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FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM (FUSRAP)
CONTRACT NO. DE-AC05-81OR20722

SURVEY PLAN FOR THE RADIOLOGICAL CHARACTERIZATION OF THE VICINITY PROPERTIES OF THE STEPAN CHEMICAL PLANT

MAYWOOD, NEW JERSEY

NOVEMBER 1983

Bechtel Job 14501
Bechtel National, Inc.
Nuclear Fuel Operations

16003

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Engineers — Constructors

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DEC 1 1983

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Attention: E. L. Keller, Director
Technical Services Division

Subject: Bechtel Job No. 14501, FUSRAP Project
DOE Contract No. DE-AC05-81OR20722
Final Survey Plans for Wayne Pequannock
and Maywood Sites
File No. 066, 137A/138A

Dear Mr. Keller:

Attached are the final survey plans for the subject sites.

Very truly yours,

Robert L. Rudolph

Robert L. Rudolph
Project Manager - FUSRAP

RDG:jm
Attachment: As Stated

cc: E. H. Hardison, with attachment

K0003

10-05-138-001

SURVEY PLAN FOR THE RADIOLOGICAL CHARACTERIZATION OF THE VICINITY PROPERTIES OF THE STEPAN CHEMICAL PLANT MAYWOOD, NEW JERSEY

NOVEMBER 1983

Prepared for

UNITED STATES DEPARTMENT OF ENERGY
OAK RIDGE OPERATIONS OFFICE
Under Contract No. DE-AC05-81OR20722

By
Bechtel National, Inc.
Oak Ridge, Tennessee

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1.0 INTRODUCTION

Two areas near the Stepan Chemical plant require radiological characterization. These areas are suspected of being contaminated as they are adjacent to properties that have previously been surveyed and are known to have both surface and subsurface contamination (References 1 and 2). This contamination originated from the processing of thorium ores between 1916 and 1956 by the Maywood Chemical Works (later purchased by Stepan Chemical) and is known to consist primarily of Th-232 and its daughters with some elevated concentrations of U-238 and its daughters.

The major objective of this survey is to locate both 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 these sites.

2.0 DESCRIPTION OF PROPERTIES

The first area requiring characterization is the New York Susquehanna and Western (NYS&W) Railroad property adjacent to Stepan's northern boundary. This area is approximately 2,800 feet long and 100 feet wide and also forms the northern boundary for the Ballod Associates Property (formerly part of Stepan Chemical Company property). Two sets of railroad tracks on the NYS&W property are currently in daily use. Figure 1 shows the boundaries of the railroad property to be surveyed.

The second area borders the Ballod property on the southwest as shown in Figure 2. This area (lots 36-72 on Figure 2) consists of the backyards of several houses that face Grove Avenue in Rochelle Park Township. A survey of the Ballod property was conducted by Oak Ridge Associated Universities in 1982 (Reference 1). Surface and subsurface thorium contamination were found at the boundary between the Ballod property and the private properties, but no measurements were made on the residential side of the boundary.

