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

SURVEY PLAN FOR THE RADIOLOGICAL CHARACTERIZATION OF THE BALLOD AND ASSOCIATES PROPERTY

Rochelle Park, New Jersey

December 1984

Bechtel National, Inc.
Advanced Technology Division

DOE/OR/20722-50

SURVEY PLAN FOR THE RADIOLOGICAL CHARACTERIZATION OF THE BALLOD AND ASSOCIATES PROPERTY, ROCHELLE PARK, NEW JERSEY

DECEMBER 1984

Prepared for

UNITED STATES DEPARTMENT OF ENERGY

OAK RIDGE OPERATIONS OFFICE

Under Contract No. DE-AC05-81OR20722

By

Bechtel National, Inc.

Advanced Technology Division

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Bechtel Job No. 14501

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1.0 INTRODUCTION

A characterization survey of the Ballod and Associates property is required to complete remedial action engineering. This property was designated for cleanup based on a previous survey (Ref. 1). The contamination on the property 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 Ballod property was originally part of the Maywood Chemical Works.

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 this site.

2.0 DESCRIPTION OF PROPERTY

The Ballod and Associates property is a vacant tract of approximately 7 acres located in Rochelle Park, New Jersey. This property is bounded on the east by New Jersey State Highway 17, on the north by the New York Susquehanna and Western (NYS&W) Railroad, and on the south and west by residential properties (Figure 1).

The site is known to have buried deposits of radioactivity in the northeast corner (the "north dike area") and on the south end ("south dike area"). Surface contamination (upper 6-in. layer) appears to be nonuniform and irregularly distributed over a relatively large percentage of the property (Refs. 1 and 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.

