D	0+22.5, BL	30-45	-	0.67
AL52B3A	0+27, BL	0-5	-	72
AL52B3B	0+27, BL	5-15	-	12

Table 3 (continued)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
AL52B4A	0+26, 11R	0-5	-	22
AL52B4B	0+26, 11R	5-15	-	16
AL52B5A	0+21, 9.5R	0-5	-	120
AL52B6A	0+16, 9.5R	0-5	-	40
AL52B7A	0+08, BL	0-5	-	79
AL52B7B	0+08, BL	5-15	-	60
AL52B7C	0+08, BL	15-30	-	6.3
AL52B7D	0+08, BL	30-45	-	1.2

[a]Locations of soil samples are shown on Fig. 5.

[b]Indicated counting error is at the 95% confidence level ($\pm 2\sigma$).

[c]Analytical error of measurement results is $< \pm 5\%$ (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Results of surface analysis of structures at 1168 Central Avenue, Colonie, New York (AL052)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity					
Roof of house	3	54,163,68	-	95	-
Beta-Gamma					
Roof of house	3	-	0.03,0.12,0.04	-	0.06

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 ergs per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

Table 5. Summary of outdoor measurements and sample results on the property at 1168 Central Avenue, Colonie, New York (AL052)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	54	7-14	12
Gamma exposure rate at surface (μR/h)[a]	54	7-20	13
Scan, gamma exposure rate near surface (μR/h)[b]	-	7-20	-
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	25	0.90-60	22
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	11	0.67-410	70
Concentration of ^{226}Ra in surface soil (pCi/g), systematic locations[c]	3	0.86-1.7	1.1
Estimated area of contamination exceeding guidelines (m^2)	-	-	86
<u>Surface measurements</u>[e]			
Alpha activity (dpm/100 cm^2)			
Roof of house	3	54-163	95
Beta-gamma activity (mrad/h)			
Roof of house	3	0.03-0.12	0.06

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Biased samples, Table 3.
[e]Surface measurements, Table 4.

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1166 CENTRAL AVENUE, COLONIE, NEW YORK (AL053)

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ORNL/RASA-85/8
(AL053)

Health and Safety Research Division

RESULTS OF THE RADIOLOGICAL SURVEY AT 1166 CENTRAL AVENUE, COLONIE, NEW YORK (AL053)

M. G. Yalcintas, B. A. Berven, and W. D. Cottrell

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1166 CENTRAL AVENUE, ALBANY, NEW YORK (AL053)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the DOE in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 16 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period October 23-November 2, 1984. The property at 1166 Central Avenue in Colonie, New York (AL053) was the subject of a radiological investigation on October 25, 1984.

The building on this property is a two-story frame house and occupied. A diagram of the property showing the approximate property boundaries and grid network established for measurements outside the house is shown in Fig. 1. The rectangular lot included in the radiological survey was ~42 m deep by 12.5 m wide. Front and back views of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha and beta-gamma activity from surfaces of structures outdoors on the property. A comprehensive description of the survey methods and instrumentation has been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. The data is 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/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 6 to 12 μR/h (microroentgens* per hour) and averaged 9 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 6 to 16 μR/h and averaged 10 μR/h. The gamma exposure rate measured was 22 μR/h around the dripline at the east side of the house around the drip line at approximately grid locations 0+12, 8L and 0+28, 8L.

---

*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.

Soil Sampling

Fifty-eigth soil samples were taken at this property. Fourteen of these at seven locations [denoted as systematic samples (AL053S)] were taken without regard to gamma exposure rates at the sampling points. Forty-four samples at nineteen locations [denoted biased samples (AL053B)] were selected at positions having elevated gamma exposure levels. The locations of samples are shown on Fig. 5, and results of analysis are presented in Table 3.

Samples were taken at 0 to 5 cm and at 5 to 15 cm depths from each location. Concentrations of ^{238}U in the soil samples ranged from 1.4 to 60 pCi/g (picocuries* per gram) and averaged 22 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm, and 5 to 15 cm depth samples averaged 31 pCi/g and 15 pCi/g, respectively. The ratio of concentration at 0 to 5 cm to concentration at 5 to 15 cm is 2.55. The sample from grid location 0+19, BL (AL53S7A), having the maximum concentration found on the property (60 pCi/g) on the west side of the house.

The estimated area with contamination exceeding guidelines on the property approximately 40 m^2 is shown in Fig. 6.

Radium concentration was measured in 5 systematic and 9 biased soil samples. The concentration of ^{226}Ra ranged from 0.6 to 1.5 pCi/g and averaged 0.79 pCi/g. The average background concentration for the Albany area is 0.85 pCi/g ^{226}Ra.

Surface Measurements

Alpha and beta-gamma activity measurements were taken at selected locations on the roof of the house, the porch, and on the concrete walkway. The results of these measurements are listed in Table 4. The alpha activity ranged from 20 to 74 dpm/100 cm^2 and averaged 40 dpm/100 cm^2. Beta-gamma activity ranged from 0.025 to 0.048 mrad/h and averaged 0.037 mrad/h.

A summary of the surface analysis of structures is provided in Table 5.

---

*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.

SIGNIFICANCE OF FINDINGS

Measurements of the gamma exposure levels outdoors on the property determined that the exposure rates at 1 m above the ground surface ranged from 6 to 12 μR/h and averaged 9 μR/h, the same as the background for the albany area. For comparison, the typical background for the Albany area is 9 μR/h; and the background for the state of New York[8,9] averages 9.5 μR/h and ranges from 6.8 to 13 μR/h (one standard deviation) based on 51 measurements. Based on this information, there is no indication of risk to health caused by gamma exposure outdoors on the property.

The results of ^{238}U analysis establish the presence of uranium at concentrations significantly above background on the property. The average concentration of 23 pCi/g of ^{238}U in the systematic samples is approximately 24 times the background of 0.96 pCi/g for the Albany area. This value is below the DOE guideline[10] of 35 pCi/g of ^{238}U.

The average concentration of ^{238}U for biased samples is 68 pCi/g and approximately 70 times of the background for Albany area. This average value is higher than the DOE guideline[10] of 35 pCi/g of ^{238}U. The maximum concentration of ^{238}U (330 and 300 pCi/g) in biased samples is approximately nine times the DOE guideline[10].

The average (37 dpm/100 cm^2) alpha activity on several different surface areas surveyed is at the background (13 dpm/100 cm^2), and well below the DOE criterion of 5000 dpm/100 cm^2 for alpha activity from natural uranium, uranium-235, and/or uranium-238.

The average and maximum beta-gamma activities of 0.037 mrad/h and 0.045 mrad/h are less than the DOE criteria of 0.20 and 1.0 mrad/h at 1 cm, respectively.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/EQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindekin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. Environmental Research Division, Argonne National Laboratory, Argonne, IL, "Action Description memorandum. Proposed FY 84 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site", June 5, 1984.

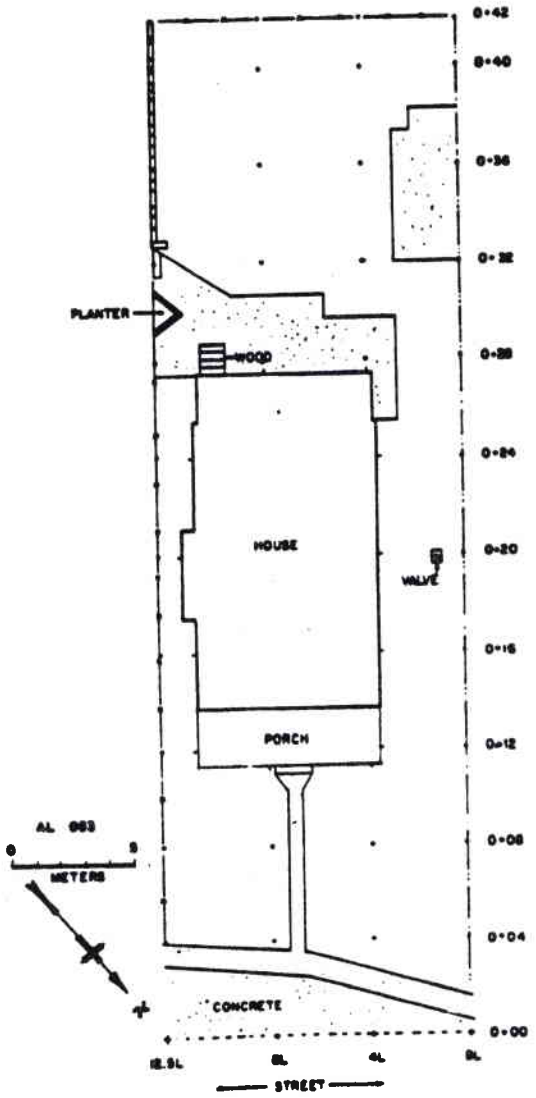

Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 1166 Central Avenue, Colonie, New York (AL053).

Fig. 2. Front view of the property at 1166 Central Avenue, Colonie, New York (AL053) looking southwest.

Fig. 3. Back view of the property at 1166 Central Avenue, Colonie, New York (AL053) looking northeast.

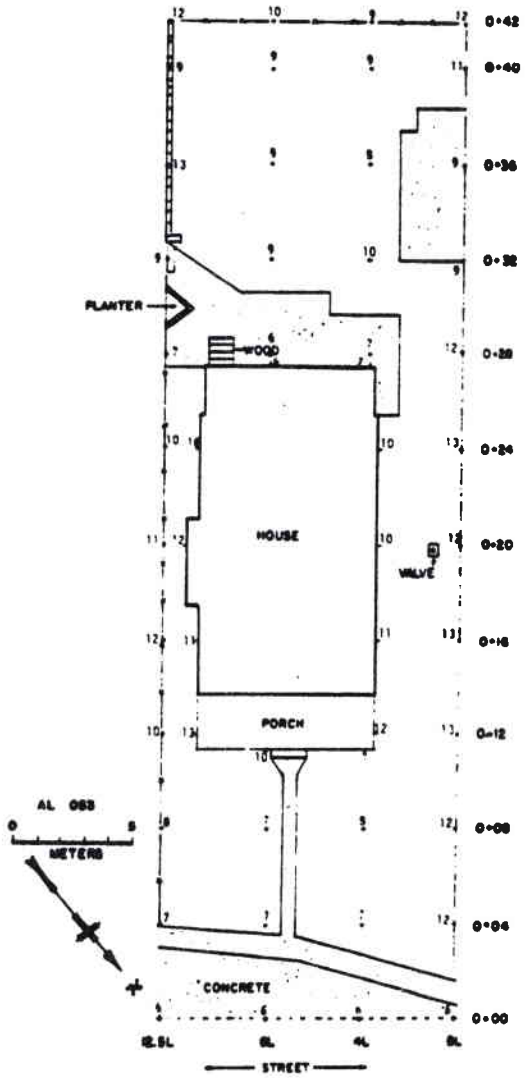

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 1166 Central Avenue, Colonie, New York (AL053).

