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

SURVEY PLAN FOR THE RADIOLOGICAL CHARACTERIZATION OF RESIDENTIAL PROPERTIES

Lodi, New Jersey

November 1984

Bechtel National, Inc.
Advanced Technology Division

DOE/OR/20722-49

SURVEY PLAN FOR THE RADIOLOGICAL CHARACTERIZATION OF RESIDENTIAL PROPERTIES IN LODI, NEW JERSEY

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Prepared for

UNITED STATES DEPARTMENT OF ENERGY

OAK RIDGE OPERATIONS OFFICE

Under Contract No. DE-AC05-81OR20722

By

Bechtel National, Inc.

Advanced Technology Division

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1.0 INTRODUCTION

Based on designation survey data collected by the Oak Ridge National Laboratory (ORNL), the Department of Energy (DOE) designated six properties in Lodi, New Jersey, for remedial action. Bechtel National, Inc. (BNI) has subsequently been tasked by the DOE to "conduct appropriate comprehensive characterization surveys to determine the extent and magnitude of contamination on the designated residential properties and adjacent properties that BNI suspects may also be contaminated" (Ref. 1).

The material contaminating the designated properties is thought to have originated on the property now known as the Stepan Company. This contamination originated from the processing of thorium ores between 1916 and 1956 by Maywood Chemical Works (now Stepan Company) and is known to consist primarily of thorium-232 and its daughters with some elevated concentrations of uranium-238 and its daughters.

The major objective of this survey is to locate the horizontal and vertical boundaries of radioactive contamination exceeding remedial action criteria. An important secondary objective is to identify and evaluate any pathways by which contamination could migrate from the properties.

2.0 DESCRIPTION OF PROPERTIES

Four residential properties were designated by DOE. These include:

- 58 Trudy Drive, Lodi, New Jersey
- 59 Trudy Drive, Lodi, New Jersey
- 61 Trudy Drive, Lodi, New Jersey
- 59 Avenue C, Lodi, New Jersey

Commercial properties at 170 Gregg Street and 8 Mill Street are not included in this survey.

Locations of the designated residential properties are shown in Figures 1 and 2. Because of the limited data available and the possibility that contamination may extend