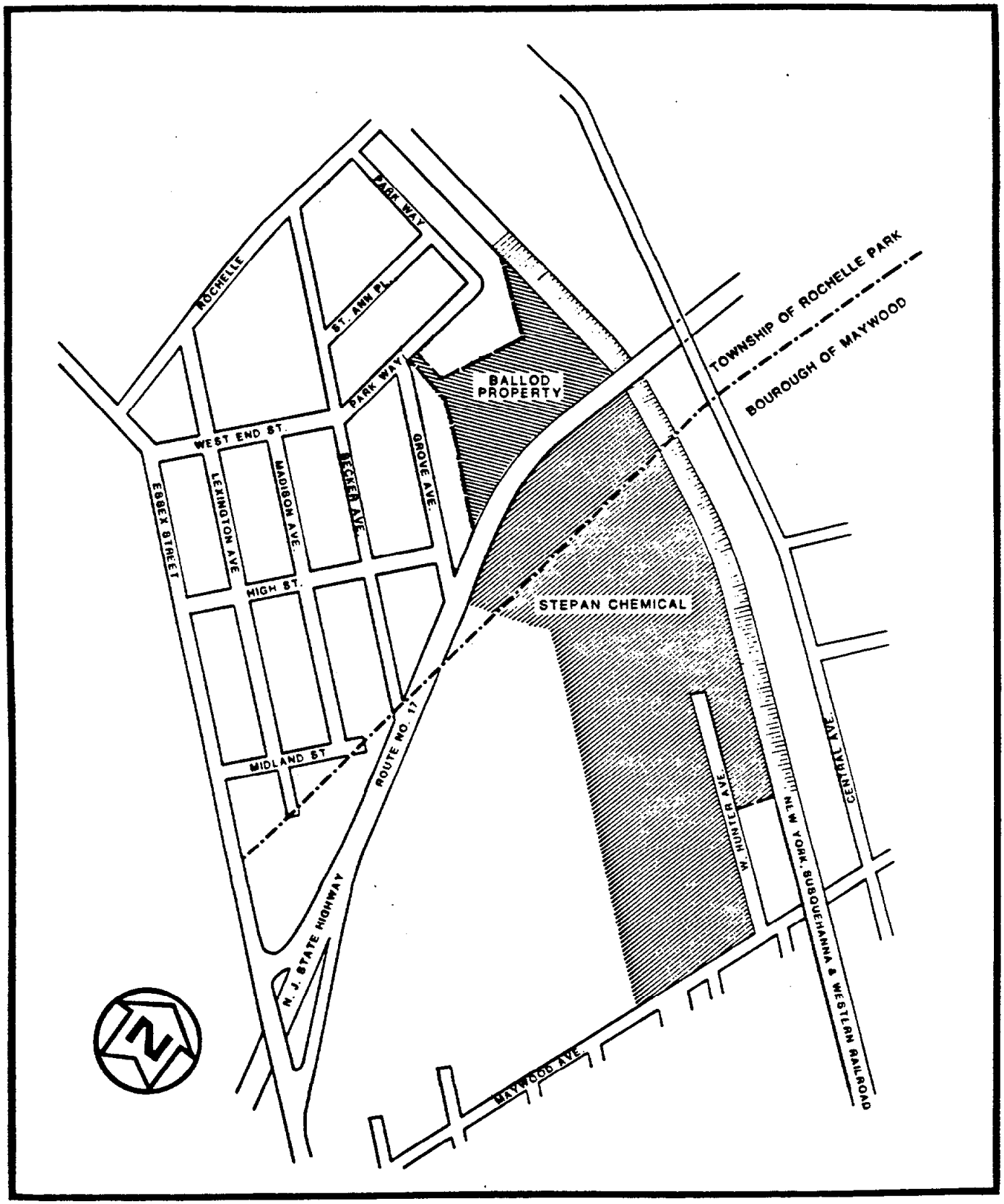

FIGURE 1 MAP OF BALLOD PROPERTY AND SURROUNDING AREA

3.2 NEAR-SURFACE GAMMA RADIATION MEASUREMENTS

Near-surface gamma radiation measurements will be made using an 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 SUBSURFACE GAMMA RADIATION LOGGING

Gamma radiation profiles of the augered holes will be obtained using an NaI (Tl) scintillation detector coupled to a portable scaler. Gamma radiation spectra will be obtained from a selected number of holes with a portable multi-channel analyzer at points of maximum gross count rate. 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.

4.0 RADIOLOGICAL SURVEY MEASUREMENTS

4.1 GRID SURVEY MEASUREMENTS

A 50-ft grid will be established on the Ballod property by extending the grid used by Bechtel National, Inc. (BNI) in their 1983 survey of the Ballod vicinity properties (Figure 2). This grid system is tied to the New Jersey State Grid. Grid points will be staked with wooden hubs except on asphalt surfaces where nails and flagging will be used. Grid points are defined as the intersection of the perpendicular grid lines, or the intersection of grid lines with buildings and/or property boundaries.

The site grid system is the 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 near-surface gamma measurements will be made using the NaI (Tl) scintillation detector with digital readout. They will be made at 25-ft intervals or as required to adequately characterize the contamination.