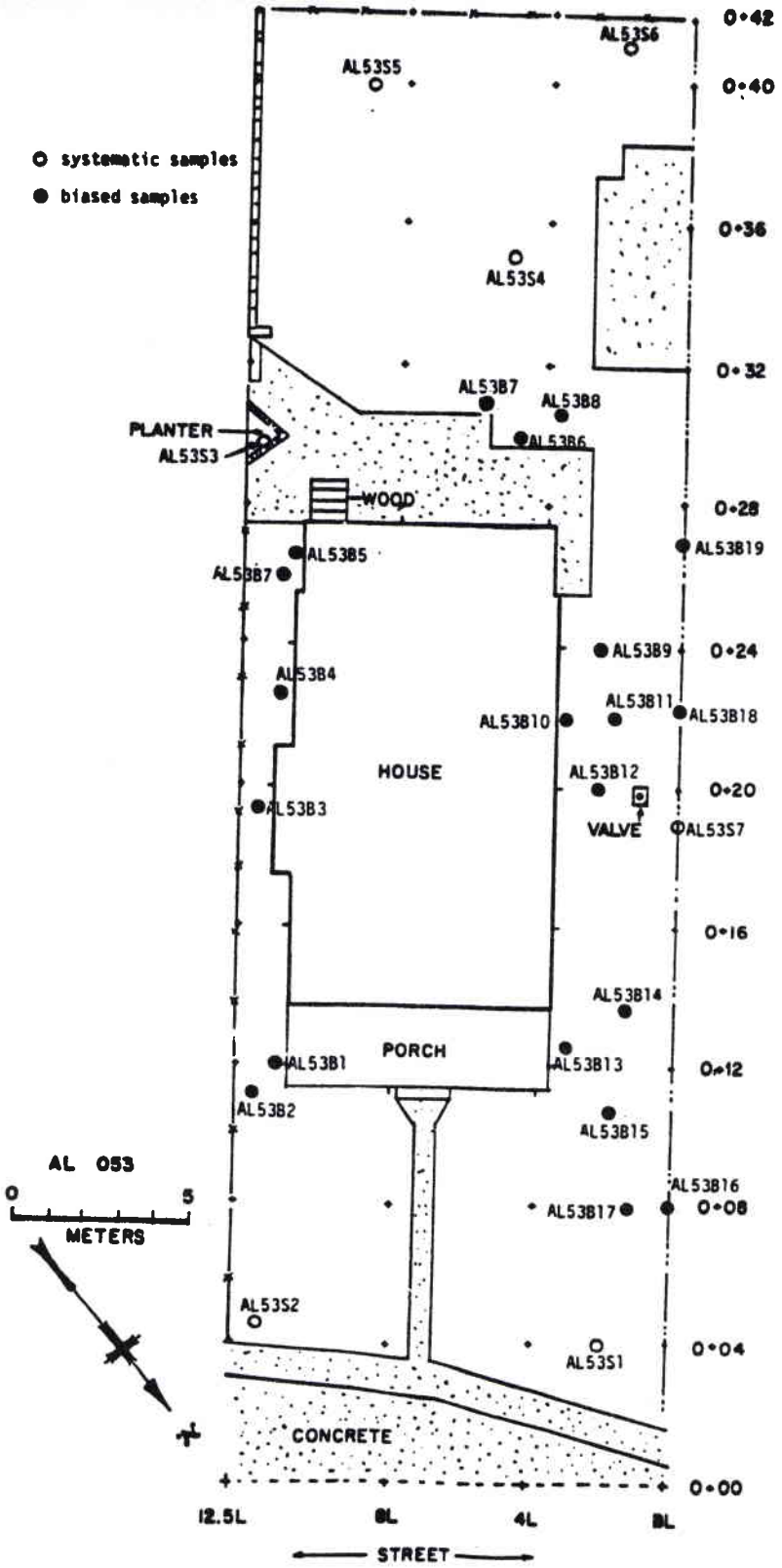

Fig. 5. Locations of soil samples on the property at 1166 Central Avenue, Colonie, New York (AL053).

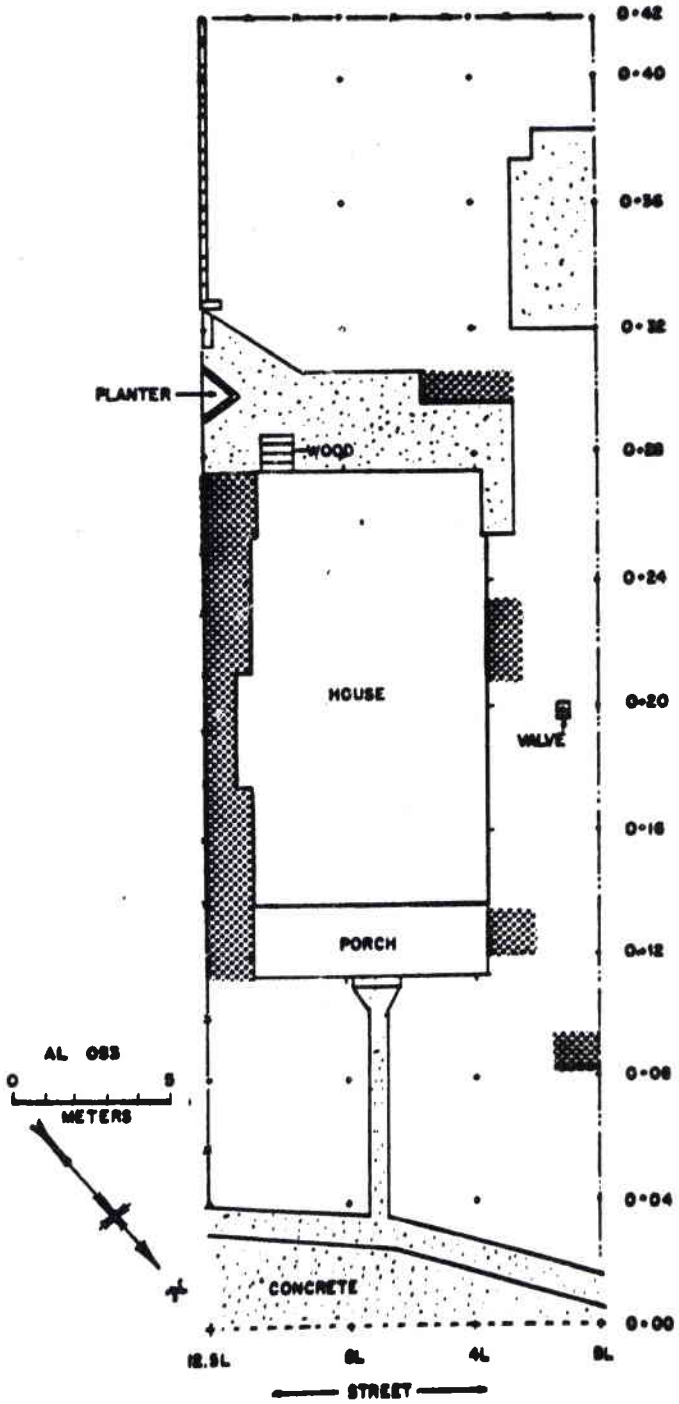

Fig. 6. Estimated area with contamination exceeding guidelines on the property at 1166 Central Avenue, Colonie, New York (AL053).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 1166 Central Avenue, Colonie, New York (AL053)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	6	6	6-9
0+04, BL	9	12	8-12
0+08, BL	11	12	9-13
0+12, BL	11	13	10-16
0+16, BL	11	13	10-13
0+20, BL	11	12	10-16
0+24, BL	12	13	7-12
0+28, BL	11	12	7-13
0+32, BL	9	9	7-10
0+36, BL	9	9	8-10
0+40, BL	10	11	8-13
0+42, BL	11	12	-
0+12, 3.5L	10	12	-
0+16, 3.5L	11	11	-
0+20, 3.5L	11	10	-
0+24, 3.5L	9	10	-
0+00, 4L	7	6	4-7
0+04, 4L	7	7	6-8
0+08, 4L	8	8	4-8
0+11, 4L	7	7	-
0+12, 4L	e	e	-
0+16, 4L	e	e	-
0+20, 4L	e	e	-
0+24, 4L	e	e	-
0+27.5, 4L	8	7	-
0+28, 4L	8	7	6-16
0+32, 4L	9	10	8-10
0+36, 4L	7	8	8-10
0+40, 4L	9	9	8-11
0+42, 4L	10	9	-
0+00, 8L	6	6	5-8
0+04, 8L	7	7	6-8
0+08, 8L	7	7	7-17
0+11, 8L	8	10	-
0+12, 8L	e	e	9-22
0+16, 8L	e	e	10-12
0+20, 8L	e	e	10-18
0+24, 8L	e	e	6-17
0+27.5, 8L	7	6	-
0+28, 8L	7	6	5-20
0+32, 8L	9	9	7-18

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+36, 8L	9	9	8-10
0+40, 8L	9	9	8-17
0+42, 8L	9	10	-
0+12, 11L	9	13	-
0+16, 11L	10	11	-
0+24, 11L	11	16	-
0+20, 11.5L	9	12	-
0+00, 12.5L	7	6	-
0+04, 12.5L	7	7	-
0+08, 12.5L	7	8	-
0+12, 12.5L	9	10	-
0+16, 12.5L	11	12	-
0+20, 12.5L	9	11	-
0+24, 12.5L	9	10	-
0+28, 12.5L	7	7	-
0+32, 12.5L	9	9	-
0+36, 12.5L	10	13	-
0+40, 12.5L	8	9	-
0+42, 12.5L	10	12	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 3.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analyses on the property at 1166 Central Avenue, Colonie, New York (AL053)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
			Systematic samples[d]	
AL53S1A	0+04, 2L	0-5	0.64 ± 0.09	5.7
AL53S1B	0+04, 2L	5-15	-	1.4
AL53S2A	0+4.5, 11.5L	0-5	-	14
AL53S2B	0+4.5, 11.5L	5-15	-	9.3
AL53S3A	0+30, 11.5L	0-5	0.70 ± 0.13	23
AL53S3B	0+30, 11.5L	5-15	-	14
AL53S4A	0+35, 5L	0-5	-	50
AL53S4B	0+35, 5L	5-15	1.5 ± 0.08	34
AL53S5A	0+40, 9L	0-5	0.72 ± 0.09	22
AL53S5B	0+40, 9L	5-15	-	13
AL53S6A	0+41, 2L	0-5	0.65 ± 0.15	44
AL53S6B	0+41, 2L	5-15	-	9.0
AL53S7A	0+19, BL	0-5	-	60
AL53S7B	0+19, BL	5-15	-	23
			Biased samples[e]	
AL53B1A	0+12, 11L	0-5	-	170
AL53B1B	0+12, 11L	5-15	0.69 ± 0.11	130
AL53B2A	0+11, 12L	0-5	-	73
AL53B2B	0+11, 12L	5-15	-	8.7
AL53B3A	0+19, 12L	0-5	-	5.0
AL53B3B	0+19, 12L	5-15	-	100
AL53B4A	0+22.5, 11.5L	0-5	0.85 ± 0.15	330
AL53B4B	0+22.5, 11.5L	5-15	0.71 ± 0.12	160
AL53B5A	0+26, 11L	0-5	0.83 ± 0.10	53
AL53B5B	0+26, 11L	5-15	0.60 ± 0.04	11
AL53B6A	0+30, 5L	0-5	-	240
AL53B6B	0+30, 5L	5-15	-	110
AL53B7A	0+31, 6L	0-5	-	40
AL53B7B	0+31, 6L	5-15	-	13
AL53B8A	0+30.5, 3.5L	0-5	0.75 ± 0.13	140
AL53B8B	0+30.5, 3.5L	5-15	-	22
AL53B9A	0+24, 2.5L	0-5	-	80
AL53B9B	0+24, 2.5L	5-15	-	3.3
AL53B10A	0+22, 3L	0-5	-	120
AL53B10B	0+22, 3L	5-15	1.0 ± 0.10	58
AL53B11A	0+22, 2L	0-5	-	17
AL53B11B	0+22, 2L	5-15	-	2.5

Table 3 (continued)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
AL53B12A	0+20, 2.5L	0-5	0.70 ± 0.06	69
AL53B12B	0+20, 2.5L	5-15	-	4.0
AL53B13A	0+12.5, 3L	0-5	-	300
AL53B13B	0+12.5, 3L	5-15	-	18
AL53B14A	0+13.5, 1.5L	0-5	0.7 ± 0.05	35
AL53B14B	0+13.5, 1.5L	5-15	-	4.3
AL53B14C	0+13.5, 1.5L	15-30	-	0.90
AL53B14D	0+13.5, 1.5L	30-45	-	0.67
AL53B15A	0+11, 2L	0-5	-	16
AL53B15B	0+11, 2L	5-15	-	100
AL53B16A	0+08, BL	0-5	-	79
AL53B16B	0+08, BL	5-15	-	60
AL53B16C	0+08, BL	15-30	-	6.3
AL53B16D	0+08, BL	30-45	-	1.2
AL53B17A	0+08, 1.5L	0-5	-	23
AL53B17B	0+08, 1.5L	5-15	-	4.7
AL53B18A	0+22.5, BL	0-5	-	48
AL53B18B	0+22.5, BL	5-15	-	13
AL53B18C	0+22.5, BL	15-30	-	5
AL53B18D	0+22.5, BL	30-45	-	0.67
AL53B19A	0+27, BL	0-5	-	72
AL53B19B	0+27, BL	5-15	-	12

[a]Locations of soil samples are shown on Fig. 5.

[b]Indicated counting error is at the 95% confidence level (± 2σ).