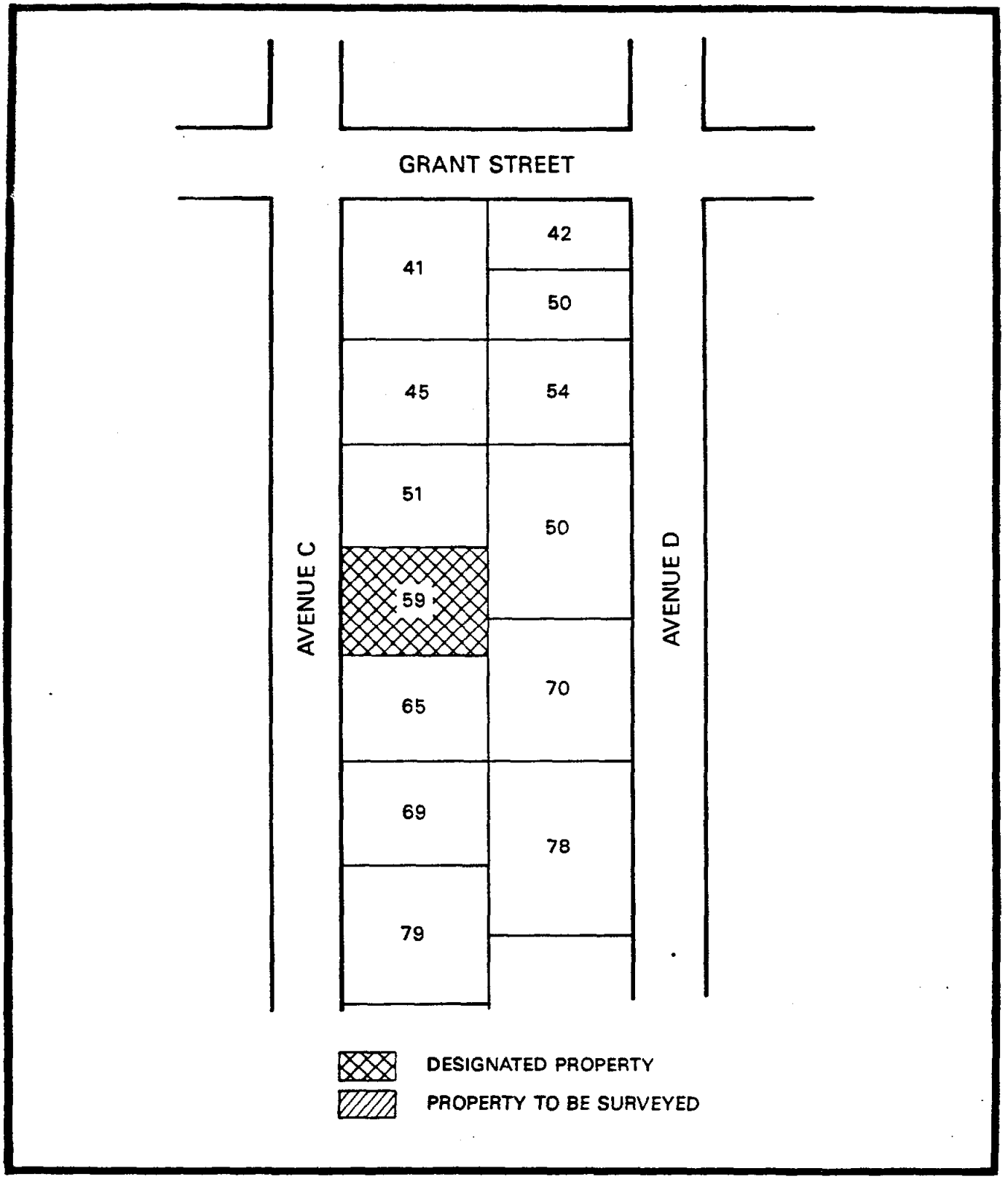

FIGURE 1 RESIDENTIAL PROPERTY ON AVENUE C REQUIRING CHARACTERIZATION

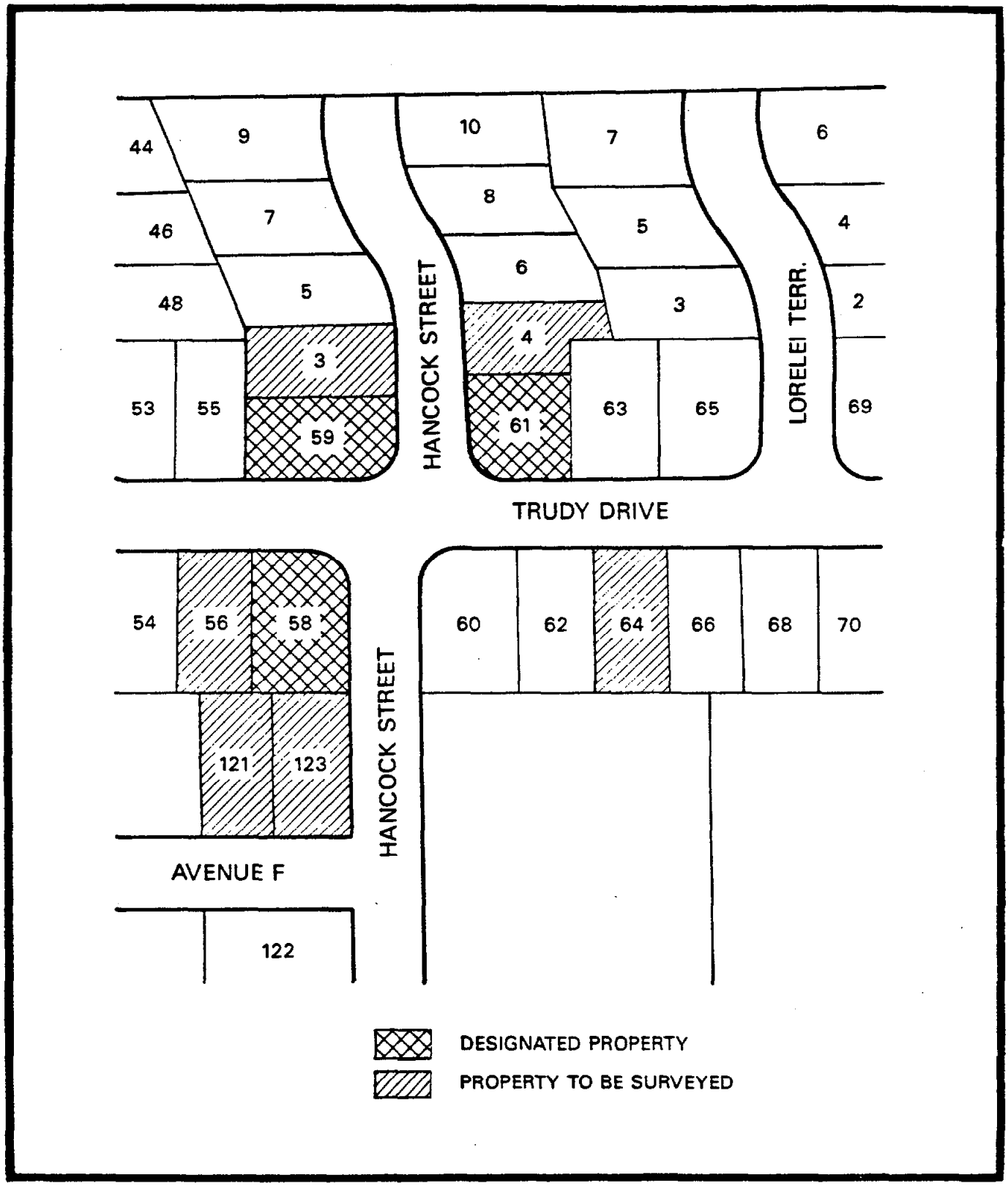

FIGURE 2 RESIDENTIAL PROPERTIES IN THE VICINITY OF HANCOCK STREET REQUIRING CHARACTERIZATION

across property boundaries, the following properties will also be included as a part of the characterization survey:

- o 3 Hancock Street, Lodi, New Jersey
- o 4 Hancock Street, Lodi, New Jersey
- o 56 Trudy Drive, Lodi, New Jersey
- o 64 Trudy Drive, Lodi, New Jersey
- o 121 Avenue F, Lodi, New Jersey
- o 123 Avenue F, Lodi, New Jersey

The parcel at 64 Trudy Avenue has been included based on a survey conducted by the ORNL scanning van (Ref. 2). No designation survey was conducted at the owner's request. Locations of these six additional properties are also shown in Figure 2.

3.0 RADIOLOGICAL SURVEY INSTRUMENTATION

3.1 GAMMA RADIATION EXPOSURE RATE MEASUREMENTS

Gamma radiation exposure rate measurements will be made 3 ft above the surface at selected grid points throughout the site using a pressurized ionization chamber (PIC). These measurements will be used to determine field calibration factors for the 2- x 2-in. NaI (Tl) gamma scintillation detectors used with a portable ratemeter or scaler.

3.2 NEAR-SURFACE GAMMA RADIATION MEASUREMENTS

Near-surface gamma radiation measurements will be made using a NaI (Tl) detector contained in a cone-shaped lead shield (mounted on a wheeled dolly) that positions the detector 12 in. above the ground. Signals from this detector, which is standardized each day with a uranium ore source, are registered on a digital ratemeter/scaler. A portable multi-channel analyzer will be available to identify radionuclides.

3.3 SURFACE BETA-GAMMA DOSE RATES

Surface beta-gamma dose rates will be measured using a Geiger-Mueller (G-M) detector with a thin (7 mg/cm^2) window. The estimated dose rate (mrad/h) will be determined by applying a calibration factor that relates the response of the detector to the radiation from a slab of uranium metal.

3.4 SUBSURFACE GAMMA RADIATION LOGGING

Gamma radiation profiles of the augered holes will be obtained using a NaI (Tl) scintillation detector coupled to a portable scaler. Gamma radiation spectra will be obtained with a portable multi-channel analyzer at points of maximum gross count rate in a selected number of holes where contamination appears to be present. Calibration of the scintillation detector system will be accomplished by correlating the system count rates with soil sample analysis results to obtain a count per minute per picocurie per gram (cpm/pCi/gm) calibration factor.

3.5 RADON AND RADON DAUGHTER CONCENTRATIONS

Radon and radon daughter concentrations will be measured using the gas bag collection methodology and Terradex detector plus other techniques as deemed appropriate based on field conditions.

4.0 RADIOLOGICAL SURVEY MEASUREMENTS

4.1 GRID SURVEY MEASUREMENTS

The civil surveyor will establish property lines; property corners; and the locations of gravel, asphalt, concrete surfaces, and buildings. This information will be transferred to drawings on a scale where 1 inch equals 10 feet. Property line dimensions, ties to the State Coordinate System, and other pertinent data will be supplied. Other property features will be drawn to scale without dimensions. Iron pins will be used to mark each property corner and one of these will be identified by New Jersey State Coordinates.

The radiological survey team will establish the measurement grid system for each parcel. The exact dimensions of that grid will be established in the field based on the characteristics of the parcel and in Section 22.00, Decontamination Monitoring, of the Formerly Utilized Sites Remedial Action Program Project Instructions.

The site grid system serves as a basis for planning the location of specific points where radiation measurements will be made and where samples of environmental media will be collected for analysis of radionuclide concentrations.

The following measurements will be made and recorded as required to adequately characterize the contamination (a minimum of 30 measurements per parcel is required):

- Near-surface gamma measurements using a cone-shaped, lead-shielded, 2- x 2-in. NaI (Tl) detector with digital readout
- Beta-gamma dose rate at the ground surface using a thin window G-M detector and digital readout

Gamma exposure rate will be measured 3 ft above the ground at selected locations on each parcel using a PIC. Typically, 5 to 10 gamma exposure rate measurements per parcel are adequate, but additional measurements may be made if conditions warrant. These measurements may be made using a 2- x 2-in. NaI (Tl) detector whose response has been compared to a PIC at several locations on each property.