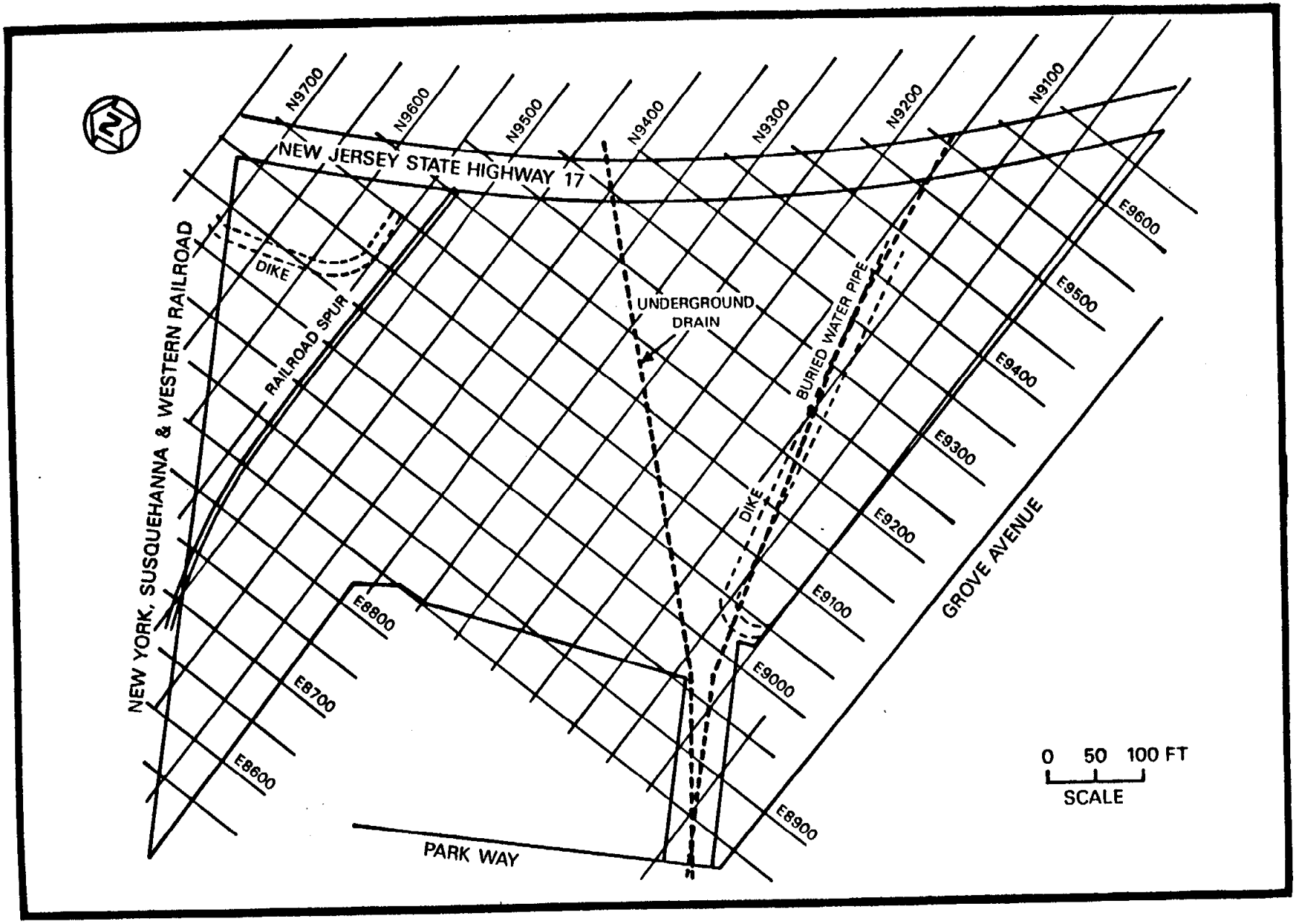

FIGURE 2 BALLOD PROPERTY SHOWING RADIOLOGICAL SURVEY GRID

4.2 SUBSURFACE GAMMA-RADIATION LOGGING

A portable gas-powered auger capable of drilling a 6-in. diameter hole to a depth of 6 to 8 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. Approximately 100 holes will be required for systematic sampling and additional biased holes will be drilled as required to refine subsurface contamination boundaries.

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 100 soil samples 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 the 50-ft grid points; however, in areas known to be highly contaminated (north dike area) and in the area previously excavated, soil samples will not be taken. Surface soil samples will also be collected at approximately 10-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 thorium-232 and daughters as well as uranium-238 and daughters (particularly radium-226).

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. Radionuclide concentrations in these samples will be used to establish a calibration factor for gamma logs of boreholes.

5.3 CHEMICAL ANALYSES OF SOIL SAMPLES

Several samples of subsurface soils from the area will be collected. Samples will be taken for off-site laboratory determination of nonradiological parameters included in the U.S. Environmental Protection Agency (EPA) list of priority pollutants. These data are required to provide documentation of chemical contaminants, if any, to ensure that proper industrial safety precautions are applied during the remedial action phase.

The nonradiological measurements fall into three categories: metals, inorganic ions, and other parameters. Samples for measurements of the parameters within each of these categories shall be taken, packaged, and preserved according to the requirements specified in the latest edition of Standard Methods for Examination of Water and Wastewater (Standard Methods).

Measurements for the following metals will be made: aluminum, silver, arsenic, beryllium, cadmium, chromium, copper, cobalt, iron, lead, lithium, manganese, magnesium, mercury, molybdenum, nickel, selenium, sodium, zinc, strontium, vanadium, titanium, scandium, niobium, cerium, lanthanum, and zirconium. With the exceptions of yttrium, scandium, niobium, cerium, lanthanum, and zirconium, metals concentrations shall be made by atomic absorption spectrophotometry in accordance with procedures described in the latest edition of Standard Methods. For yttrium, scandium, niobium,

cerium, lanthanum, and zirconium, concentrations shall be measured by inductively coupled plasma-atomic emission spectrometry in accordance with the procedures described in Inductively Coupled Plasma-Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes -- EPA Method 200.7 and Line Coincidence Tables for Inductively Coupled Plasma-Atomic Emission Spectrometry, Volumes I and II, by P.W.J.M. Boumans. Each metal shall be determined as both "total" and "dissolved" as defined in Standard Methods and EPA Method 200.7. Each metal shall be determined to the lowest minimum detection limit indicated in the procedures for a particular metal.

Inorganic ion determinations will include sulfate, chloride, fluoride, nitrate, and phosphate (total dissolved-and-suspended orthophosphate). Inorganic ions shall be determined by procedures described in the latest edition of Standard Methods. Each inorganic ion shall be determined to the lowest minimum detection limit indicated in the appropriate Standard Methods procedure.

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 dissolved total 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 be collected from any standing surface water 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 thorium-232 and daughters as well as uranium-238 and daughters (particularly radium-226) in the same manner as soil samples.

7.0 BACKGROUND MEASUREMENTS

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

8.0 SCHEDULE

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

REFERENCES

1. Cole, L.W., J. Berger, P. Cotton, R. Gosslee, J. Sowell, and C. Weaver. Radiological Assessment of Ballod and Associates Property (Stepan Chemical Company), Maywood, New Jersey, Oak Ridge Associated Universities, Oak Ridge, TN, July 30, 1983.

2. Morton, Henry W. Natural Thorium in Maywood, New Jersey, Nuclear Safety Associates, Inc., MD, (Undated).