[c]Analytical error of measurement results is < ± 5% (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Results of surface analysis of structures at 1166 Central Avenue, Colonie, New York (AL053)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity					
Roof of house	5	34,27,20,32,74	-	37	-
Patio	1	48	-	48	-
Concrete walkway	1	34	-	34	-
Total	7	20-74	-	39.6	-
Beta-Gamma					
Roof of house	5	-	0.034,0.029,0.044,0.045,0.048	-	0.038
Patio	1	-	0.039	-	0.039
Concrete walkway	1	-	0.025	-	0.025
Total	7	-	0.025-0.048	-	0.037

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 ergs per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

Table 5. Summary of outdoor measurements and sample results on the property at 1166 Central Avenue, Colonie, New York (AL053)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	52	6-12	9
Gamma exposure rate at surface (μR/h)[a]	52	6-16	10
Scan, gamma exposure rate near surface (μR/h)[b]	-	4-22	-
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	14	1.4-60	23
Concentration of ^{238}U in surface soil (pCi/g), biased locations[d]	44	0.67-330	59
Concentration of ^{226}Ra in surface soil (pCi/g), systematic locations[c]	5	0.64-1.5	0.84
Concentration of ^{226}Ra in surface soil (pCi/g), biased locations[d]	9	0.60-1.0	0.76
Estimated area of contamination exceeding guidelines (m^2)	-	-	40
<u>Surface measurements</u>[e]			
Alpha activity (dpm/100 cm^2)			
Roof of house	5	20-74	37
Patio	1	48	48
Concrete walkway	1	34	34
Beta-gamma activity (mrad/h)			
Roof of house	5	0.029-0.048	0.038
Patio	1	0.039	0.039
Concrete walkway	1	0.025	0.025

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Biased samples, Table 3.
[e]Surface measurements, Table 4.

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1167 CENTRAL AVENUE, COLONIE, NEW YORK (AL054)

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Health and Safety Research Division

Nuclear and Chemical Waste Programs
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RESULTS OF THE RADIOLOGICAL SURVEY AT 1167 CENTRAL AVENUE, COLONIE, NEW YORK (AL054)

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Date of Issue - September 1986

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1167 CENTRAL AVENUE, COLONIE, NEW YORK (AL054)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] Radiological surveys were performed at 16 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period October 23-November 2, 1984. The property at 1167 Central Avenue in Colonie, New York (AL054) was the subject of a radiological investigation initiated on October 25, 1984.

The building on this property is a two-story frame house occupied by a business. The surrounding area is in good condition and the roof appeared to be replaced recently. A diagram of the property showing the approximate property boundaries and grid network established for measurements outside the building is shown in Fig. 1. The rectangular lot included in the radiological survey was ~47 m deep by 12 m wide. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha and beta-gamma activity from surfaces of structures outdoors on the property. A comprehensive description of the survey methods and instrumentation has been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. The data is 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/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 6 to 11 μR/h (microroentgens* per hour) and averaged 9 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 7 to 15 μR/h and averaged 9 μR/h.

Soil Sampling

Thirty-eight soil samples were taken at this property from nineteen locations. The samples, taken without strict regard to gamma exposure rates at the sampling points are denoted as systematic samples (AL54S). The locations of the samples are shown in Fig. 5, and the results of analysis are presented in Table 3.

---

*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.

Samples were taken at 0 to 5 cm and at 5 to 15 cm depths from each location. Concentrations of ^{238}U in the soil samples ranged from 0.83 to 78 pCi/g (picocuries* per gram) and averaged 11 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm depth samples averaged 15 pCi/g and averaged 7.4 pCi/g in the 5 to 15 cm depth samples. The ratio of concentration at 0 to 5 cm to concentration at 5 to 15 cm depths was 2, indicating that the higher concentrations are located near the surface. The sample from grid location 0+29, 1.5R (AL54S4A) having the maximum concentration found on the property (78 pCi/g) was from depths of 0 to 5 cm. A total area of approximately 19 m^2 located at drainage or drip-line areas of the house, Fig. 6, was found to exceed uranium concentrations of 35 pCi/g.

Radium was measured in samples AL54S2A and AL54S12A. The concentrations of ^{226}Ra averaged 0.59 pCi/g.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the asphalt paving and on the roof of the house. The results of these measurements are listed in Table 4. The alpha activity ranged from 13 to 25 dpm/100 cm^2 and averaged 20 dpm/100 cm^2. Beta-gamma activity ranged from 0.02 to 0.04 mrad/h and averaged 0.03 mrad/h.

A summary of the outdoor measurement results is provided in Table 5.

SIGNIFICANCE OF FINDINGS

The background gamma radiation exposure rate for the State of New York averages 9.5 μR/h[8,9] and averages 9 μR/h for the Albany area (Table 1). The gamma exposure rates measured on this property at 1 m above the ground surface range from 6 to 11 μR/h and average 9 μR/h (the same as the background for the Albany area). The DOE guidelines[10] state that gamma exposure rates inside occupied or habitable structures shall not exceed 20 μR/h. Gamma exposure rates outside of structures shall be such that these exposure rates, due to residual radioactivity, will not result in potential doses (assuming a conservative but plausible use scenario) in excess of 100 mrem/y for long term exposure and 500 mrem/y for short term exposure (less than 5 years). These guidelines are not exceeded at this property.

---

*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.

The DOE guideline for ^{238}U concentration in soil at the Colonie, New York site is: (a) the ^{238}U concentration shall not exceed the limits of 35 pCi/g averaged over an area of 10 m x 10 m (33 ft x 33 ft), and over 5 cm (2 in.) depth; and (b) the concentration shall not exceed the additional restriction of 100 pCi/g maximum at a 1 m x 1 m spot (1 m^2) averaged over 5 cm (2 in.) depth.[11,12] No 10 m x 10 m area was found that averaged more than 35 pCi/g of ^{238}U in the soil. The average concentration was 11 pCi/g of ^{238}U in the systematic samples, approximately eleven times the background of 0.96 pCi/g for the Albany area; however, the average concentration is well below the DOE guideline. The maximum concentration of ^{238}U measured was 78 pCi/g (sample AL5484A), well below the limit of 100 pCi/g averaged over 1 m^2 area. The 0.59 pCi/g of ^{226}Ra measured in the soil is less than the Albany area background of 0.85 pCi/g of radium-226. The concentrations of some radionuclides in the soil at this property are above background levels, but are below applicable DOE guidelines.

Surface contamination of the structures on the property, as evaluated by alpha and beta-gamma activity, was well below the DOE guidelines and the State of New York Department of Labor (DOL) Industrial Code, Rule 38.[13] The average alpha activity of 20 dpm/100 cm^2 obtained by measurements on the asphalt paving and on the roof of the building is well below the DOE limit of 5000 dpm/100 cm^2 and the DOL limit of 1000 dpm/100 cm^2 for fixed alpha activity from natural uranium, uranium-235, or uranium-238. The average and maximum beta-gamma activities of 0.03 and 0.04 mrad/h from these structures are less than the DOE limits of 0.20 and 1.0 mrad/h and the DOL limit of 0.25 mrem at 1 cm, respectively.

In summary, while some radiological measurements were in excess of background levels normally encountered in the State of New York and the Albany area, no radiation levels nor radionuclide concentrations were found to be in excess of relevant state and federal guidelines.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. F. Stoms, E. Kuerze, and W. Muskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindekin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. U.S. Department of Energy, Guidelines for Residual Radioactivity at Formerly Utilized Sites, Remedial Action Program and Remote Surplus Facilities Management Program Sites (Rev. 1, July 1985).

11. Environmental Research Division, Action Description Memorandum. "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

12. G. P. Turi, FUSRAP/Surplus Facilities Group, to James P. Alexander, Oak Ridge Operations Office (correspondence dated May 10, 1984).

13. State of New York, Department of Labor, "Ionizing Radiation Protection," Part 38 of Title 12 of The Official Compilation of Codes, Rules, and Regulations of the State of New York (cited as 12, NYCRR 38), July 10, 1978.

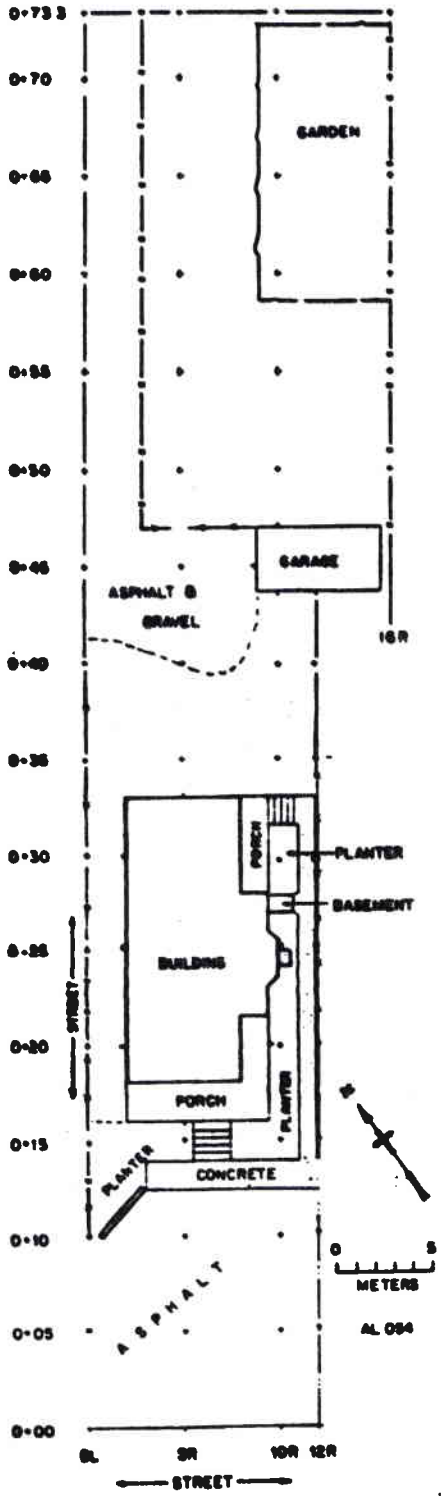
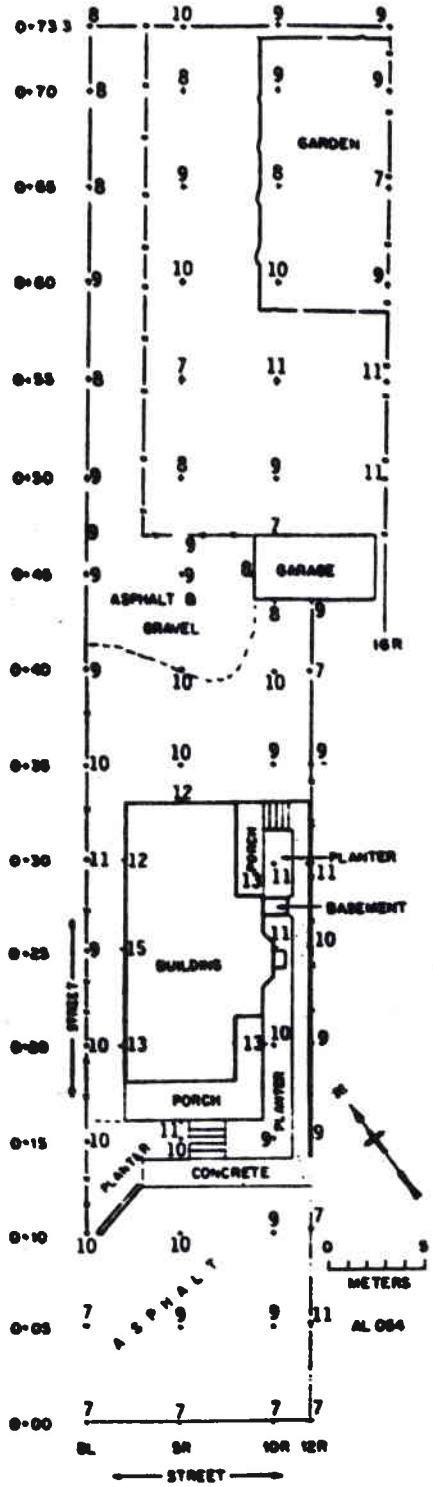


Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 1167 Central Avenue, Colonie, New York (AL054).