4.2 SUBSURFACE GAMMA-RADIATION LOGGING

A portable gas-powered auger capable of drilling a 6-in. diameter hole to a depth of 8 to 9 ft will be used. The holes will be gamma logged to determine the vertical profile of contamination boundaries. The NaI (Tl) detector will be lowered into the hole and count rate data will be taken at 0.5-ft vertical intervals.

Locations of subsurface soil samples will be determined based on historical data and near-surface gamma measurements. The actual number of holes required will vary with each parcel, but a minimum of 10 unbiased holes per parcel will be drilled. Additional biased holes will be drilled as required to characterize subsurface contamination.

Gamma spectra may be taken in selected holes at the point of maximum activity to confirm the identity of the radionuclides present. Calibration of subsurface data will be done by comparing the logging data from each borehole with the results of analyses of soil samples obtained from the same hole.

5.0 SOIL SAMPLING AND ANALYSIS

Approximately 20 soil samples per parcel will be taken and submitted for laboratory analysis. They will comprise samples from the categories listed below. The total number of samples will be subject to change based on field conditions.

5.1 SURFACE SAMPLES

Surface soil samples (0 to 6 in. depth) will be collected at selected locations on each property. Surface soil samples will also be collected at approximately 5-ft intervals from any area having near-surface gamma radiation levels or surface beta-gamma rates that exceed typical site background by a factor of three. Samples will be analyzed in an unprepared condition using high-resolution gamma spectrometry for radium-226, thorium-232 and daughters, and uranium-238 and daughters.

5.2 SUBSURFACE SAMPLES

Following an evaluation of borehole gamma logs, areas will be selected to obtain undisturbed soil samples using thin-walled Shelby tubes. These samples will be obtained from the surface to below known deposits of radioactivity if the subsurface contamination is continuous. If it is not, samples will be obtained from just above to just below isolated subsurface contamination following the removal of overburden by auger drilling to near the subsurface deposit. All holes developed by Shelby tube sampling will be augered to approximately 1 ft below the bottom of the sample and gamma logged as discussed in Section 4.2. Samples will be extruded from the Shelby tubes and processed for analysis in the same manner as surface soil samples. As previously mentioned, radionuclide concentrations in these samples will be used to establish a calibration factor for gamma logs of boreholes.

6.0 WATER AND SEDIMENT SAMPLING AND ANALYSIS

Water and sediment samples will be taken and analyzed for the radionuclides specified below if water is encountered in boreholes, drainage ditches, etc. The number of water and sediment samples will be subject to field conditions, but should be less than 25.

6.1 BOREHOLE WATER FROM RADIOACTIVELY CONTAMINATED AREAS

Samples of water encountered in holes drilled through radioactively contaminated areas will be collected before inserting the PVC pipe for gamma logging. These samples will be analyzed for total dissolved uranium, thorium-232, radium-228, and radium-226. Sample selection will be based on contamination potential and expected migration paths.

6.2 SURFACE WATER

Samples of water will also be collected from any standing surface water sources found in drainage paths from the site, and from any on-site sewer or septic tank systems. These samples will be analyzed for dissolved and suspended radionuclides as mentioned in Section 6.1.

6.3 SEDIMENTS

Samples of sediment from on-site streams, sewers, and septic tanks will be obtained using a clamshell, Ekman dredge, or other comparable device. These samples will be analyzed for uranium-238 and daughters (particularly radium-226), as well as thorium-232 and daughters in the same manner as soil samples.

7.0 MEASUREMENTS IN STRUCTURES

Structures on each parcel will be scan surveyed for surface beta-gamma and alpha contamination. Exposure rates at floor level and 3 ft above the floor will be determined in each room. Special attention will be paid to basements/crawl spaces.

Radon and radon daughter concentrations will be determined using grab sampling techniques. In addition, passive, long-term (i.e., 3-month) integrating monitors will be used to estimate the average radon concentration. Air particulate filters will be counted at several intervals after collection to determine whether there are significant concentrations of radon-220 daughters.

8.0 BACKGROUND MEASUREMENTS

No new background measurements will be made as sufficient background information exists from previous BNI, ORNL, New Jersey Department of Environmental Protection, and Oak Ridge Associated Universities surveys in this general area of New Jersey.

9.0 SCHEDULE

This survey will be conducted from November 1984 through January 1985 and will require approximately 12 man-weeks to complete.

REFERENCES

1. Letter, E. L. Keller to J. F. Nemec. "Designation for Remedial Action at Vicinity Properties in Lodi, New Jersey," October 25, 1984.

2. Oak Ridge National Laboratory. Results of the Mobile Gamma Scanning Activities in Lodi, New Jersey. Contract No. DE-AC05-84OR21400, Oak Ridge, TN, July 1984 (DRAFT).