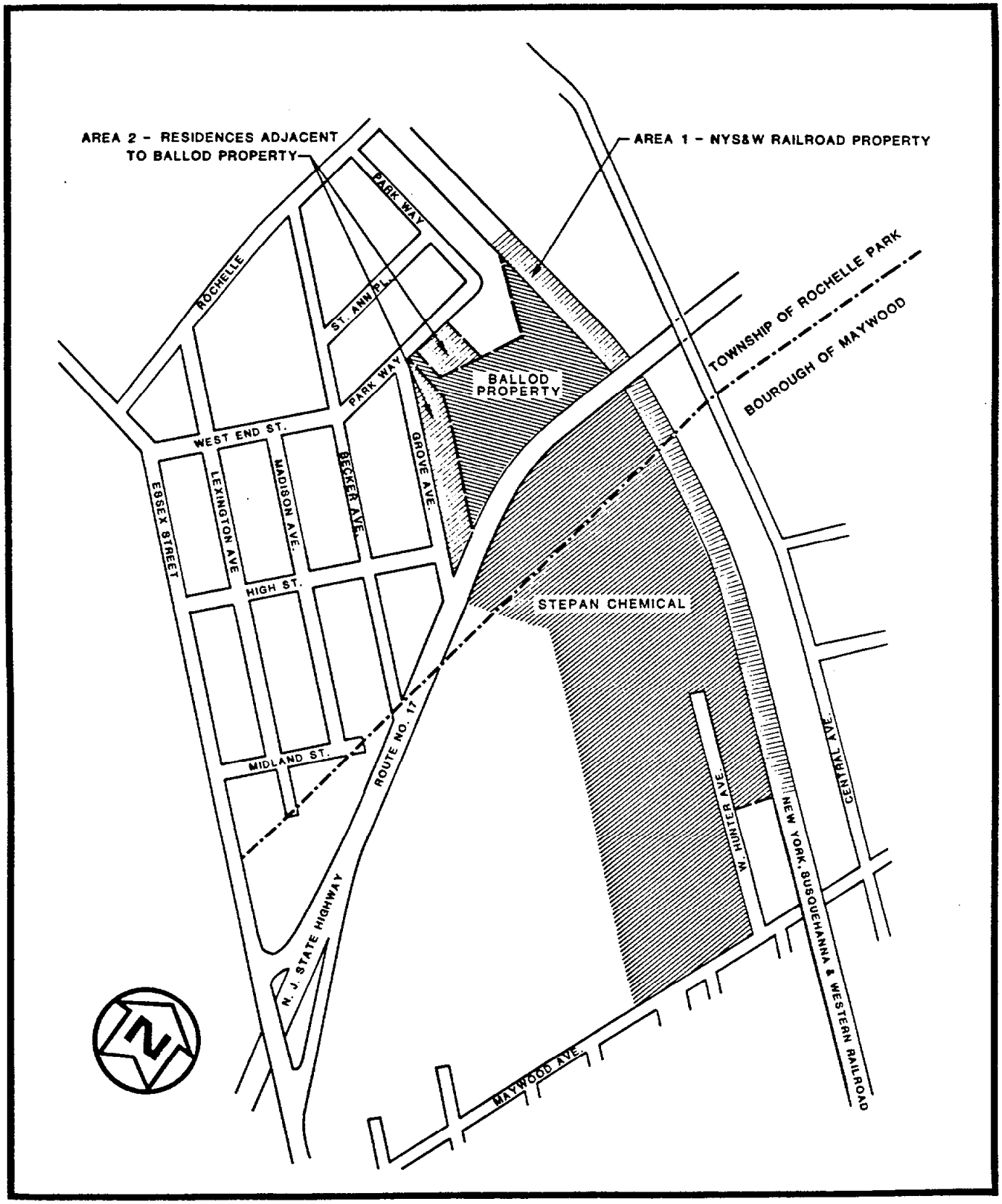

FIGURE 1 MAP OF STEPAN CHEMICAL PLANT AND VICINITY PROPERTIES

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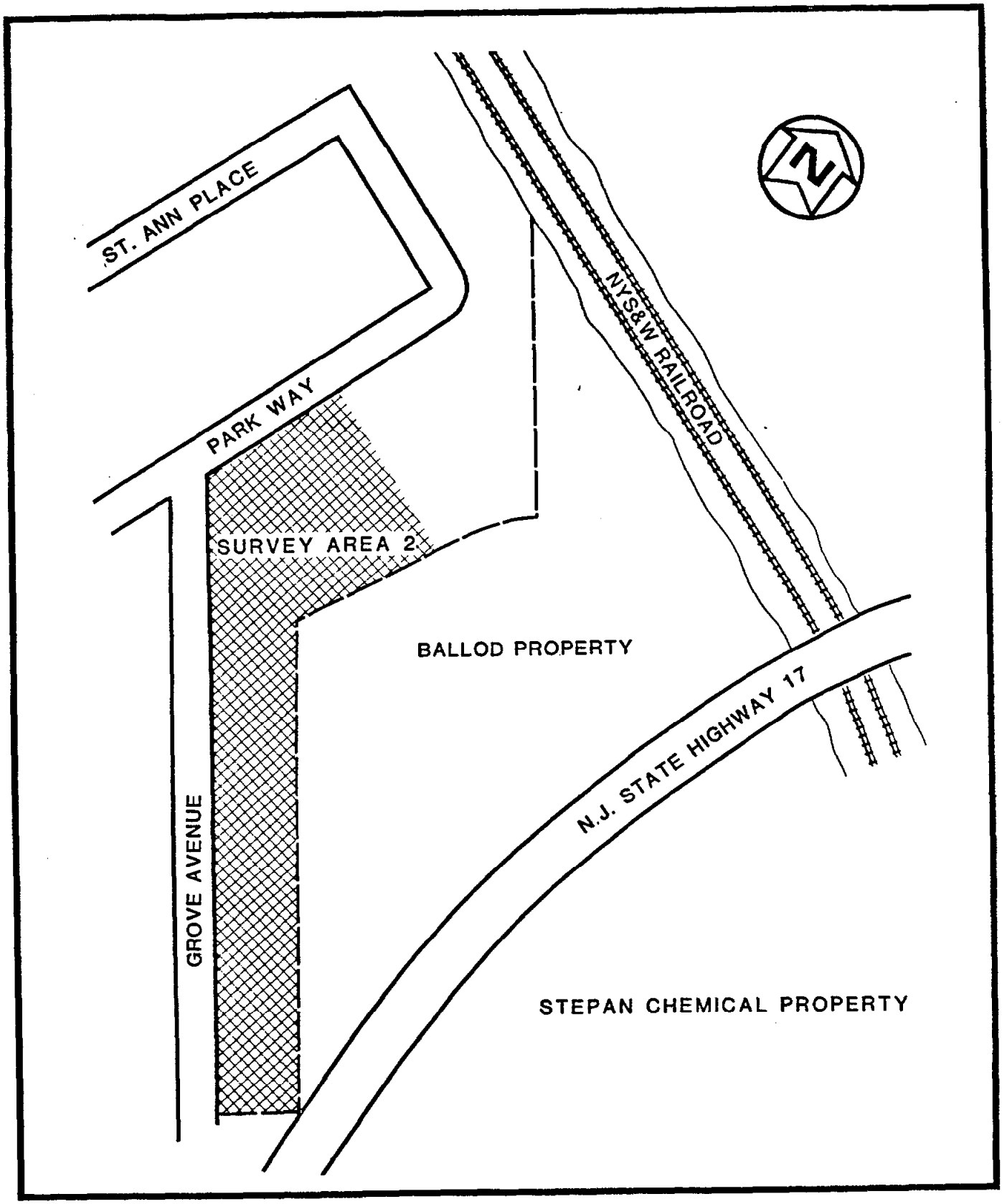

FIGURE 2 RESIDENTIAL PROPERTIES
REQUIRING RADIOLOGICAL SURVEYS

3.0 RADIOLOGICAL SURVEY INSTRUMENTATION

3.1 Gamma-Ray Exposure Rate Measurements

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

3.2 Near-Surface Gamma-Ray Measurements

Near-surface gamma-ray 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 an Am-241 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 dose rate (mrad/hr) will be determined by calibrating the G-M detector against a portable ionization chamber using U-238, Th-232, and Ra-226 sources.

3.4 Subsurface Gamma-Ray Logging

Gamma-ray profiles of the augered holes will be obtained using a NaI (Tl) scintillation detector coupled to a portable scaler. Gamma-ray spectra will be obtained with a portable multi-channel analyzer at

points of maximum gross count rate in each hole 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.

4.0 RADIOLOGICAL SURVEY MEASUREMENTS

4.1 Grid System Measurements

A 50-ft grid will be established on both the NYS&W railroad property and on the residential properties by extending the grid used by Nuclear Safety Associates, Inc. in their 1982 survey of the Stepan Chemical Plant property (Reference 2). The grid system is to be 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 grid perpendicular lines, or the intersection of grid lines with buildings and/or property boundaries.

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 at 25 ft intervals or as required to adequately characterize the contamination:

- Near-surface gamma-ray measurements using a cone shielded 2 in. 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-ray exposure rate will be measured 3 ft above the ground at selected locations using a pressurized ionization chamber.