Fig. 2. Front view of the property at 1167 Central Avenue, Colonie, New York (AL054) looking northeast.

Fig. 3. Rear view of the property at 1167 Central Avenue, Colonie, New York (AL054) looking southwest.



Gamma exposure rate measurements are given in μR/h.

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 1167 Central Avenue, Colonie, New York (AL054).

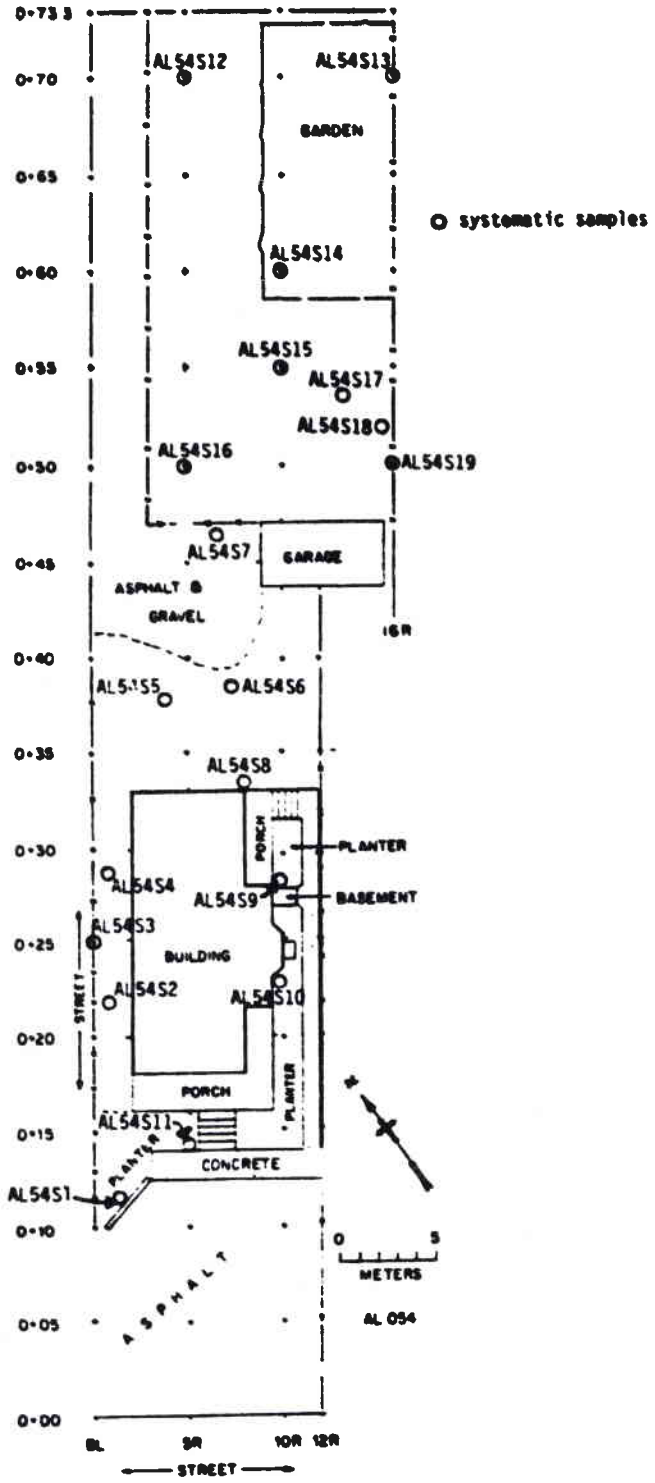


Fig. 5. Locations of soil samples on the property at 1167 Central Avenue, Colonie, New York (AL054).

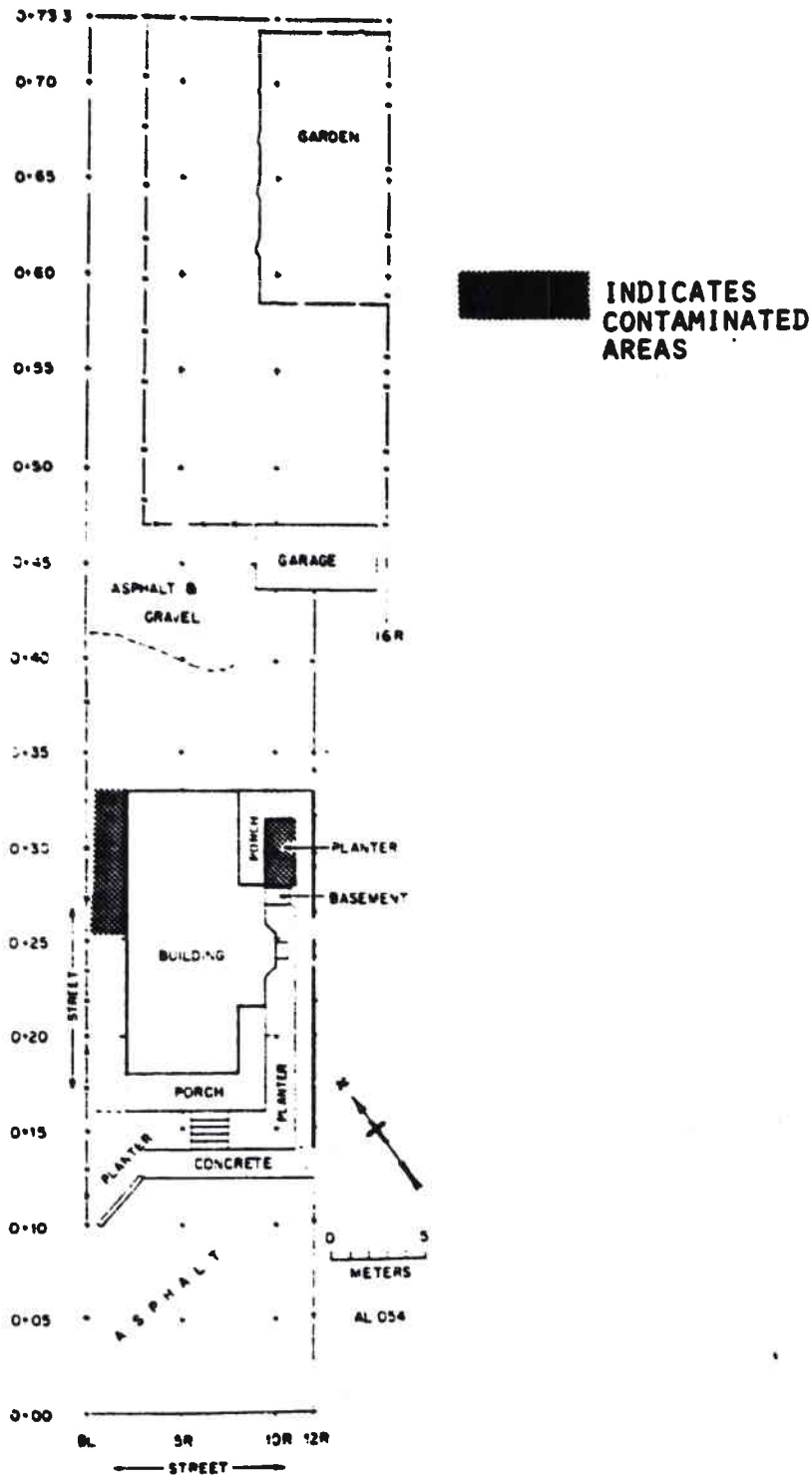


Fig. 6. Estimated area with uranium-238 concentrations exceeding 35 pCi/g in the soil of the property at 1167 Central Avenue, Colonie, New York (AL054).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 1167 Central Avenue, Colonie, New York (AL054)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	8	7	6-9
0+05, BL	8	7	7-9
0+10, BL	9	10	9-12
0+15, BL	9	10	10-15
0+20, BL	9	10	10-13
0+25, BL	8	9	9-14
0+30, BL	11	11	9-13
0+35, BL	9	10	8-11
0+40, BL	8	9	7-11
0+45, BL	9	9	8-10
0+47, BL	9	9	-
0+50, BL	8	9	8-9
0+55, BL	9	8	8-10
0+60, BL	9	9	8-10
0+65, BL	9	8	7-9
0+70, BL	7	8	8-10
0+73.3, BL	7	8	-
0+20, 2R	10	13	-
0+25, 2R	11	15	-
0+30, 2R	11	12	-
0+00, 5R	8	7	4-7
0+05, 5R	9	9	8-9
0+10, 5R	8	10	8-11
0+15, 5R	10	10	7-13
0+16, 5R	11	11	-
0+20, 5R	e	e	8-13
0+25, 5R	e	e	8-15
0+30, 5R	e	e	8-13
0+33, 5R	10	12	-
0+35, 5R	9	10	8-11
0+40, 5R	9	10	7-10
0+45, 5R	9	9	7-9
0+47, 5R	8	9	-
0+50, 5R	9	8	8-11
0+55, 5R	8	7	7-11
0+60, 5R	9	10	8-10
0+65, 5R	8	9	7-9
0+70, 5R	8	8	8-9
0+73.3, 5R	9	10	-
0+45, 9R	7	8	-
0+20, 9.5R	11	13	-
0+30, 9.5R	11	13	-

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, 10R	7	7	6-9
0+05, 10R	9	9	8-11
0+10, 10R	8	9	8-10
0+15, 10R	9	9	9-11
0+20, 10R	10	10	10-12
0+25, 10R	11	11	9-11
0+30, 10R	11	11	10-12
0+35, 10R	9	9	7-10
0+40, 10R	9	10	6-10
0.43.8, 10R	8	8	-
0+45, 10R	e	e	-
0+47, 10R	7	7	-
0+50, 10R	9	9	9-12
0+55, 10R	10	11	8-12
0+60, 10R	9	10	7-10
0+65, 10R	9	8	7-10
0+70, 10R	8	9	8-10
0.73.8, 10R	9	9	-
0+00, 12R	7	7	-
0+05, 12R	9	11	-
0+10, 12R	7	7	-
0+15, 12R	9	9	-
0+20, 12R	9	9	-
0+25, 12R	9	10	-
0+30, 12R	10	11	-
0+35, 12R	8	9	-
0+40, 12R	8	7	-
0+43.8, 12R	7	9	-
0+45, 12R	e	e	-
0+47, 12R	e	e	-
0+50, 16R	11	11	-
0+55, 16R	9	11	-
0+60, 16R	9	9	-
0+65, 16R	9	7	-
0+70, 16R	9	9	-
0.73.3, 16R	9	9	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analysis on the property at 1167 Central Avenue, Colonie, New York (AL054)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
			Systematic samples[d]	
AL54S1A	0+10.5, 2R	0-5	±	2.0
AL54S1B	0+10.5, 2R	5-15	±	3.7
AL54S2A	0+21, 1.5R	0-5	0.52 ± 0.10	16
AL54S2B	0+21, 1.5R	5-15	±	3.3
AL54S3A	0+25, BL	0-5	±	21
AL54S3B	0+25, BL	5-15	±	3.2
AL54S4A	0+29, 1.5R	0-5	±	78
AL54S4B	0+29, 1.5R	5-15	±	6.3
AL54S5A	0+37, 4R	0-5	±	10
AL54S5B	0+37, 4R	5-15	±	0.87
AL54S6A	0+38, 7R	0-5	±	5.1
AL54S6B	0+38, 7R	5-15	±	0.83
AL54S7A	0+47, 6R	0-5	±	3.6
AL54S7B	0+47, 6R	5-15	±	2.5
AL54S8A	0+33, 8R	0-5	±	7.7
AL54S8B	0+33, 8R	5-15	±	11
AL54S9A	0+28, 9.5R	0-5	±	39
AL54S9B	0+28, 9.5R	5-15	±	35
AL54S10A	0+22, 9.5R	0-5	±	13
AL54S10B	0+22, 9.5R	5-15	±	16
AL54S11A	0+14, 5R	0-5	±	11
AL54S11B	0+14, 5R	5-15	±	3.1
AL54S12A	0+70, 5R	0-5	0.65 ± 0.05	6.7
AL54S12B	0+70, 5R	5-15	±	3.3
AL54S13A	0+70, 16R	0-5	±	4.3
AL54S13B	0+70, 16R	5-15	±	5.0
AL54S14A	0+60, 10R	0-5	±	6.7
AL54S14B	0+60, 10R	5-15	±	7.3
AL54S15A	0+55, 10R	0-5	±	8.7
AL54S15B	0+55, 10R	5-15	±	8.7
AL54S16A	0+50, 5R	0-5	±	4.7
AL54S16B	0+50, 5R	5-15	±	4.7
AL54S17A	0+54, 13R	0-5	±	11
AL54S17B	0+54, 13R	5-15	±	5.0
AL54S18A	0+51.5, 15.5R	0-5	±	7.0
AL54S18B	0+51.5, 15.5R	5-15	±	6.3
AL54S19A	0+50, 16R	0-5	±	23
AL54S19B	0+50, 16R	5-15	±	14

[a]Locations of soil samples are shown on Fig. 5.

[b]Indicated counting error is at the 95% confidence level (± 2σ).

[c]Analytical error of measurement results is < ± 5% (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

Table 4. Results of surface analysis of structures at 1167 Central Avenue, Colonie, New York (AL054)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity					
Asphalt paving	3	13,20,21	-	18	-
Roof of the house	2	25,20	-	23	-
Total	5	13-25	-	20	-
Beta-Gamma					
Asphalt paving	11	-	0.03,0.03,0.03,0.03, 0.04,0.03,0.03,0.03 0.02,0.03,0.03	-	0.03
Roof of the house	2	-	0.03,0.03	-	0.03
Total	13	-	0.02-0.04	-	0.03

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 ergs per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

Table 5. Summary of outdoor measurements and sample results on the property at 6 Osborne Road, Colonie, New York (AL054)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	72	6-11	9
Gamma exposure rate at surface (μR/h)[a]	72	7-15	9
Scan, gamma exposure rate near surface (μR/h)[b]	-	4-15	-
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	38	0.83-78	11
Estimated area with ^{238}U contamination exceeding guidelines (m^2)	-	-	None
Concentration of ^{226}Ra in surface soil (pCi/g), systematic locations[c]	2	0.52-0.65	0.59
<u>Surface measurements</u>[e]			
Alpha activity (dpm/100 cm^2)	5	13-25	20
Beta-gamma activity (mrad/h)	13	0.02-0.04	0.03

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Biased samples, Table 3.
[e]Surface measurements, Table 4.

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1163/1161 CENTRAL AVENUE, COLONIE, NEW YORK (AL056)

OPERATED BY
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ORNL/RASA-85/11
(AL056)

Health and Safety Research Division

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M. G. Yalcintas, B. A. Berven, and W. D. Cottrell

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Work performed as part of the
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RESULTS OF THE RADIOLOGICAL SURVEY AT 1163/1161 CENTRAL AVENUE, COLONIE, NEW YORK (AL056)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] A radiological survey was performed at 16 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period October 23-November 2, 1984. The property at 1163/1161 Central Avenue in Colonie, New York (AL056) was the subject of a radiological investigation on October 27-28, 1984.

There are two main buildings on this property. Building 1 is a single-story brick building occupied by a business, and Building 2 (Fig. 1) is a two-story frame house and occupied. Both buildings are connected on the front by a breezway. Building 1 continues toward the back of the property as a greenhouse. On the back of the property there are two storage buildings, and that area is covered with rubble. The surrounding area is in good condition. The backyard of the house is covered with a well cared for lawn, and the front of the property is a parking lot for the business and is covered with gravel. The roof of Building 2 is covered with tar that softens in the hot weather. A diagram of the property showing the approximate property boundaries and grid network established for measurements outside the buildings is shown in Fig. 1. The rectangular lot included in the radiological survey was ~83 m deep by 23 m wide. Front and back views of the property are shown in Figs. 2 and 3, and four other views are shown in Figs. 4-7.

Soil Sampling

Sixty-five soil sample were taken at this property. Twenty-nine of these at thirteen locations [denoted as systematic samples (AL56S)] were taken without regard to gamma exposure rates at the sampling points. Thirty-six samples at eighteen locations [denoted biased samples (AL56B)] were selected at positions having elevated gamma exposure levels. The locations of samples are shown on Fig. 9, and the results of analysis are presented in Table 3.

Samples were taken at 0 to 5 cm and at 5 to 15 cm depths from each location. Concentrations of ^{238}U in the systematic soil samples ranged from 1.1 to 24 pCi/g (picocuries* per gram) and averaged 6.9 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 8.2 pCi/g and averaged 6.6 pCi/g respectively. The ratio of concentration at 0 to 5 cm to concentration at 5 to 15 cm is 2.08. The samples from grid locations 0+05, 10R and 0+32, 15R (AL56B3B) had the maximum concentrations found on the property (92 pCi/g) on the front of the property on the northwest side of Building 1.

Radium concentration in the soil ranged from 0.59 to 3.1 pCi/g and averaged 1.9 pCi/g.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the roofs of the buildings. The results of these measurements are listed in Table 4. The alpha activity ranged from 6 to 57 dpm/100 cm^2 and averaged 32 dpm/100 cm^2. Beta-gamma activity ranged from 0.036 to 0.23 mrad/h and averaged 0.06 mrad/h.

A summary of the outdoor measurement results is provided in Table 5.

---

*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.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindekin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. Environmental Research Division, Action Description Memorandum. "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

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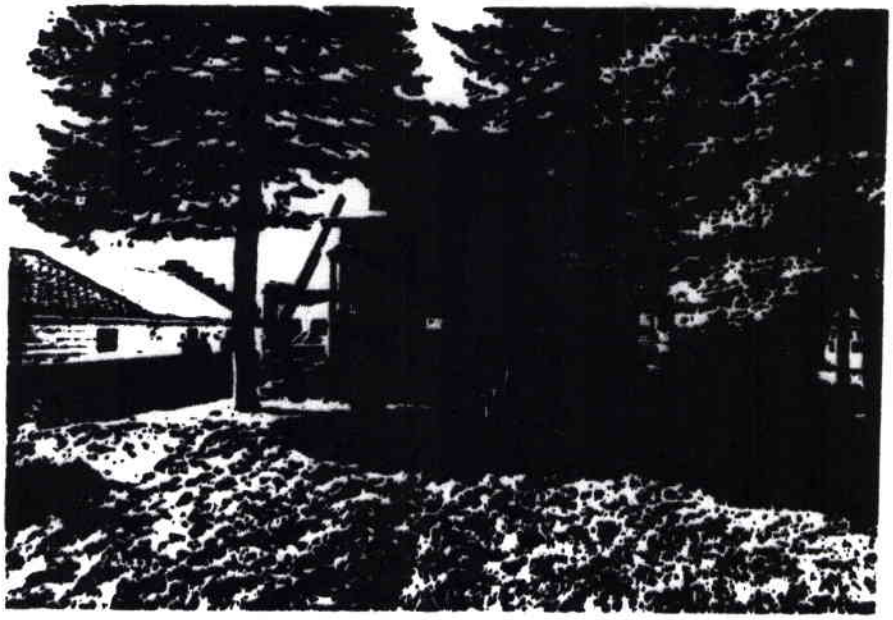


Fig. 3. Back view of the property at 1163/1161 Central Avenue, Colonie, New York (AL056) looking southwest.

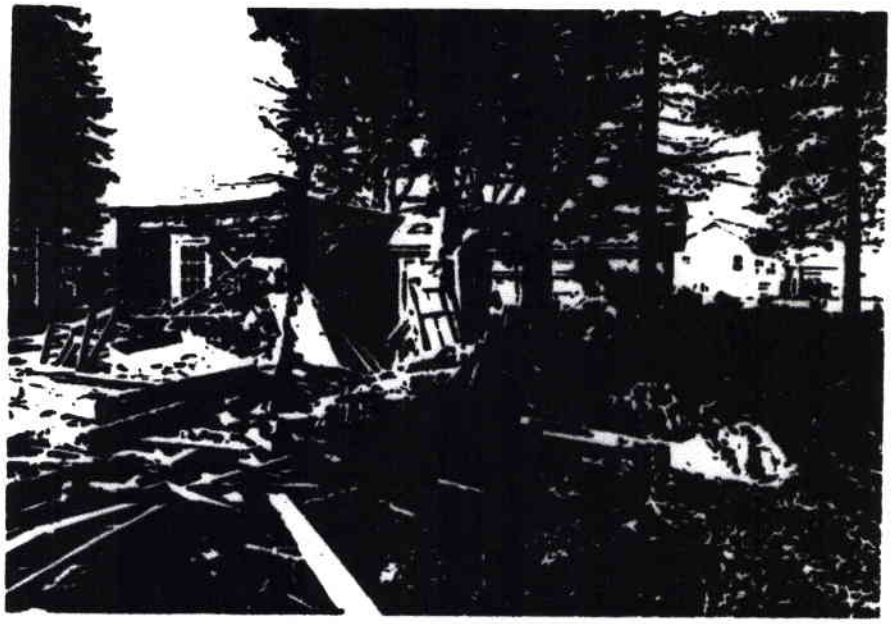
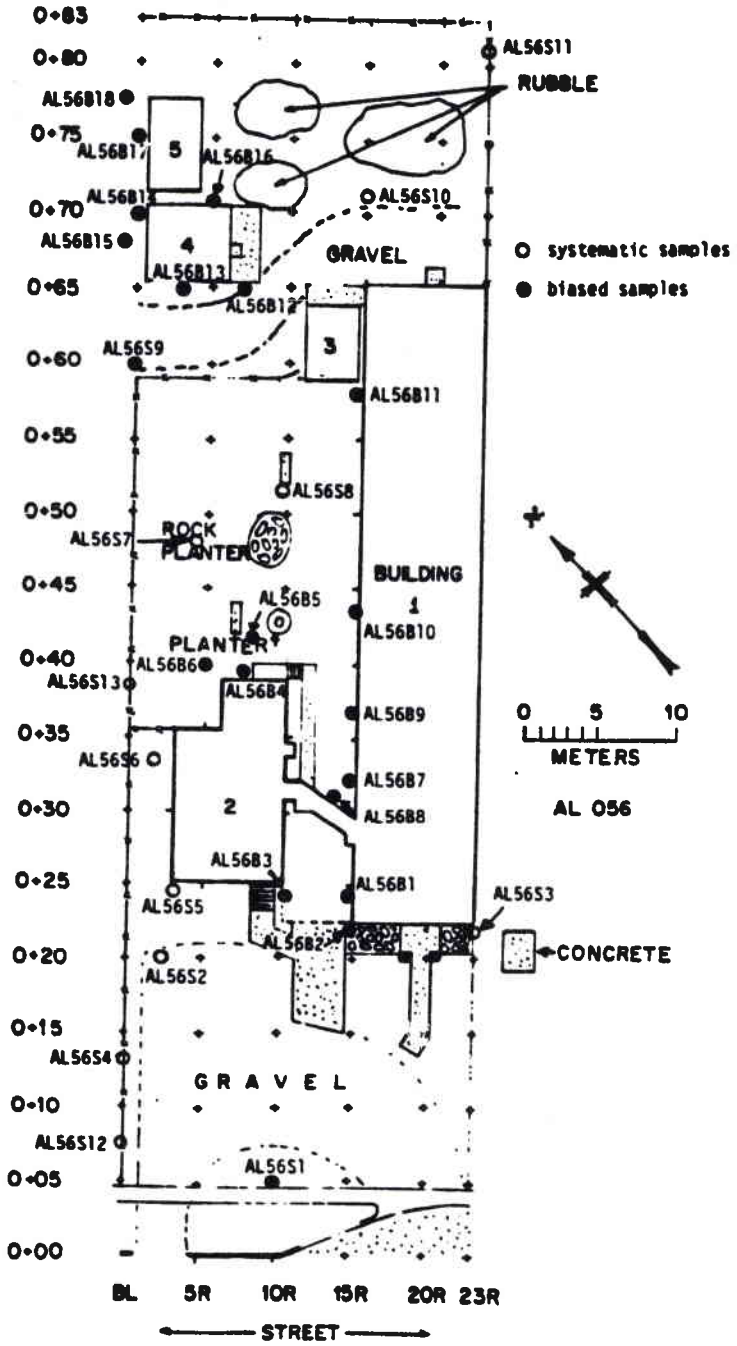


Fig. 5. Rear view of the flower shop and storage buildings on the property at 1163/1161 Central Avenue, Colonie, New York (AL056) looking southeast.