4.2 Subsurface Gamma-Radiation Logging

Thin-walled Shelby tubes will be used to obtain 2-ft deep subsurface soil samples. The resulting holes will be gamma-ray logged to determine the vertical and lateral contamination boundaries. The NaI (Tl) detector will be lowered into the hole and count-rate data will be taken at one-half-foot vertical intervals. If logging indicates that the contamination was not totally characterized by the first Shelby tube, a second tube will be used to collect a sample from the 2-ft to 4-ft strata. The maximum depth to which soil can be characterized by this method is 4 ft.

Location of subsurface soil samples will be field determined based on historical data and near-surface gamma-ray measurements. Approximately 25 Shelby tube samples will be required.

Gamma-ray spectra will 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 soil sample analyses from the same hole.

5.0 SOIL SAMPLING AND ANALYSIS

Approximately 50 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 selected locations on each private property and at selected 50-ft grid points

along the railroad. 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 dried, pulverized, homogenized, and stored for Rn-222 ingrowth. These samples will be analyzed by high-resolution gamma-ray spectrometry for Ra-226 and Th-232 and daughters. These samples will also be analyzed for total uranium by alpha spectrometry following radiochemical separation and electro-deposition of uranium onto a metal substrate.

5.2 Subsurface Samples

Following an evaluation of borehole gamma-ray logs, several 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. 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 obtain a calibration factor for gamma-ray logs of boreholes.

5.3 Chemical Analyses of Soil Samples

Three samples of subsurface soils from the area will be collected. Samples will be taken for offsite laboratory determination of non-radiological 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 non-radiological 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: Al, Ag, As, Be, Cd, Cr, Cu, Co, Fe, Pb, Li, Mn, Mg, Hg, Mo, Ni, Se, Na, Zn, Sr, V, Ti, V, Sc, Nb, Ce, La, and Zr. With the exceptions of Y, Sc, Nb, Ce, La, and Zr, metals concentrations shall be made by atomic absorption spectrophotometry in accordance with procedures described in the latest edition of Standard Methods. For Y, Sc, Nb, Ce, La, and Zr, 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

Up to 25 water/sediment samples will be taken for the radionuclides specified below if water is encountered in boreholes, drainage ditches, etc. The number of water/sediment samples will be subject to change based on field conditions.

6.1 Borehole Water from Radiologically Contaminated Areas

Samples of water encountered in holes drilled through radiologically contaminated areas will be collected prior to insertion of the PVC pipe for gamma-ray logging. Radionuclides for which samples will be analyzed are total uranium, Th-232, Ra-228, and Ra-226. A maximum of 25 samples will be collected and analyzed. Selection of samples will be based on contamination potential and expected migration paths.

6.2 Surface Water

Samples of water will also be collected from standing surface water found in drainage paths from the site, and from any onsite sewer or septic tank systems.

6.3 Sediments

Samples of sediment from onsite streams, sewers, and septic tanks will be obtained using a clamshell, Ekman dredge, or other comparable device. These samples will be analyzed for total uranium, Ra-226, and Th-232 in the same manner as soil samples.

7.0 BACKGROUND MEASUREMENTS AND SAMPLES

Background locations will be selected to establish the following background values:

- Gamma-ray exposure rate at surface and at 3 ft
- Surface soil radionuclide concentration
- Surface water radionuclide concentration

The locations for background measurements will be in the general vicinity of the properties and care will be exercised to ensure that such measurements are not influenced by the contamination at the Stepan site.

8.0 SCHEDULE

It is expected that this survey will be conducted in two stages: First the NYS&W railroad property, followed by the private residences facing Grove Avenue, Rochelle Park, adjacent to the Ballod Property. The first stage will require approximately 8 man-weeks to complete during the period June 1984 to July 1984. The second stage will require approximately 4 man-weeks to complete and is expected to occur between July 1984 and October 1984.

REFERENCES

1. Cole, L.W., J. Berger, P. Cotten, 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, Tennessee, July 30, 1983.

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