Fig. 7. Side view of the storage buildings at the rear of the property at 1163/1161 Central Avenue, Colonie, New York (AL056) looking south.



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Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+80, 5R	9	10	8-12
0+83, 5R	9	9	-
0+70, 6.5R	8	7	-
0+00, 10R	9	9	8-12
0+05, 10R	9	10	9-13
0+10, 10R	9	9	9-11
0+15, 10R	9	10	9-12
0+20, 10R	9	9	9-16
0+25, 10R	12	14	-
0+30, 10R	e	e	11-21
0+35, 10R	e	e	11-19
0+40, 10R	12	13	12-16
0+45, 10R	12	12	10-15
0+50, 10R	10	11	10-19
0+55, 10R	10	11	10-21
0+60, 10R	9	9	9-13
0+65, 10R	9	9	9-13
0+70, 10R	9	11	10-12
0+75, 10R	9	10	9-14
0+80, 10R	10	9	9-13
0+83, 10R	10	11	-
0+32, 10.5R	11	11	-
0+35, 10.5R	11	12	-
0+60, 11R	9	10	-
0+00, 15R	7	7	7-12
0+05, 15R	8	10	9-11
0+10, 15R	9	9	8-11
0+15, 15R	9	10	9-14
0+20, 15R	9	10	9-17
0+22.5, 15R	11	13	-
0+25, 15R	e	e	-
0+30, 15R	13	16	-
0+35, 15R	11	12	-
0+40, 15R	10	11	-
0+45, 15R	9	10	-

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+40, 23R	•	•	–
0+45, 23R	•	•	–
0+50, 23R	•	•	–
0+55, 23R	•	•	–
0+60, 23R	•	•	–
0+65, 23R	•	•	–
0+70, 23R	8	9	–
0+75, 23R	9	9	–
0+80, 23R	8	8	–
0+83, 23R	9	9	–

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3 (continued)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
			Biased samples[e]	
AL56B3A	0+24, 10R	0-5	-	83
AL56B3B	0+24, 10R	5-15	-	48
AL56B4A	0+39.5, 7R	0-5	-	33
AL56B4B	0+39.5, 7R	5-15	-	12
AL56B5A	0+41, 8R	0-5	-	17
AL56B5B	0+41, 8R	5-15	-	4.3
AL56B6A	0+40, 5R	0-5	-	17
AL56B6B	0+40, 5R	5-15	-	4.4
AL56B7A	0+32, 15R	0-5	-	92
AL56B7B	0+32, 15R	5-15	-	36
AL56B8A	0+31, 14R	0-5	-	29
AL56B8B	0+31, 14R	5-15	-	7.9
AL56B9A	0+37, 15R	0-5	-	7.1
AL56B9B	0+37, 15R	5-15	-	12
AL56B10A	0+43.5, 15R	0-5	-	17
AL56B10B	0+43.5, 15R	5-15	-	22
AL56B11A	0+58, 15R	0-5	-	9.6
AL56B12A	0+65, 7R	0-5	-	27
AL56B13A	0+65, 3R	0-5	-	23
AL56B13B	0+65, 3R	5-15	3.1 ± 0.12	10
AL56B13C	0+65, 3R	15-30	2.0 ± 0.09	5.8
AL56B13D	0+65, 3R	30-40	-	3.7
AL56B14A	0+70, BL	0-5	-	22
AL56B14B	0+70, BL	5-15	-	11
AL56B15A	0+68, 1L	0-5	-	2.0
AL56B15B	0+68, 1L	5-15	-	9.6
AL56B16A	0+70, 5R	0-5	-	19
AL56B16B	0+70, 5R	5-15	-	8.8
AL56B17A	0+75, BL	0-5	-	43
AL56B17B	0+75, BL	5-15	-	17
AL56B18A	0+77, 1L	0-5	-	6.2
AL56B18B	0+77, 1L	5-15	-	4.7

[a]Locations of soil samples are shown on Fig. 5.

[b]Indicated counting error is at the 95% confidence level (± 2σ).

[c]Analytical error of measurement results is < ± 5% (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e]Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 5. Summary of outdoor measurements and sample results on the property at 1163/1161 Central Avenue, Colonie, New York (AL056)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	100	7-13	10
Gamma exposure rate at surface (μR/h)[a]	100	7-20	11
Scan, gamma exposure rate near surface (μR/h)[b]	-	7-24	-
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	29	1.1-24	6.9
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	36	2.0-92	20
Concentration of ^{226}Ra in surface soil (pCi/g), systematic locations[c]	3	0.59-3.1	1.89
Estimated area with contamination exceeding guidelines (m^2)	-	-	15.5
<u>Surface measurements</u>[e]			
Alpha activity (dpm/100 cm^2)			
Roof of buildings	9	6-57	32
Asphalt paving	1	32	32
Beta-gamma activity (mrad/h)			
Roof of buildings	9	0.04-0.23	0.07
Asphalt paving	1	0.04	0.04

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Biased samples, Table 3.
[e]Surface measurements, Table 4.

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1195 CENTRAL AVENUE, COLONIE, NEW YORK (AL065)

OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
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(AL065)

Health and Safety Research Division

Nuclear and Chemical Waste Programs
(Activity No. AH 10 05 00 0; ONLWC01)

RESULTS OF THE RADIOLOGICAL SURVEY AT 1195 CENTRAL AVENUE, COLONIE, NEW YORK (AL065)

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Date of Issue - June 1986

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RESULTS OF THE RADIOLOGICAL SURVEY AT 1195 CENTRAL AVENUE, COLONIE, NEW YORK (AL065)

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.[1] Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).[2,3] Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.[1] This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.[4] Radiological surveys were performed at 16 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period October 23-November 2, 1984. The property at 1195 Central Avenue in Colonie, New York (AL065) was the subject of a radiological investigation initiated October 31, 1984.

The property was a residence located on a rectangular lot. A two-story white wood frame house faces Central Avenue. A garage located to the rear of the property has access to Central Avenue and to North Elmhurst by an extended gravel driveway. A diagram of the property showing the approximate boundaries and grid network established for measurements outside the house is shown in Fig. 1. The lot included in the radiological survey was ~47 m wide by 50 m deep and is part of a larger parcel located to the rear. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha and beta-gamma activity from surfaces of structures outdoors on the property and on the asphalt paving. A comprehensive description of the survey methods and instrumentation has been presented in another report.[6]

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. The data is 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/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 7 to 12 μR/h (microroentgens* per hour) and averaged 9 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 7 to 13 μR/h and averaged 10 μR/h. The maximum gamma exposure rate measured on the property was 17 μR/h to the rear of the house near 0+28, 14L and to the side of the garage near 0+40, 0+44, 3L.

Soil Sampling

Eighty-four soil samples were taken at this property. Eighty of these at forty locations [denoted as systematic samples (AL65S)] were taken without regard to gamma exposure rates at the sampling points. Four samples from two locations [denoted biased samples (AL65B)] were selected from positions having elevated gamma exposure rates. The locations of the samples are shown in Fig. 5, and the results of analysis are presented in Table 3.

---

*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.

Samples were taken at 0 to 5 cm and at 5 to 15 cm depths from each location. Concentrations of ^{238}U in the systematic soil samples ranged from 0.43 to 79 pCi/g (picocuries* per gram) and averaged 7.6pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 11 pCi/g and averaged 4.2 pCi/g in the 5 to 15 cm depth samples. The ratio of concentration at 0 to 5 cm to concentration at 5 to 15 cm depths was 2.6, indicating that the higher concentrations are located near the surface. The sample from grid location 0+44, 03L (AL65S15A) having the maximum concentration found on the property (79 pCi/g) was from depths of 0 to 5 cm. It was noted that the highest value, 79 pCi/g, is at the dripline of the garage and in an area containing ashes or cinders in the soil. Another location with ^{238}U concentration significantly above background, 41 pCi/g at location 0+10, 11L, is at the dripline of the house. In each case, it appears that uranium, collected on a roof, has been washed to the ground by rain and melting snow, and was absorbed and retained in the soil. It is also probable that the uranium will be diffused and become less concentrated with time as the above processes continue. These areas with probable excessive absorption, i.e., significantly above background are shown in Fig. 6 and included an area of ~18 m^2.

Radium was measured in samples AL65S14 and AL65B1. The average concentration of ^{226}Ra was 1.6 pCi/g. The probable cause of the elevated surface gamma exposure rates and the presence of radium is the residues from burning of coal. Cinders or ashes were in the soil, and it is known that residues resulting from burning of coal can contain trace elements including the naturally occurring radioactive isotopes of potassium, radium, thorium, and uranium. The presence of sufficient quantities of these elements can be observed as an increase in the gamma exposure level in an area with cinders.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the asphalt paving and on the roof of the house. The results of these measurements are listed in Table 4. The alpha activity ranged from 13 to 41 dpm/100 cm^2 and averaged 27 dpm/100 cm^2. Beta-gamma activity ranged from 0.02 to 0.03 mrad/h and averaged 0.03 mrad/h.

A summary of the outdoor measurement results is provided in Table 5.

---

*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.

SIGNIFICANCE OF FINDINGS

The background gamma radiation exposure rate for the State of New York averages 9.5 μR/h[8,9] and averages 9 μR/h for the Albany area (Table 1). The gamma exposure rate levels measured on this property at 1 m above the ground surface range from 7 to 12 μR/h and average 9 μR/h (the same as the background for the Albany area). The DOE guidelines[10] state that gamma exposure rates inside occupied or habitable structures shall not exceed 20 μR/h. Gamma exposure rates outside of structures shall be such that these exposure rates, due to residual radioactivity, will not result in potential doses (assuming a conservative but plausible use scenario) in excess of 100 mrem/y for long term exposure and 500 mrem/y for short term exposure (less than 5 years). These guidelines are not exceeded at this property.

The DOE guideline for ^{238}U concentration in soil is: (a) the ^{238}U concentration shall not exceed the limits of 35 pCi/g averaged over a depth of 5 cm (2 in.) and over an area of 10 m x 10 m (33 ft x 33 ft), and (b) the concentrations shall not exceed the additional restriction of 100 pCi/g maximum over an area of 1 m^2 averaged over 5 cm (2 in.) depth.[11,12] An estimated 18 m^2 contains more than 35 pCi/g of ^{238}U in the soil; however, when averaged over 100 m^2, requirement (a) above, the average is less than 35 pCi/g and is therefore within guidelines. The average concentration of 7.6 pCi/g of ^{238}U in the systematic samples is approximately eight times the background of 0.96 pCi/g for the Albany area; also, the average concentration is well below the DOE guideline. The maximum concentration of ^{238}U measured was 79 pCi/g in sample AL65S15A, well below the limit of 100 pCi/g. The 1.6 pCi/g of ^{226}Ra measured in the soil is 1-1/2 times the Albany area background of 0.85 pCi/g of radium-226. The concentration of radionuclides in the soil at this property are above background levels, but are below applicable DOE guidelines.

Surface contamination of the structures on the property, as evaluated by alpha and beta-gamma activity, was well below the DOE guidelines and the State of New York Department of Labor (DOL) Industrial Code, Rule 38.[13] The average alpha activity of 27 dpm/100 cm^2 obtained by measurements on the asphalt paving and on the roof of the building is well below the DOE limit of 5000 dpm/100 cm^2 and the DOL limit of 1000 dpm for fixed alpha activity from natural uranium, uranium-235, or uranium-238. The average and maximum beta-gamma activities of 0.03 and 0.03 mrad/h from these structures are less than the DOE limits of 0.20 and 1.0 mrad/h and the DOL limit of 0.25 mrem at 1 cm, respectively.

In summary, while some radiological measurements were in excess of background radiation levels normally encountered in the State of New York and the Albany area, no radiation levels were found to be in excess of relevant state and federal guidelines.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).

2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).

3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).

4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).

5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).

6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).

7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).

8. S. G. Levin, R. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).

9. C. L. Lindekin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).

10. U.S. Department of Energy, Guidelines for Residual Radioactivity at Formerly Utilized Sites, Remedial Action Program and Remote Surplus Facilities Management Program Sites (Rev. 1, July 1985).

11. Environmental Research Division, Action Description Memorandum. "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (June 5, 1984).

12. G. P. Turi, FUSRAP/Surplus Facilities Group, to James P. Alexander, Oak Ridge Operations Office (correspondence dated May 10, 1984).

13. State of New York, Department of Labor, "Ionizing Radiation Protection," Part 38 of Title 12 of The Official Compilation of Codes, Rules, and Regulations of the State of New York (cited as 12, NYCRR 38), July 10, 1978.

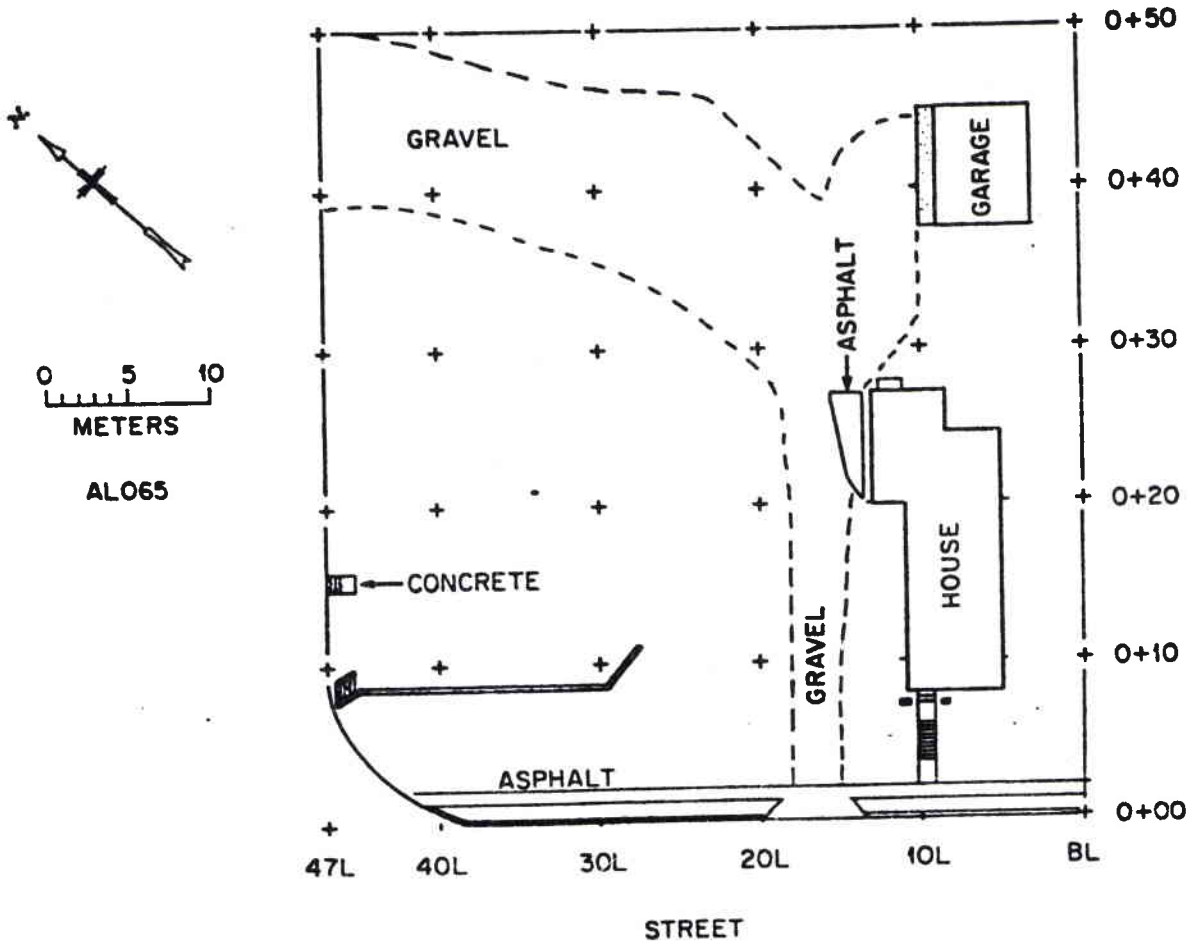

Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 1195 Central Avenue, Colonie, New York (AL065).

Fig. 2. Front view of the property at 196 Central Avenue, Colonie, New York (AL065) looking northeast.

Fig. 3. Rear view of the property at 1195 Central Avenue, Colonie, New York (AL065) looking southwest.

Gamma exposure rate measurements are given in uR/h.

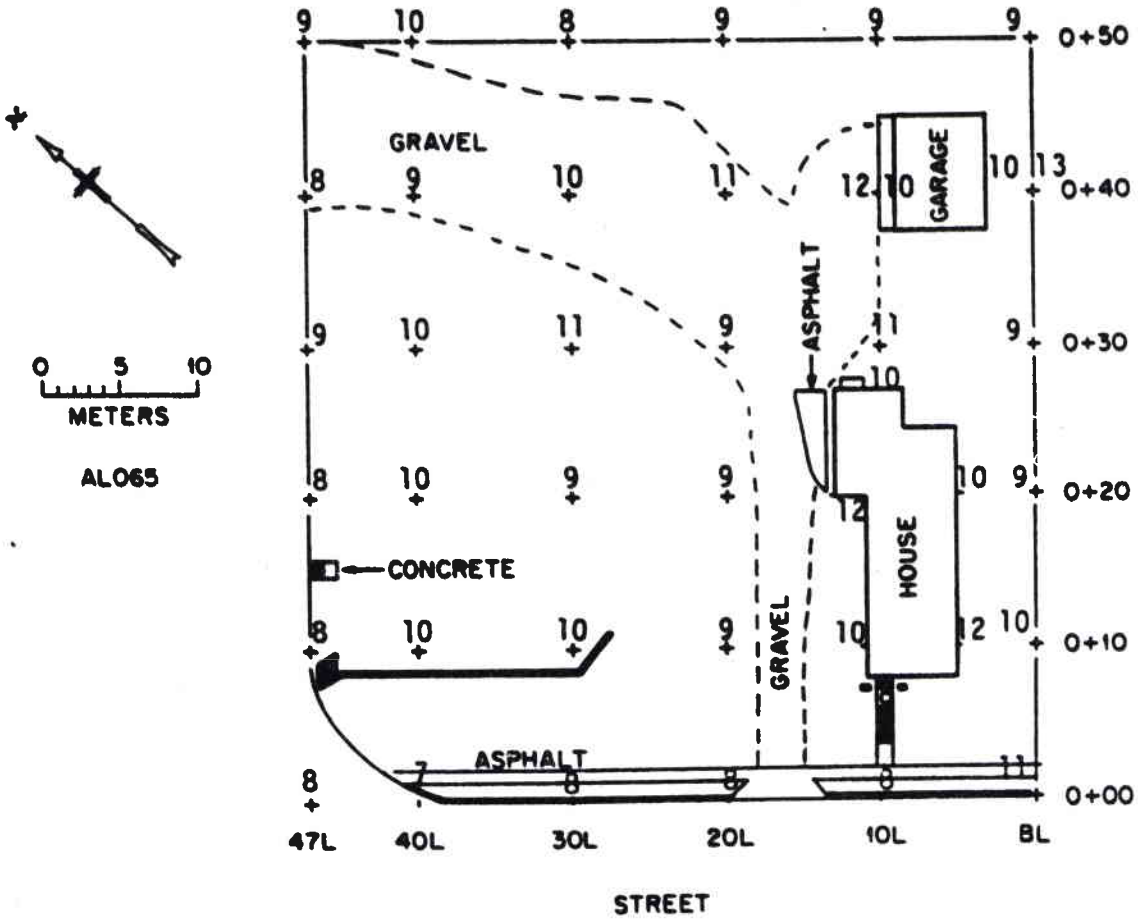

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 1195 Central Avenue, Colonie, New York (AL065).

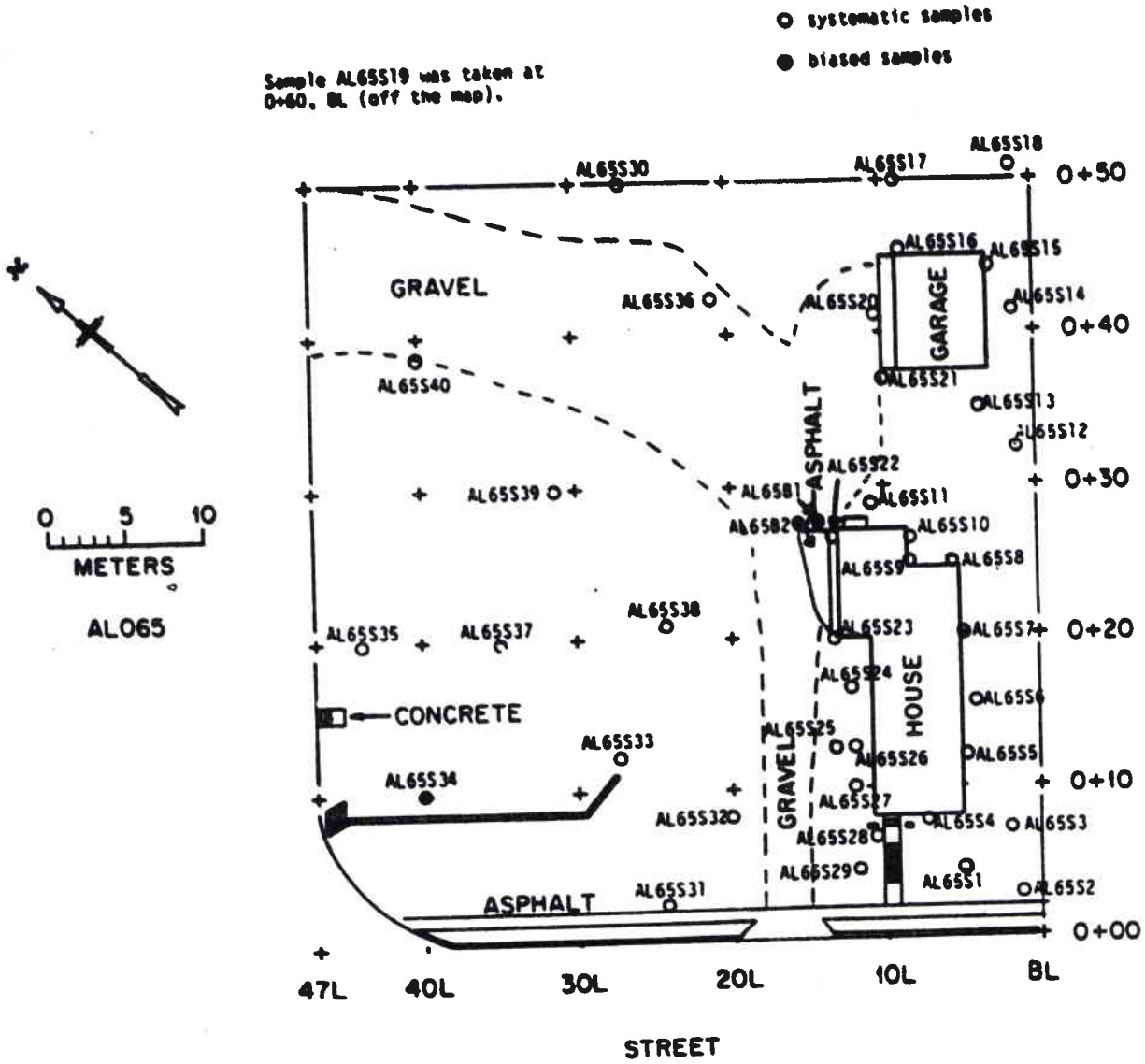

Fig. 5. Locations of soil samples on the property at 1195 Central Avenue, Colonie, New York (AL065).

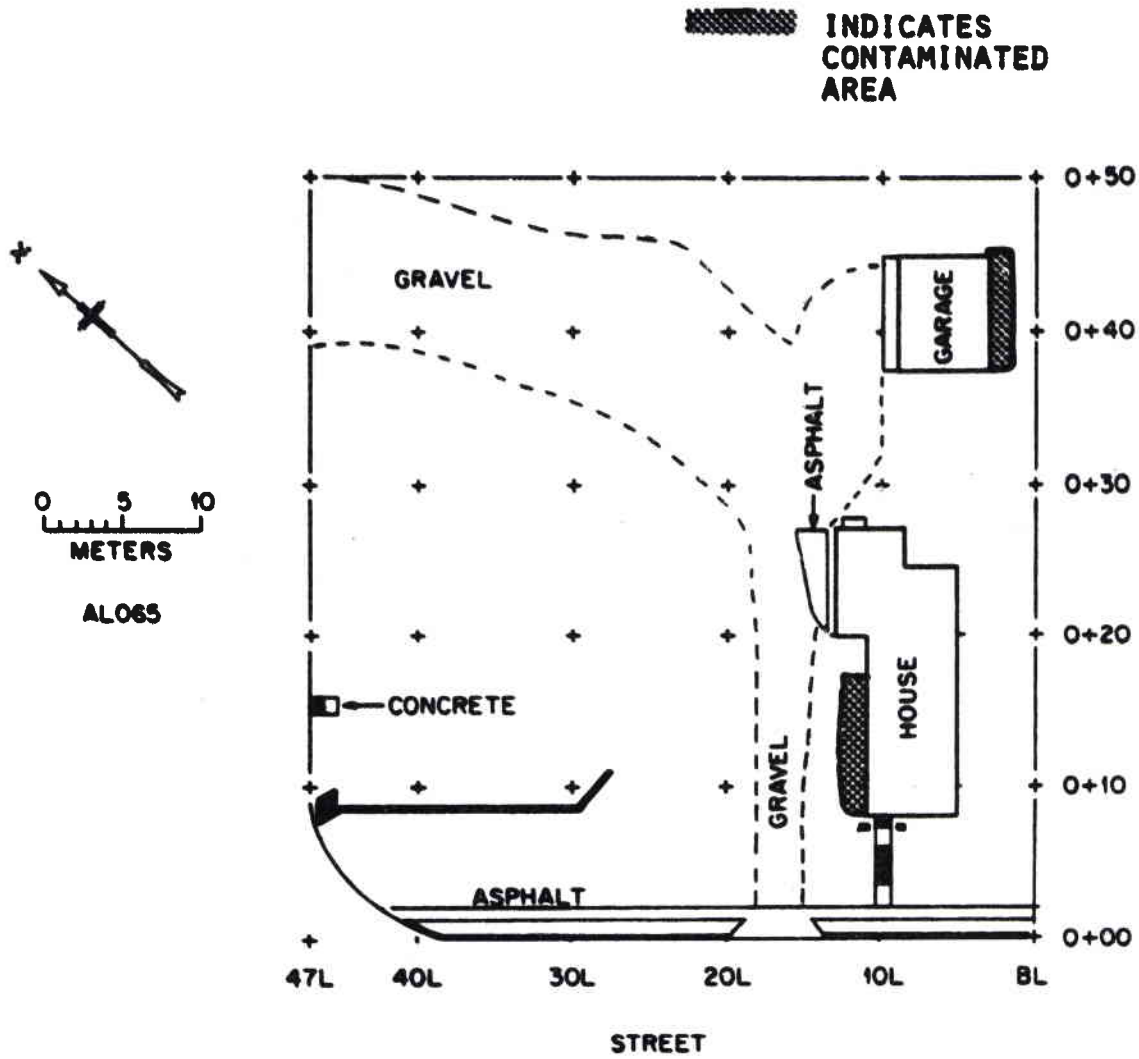

Fig. 6. Estimated area with ^{238}U contamination exceeding guidelines on the property at 1195 Central Avenue, Colonie, New York (AL065).

Table 1. Background radiation levels in the Albany 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]	8-10	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.76-1.2	0.96
^{226}Ra	0.48-1.2	0.85

[a]Values obtained from four locations in the Albany area.
[b]Soil samples (NY1-NY6) obtained from six locations around the Albany area.[7]

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 1195 Central Avenue, Colonie, New York (AL065)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	10	11	8-12
0+10, BL	11	10	8-15
0+20, BL	10	9	8-11
0+30, BL	9	9	8-14
0+40, BL	12	13	8-17
0+50, BL	9	9	-
0+10, 3L	10	12	-
0+20, 3L	10	10	-
0+40, 3L	11	10	-
0+40, 9L	10	10	-
0+00, 10L	8	8	8-12
0+08, 10L	8	8	-
0+10, 10L	e	e	8-14
0+20, 10L	e	e	8-17
0+27, 10L	10	10	-
0+30, 10L	10	11	8-13
0+40, 10L	12	12	8-12
0+50, 10L	10	9	-
0+10, 11L	10	10	-
0+20, 11L	10	12	-
0+00, 20L	8	8	8-14
0+10, 20L	8	9	7-10
0+20, 20L	8	9	7-10
0+30, 20L	9	9	7-10
0+40, 20L	10	11	7-11
0+50, 20L	10	9	-
0+00, 30L	8	8	8-12
0+10, 30L	10	10	7-10
0+20, 30L	8	9	8-11
0+30, 30L	8	11	7-11
0+40, 30L	10	10	8-11
0+50, 30L	8	8	-
0+00, 40L	7	7	7-12
0+10, 40L	10	10	8-11
0+20, 40L	10	10	7-10
0+30, 40L	9	10	7-10
0+40, 40L	8	9	8-12
0+50, 40L	9	10	-

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, 47L	8	8	-
0+10, 47L	8	8	-
0+20, 47L	8	8	-
0+30, 47L	8	9	-
0+40, 47L	8	8	-
0+50, 47L	8	9	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analysis on the property at 1195 Central Avenue, Colonie, New York (AL065)

Sample	Locations	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra	^{238}U[c]
		Systematic samples[d]		
AL65S1A	0+04, BL	0-5	±	9.5
AL65S1B	0+04, BL	5-15	±	2.8
AL65S2A	0+02, 1L	0-5	±	2.8
AL65S2B	0+02, 1L	5-15	±	0.97
AL65S3A	0+07, 1.5L	0-5	±	12
AL65S3B	0+07, 1.5L	5-15	±	4.5
AL65S4A	0+08, 07L	0-5	±	5.6
AL65S4B	0+08, 07L	5-15	±	9.9
AL65S5A	0+12, 05L	0-5	±	9.9
AL65S5B	0+12, 05L	5-15	±	1.0
AL65S6A	0+16, 04L	0-5	±	12
AL65S6B	0+16, 04L	5-15	±	6.8
AL65S7A	0+20, 5L	0-5	±	19
AL65S7B	0+20, 5L	5-15	±	8.7
AL65S8A	0+25, 5.5L	0-5	±	3.2
AL65S8B	0+25, 5.5L	5-15	±	0.70
AL65S9A	0+25, 8L	0-5	±	1.6
AL65S9B	0+25, 8L	5-15	±	0.63
AL65S10A	0+27, 8L	0-5	±	17
AL65S10B	0+27, 8L	5-15	±	1.7
AL65S11A	0+29, 10.5L	0-5	±	0.63
AL65S11B	0+29, 10.5L	5-15	±	0.43
AL65S12A	0+32, 01L	0-5	±	1.3
AL65S12B	0+32, 01L	5-15	±	0.77
AL65S13A	0+36, 03L	0-5	±	5.9
AL65S13B	0+36, 03L	5-15	±	3.2
AL65S14A	0+41, 01L	0-5	1.2 ± 0.15	16
AL65S14B	0+41, 01L	5-15	±	11
AL65S15A	0+44, 03L	0-5	±	79
AL65S15B	0+44, 03L	5-15	±	30
AL65S16A	0+44, 09L	0-5	±	22
AL65S16B	0+44, 09L	5-15	±	5.3
AL65S17A	0+50, 09L	0-5	±	4.7
AL65S17B	0+50, 09L	5-15	±	2.4
AL65S18A	0+50.5, 1L	0-5	±	4.3
AL65S18B	0+50.5, 1L	5-15	±	3.7
AL65S19A	0+60, 8L	0-5	±	14
AL65S19B	0+60, 8L	5-15	±	11
AL65S20A	0+41, 10L	0-5	±	15
AL65S20B	0+41, 10L	5-15	±	4.7

Table 3 (continued)

Sample	Locations	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
AL65S21A	0+37, 10L	0-5	±	7.8
AL65S21B	0+37, 10L	5-15	±	2.3
AL65S22A	0+27, 13L	0-5	±	8.7
AL65S22B	0+27, 13L	5-15	±	2.2
AL65S23A	0+20, 13L	0-5	±	16
AL65S23B	0+20, 13L	5-15	±	2.3
AL65S24A	0+18, 11L	0-5	±	19
AL65S24B	0+18, 11L	5-15	±	6.7
AL65S25A	0+13, 13L	0-5	±	5.7
AL65S25B	0+13, 13L	5-15	±	1.5
AL65S26A	0+13, 11L	0-5	±	27
AL65S26B	0+13, 11L	5-15	±	14
AL65S27A	0+10, 11L	0-5	±	41
AL65S27B	0+10, 11L	5-15	±	2.6
AL65S28A	0+7, 10L	0-5	±	4.5
AL65S28B	0+7, 10L	5-15	±	1.0
AL65S29A	0+04, 11L	0-5	±	2.0
AL65S29B	0+04, 11L	5-15	±	0.70
AL65S30A	0+50, 27L	0-5	±	3.7
AL65S30B	0+50, 27L	5-15	±	2.4
AL65S31A	0+02, 25L	0-5	±	8.3
AL65S31B	0+02, 25L	5-15	±	3.1
AL65S32A	0+08, 20L	0-5	±	6.2
AL65S32B	0+08, 20L	5-15	±	2.2
AL65S33A	0+12, 27L	0-5	±	4.7
AL65S33B	0+12, 27L	5-15	±	7.5
AL65S34A	0+10, 40L	0-5	±	0.87
AL65S34B	0+10, 40L	5-15	±	3.8
AL65S35A	0+20, 44L	0-5	±	5.9
AL65S35B	0+20, 44L	5-15	±	0.77
AL65S36A	0+42, 21L	0-5	±	4.7
AL65S36B	0+42, 21L	5-15	±	0.83
AL65S37A	0+20, 37L	0-5	±	4.5
AL65S37B	0+20, 37L	5-15	±	0.83
AL65S38A	0+21, 24L	0-5	±	3.5
AL65S38B	0+21, 24L	5-15	±	2.0
AL65S39A	0+30, 31L	0-5	±	6.6
AL65S39B	0+30, 31L	5-15	±	1.2
AL65S40A	0+39, 40L	0-5	±	4.2
AL65S40B	0+39, 40L	5-15	±	0.67

Table 3 (continued)

Sample	Locations[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
		Biased samples[e]		
AL65B1A	0+28, 14L	0-5	1.9 ± 0.07	4.9
AL65B1B	0+28, 14L	5-15	±	7.1
AL65B2A	0+28, 15.5L	0-5	±	3.8
AL65B2B	0+28, 15.5L	5-15	±	6.5

[a]Locations of soil samples are shown on Fig. 5.

[b]Indicated counting error is at the 95% confidence level (± 2σ).

[c]Analytical error of measurement results is < ± 5% (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

[e] Biased samples are taken from areas shown to have elevated gamma exposure rates.

Table 4. Results of surface analysis of structures at 1195 Central Avenue, Colonie, New York (AL065)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity					
Asphalt paving	1	13	-	13	-
Roof of the house	5	27,41,34,34,13	-	30	-
Total	6	13-41	-	27	-
Beta-Gamma					
Asphalt paving	1	-	0.03	-	0.03
Roof of the house	5	-	0.03,0.03,0.03, 0.02,0.03	-	0.03
Total	6	-	0.02-0.03	-	0.03

[a]The rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 ergs per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

Table 5. Summary of outdoor measurements and sample results on the property at 1195 Central Avenue, Colonie, New York (AL065)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	42	7-12	9
Gamma exposure rate at surface (μR/h)[a]	42	7-13	10
Scan, gamma exposure rate near surface (μR/h)[b]	-	7-17	-
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	80	0.43-79	7.6
Concentration of ^{238}U in soil (pCi/g), biased locations[d]	4	3.8-7.1	5.6
Estimated area with ^{238}U contamination exceeding guidelines (m^2)	-	-	18
Concentration of ^{226}Ra in surface soil (pCi/g), systematic locations[c]	2	1.2-1.9	1.6
<u>Surface measurements</u>[e]			
Alpha activity (dpm/100 cm^2)	6	13-41	27
Beta-gamma activity (mrad/h)	6	0.02-0.03	0.03

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Biased samples, Table 3.
[e]Surface measurements, Table 4.

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