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DOE/OR/20722-120

M-115

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

CHARACTERIZATION PLAN FOR THE VICINITY PROPERTIES IN LODI

Lodi, New Jersey

January 1987

Bechtel National, Inc.

cc: J. A. Blanke, w/2 copies
T. M. Dravecky, w/o
C. P. Leichtweis, w/5 copies

042644

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JAN 15 1987

U.S. Department of Energy
Oak Ridge Operations
Post Office Box E
Oak Ridge, Tennessee 37831

Attention: S. W. Ahrends, Director
Technical Services Division

Subject: Bechtel Job No. 14501, FUSRAP Project
DOE Contract No. DE-AC05-81OR20722
Characterization Plan for the Vicinity Properties in Lodi
Code: 7310/WBS: 138

Dear Mr. Ahrends:

The following is in response to your letter number 86-308 (our CCN 041992).

Enclosed are 10 copies of the subject document. BNI has incorporated all DOE comments and has revised the document to reflect the on-going nature of this characterization work. If you have any questions, please contact Chris Leichtweis at 576-1882.

Very truly yours,

J. R. Kannard
Project Manager - FUSRAP

TMD:jm
Enclosures: As Stated

cc: Without Enclosure
R. G. Atkin
B. Bervin, ORNL
B. A. Hughlett
J. F. Nemec
J. F. Wing

CONCURRENCE

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4082A

DOE/OR/20722-120

CHARACTERIZATION PLAN
FOR THE VICINITY PROPERTIES
IN LODI - 1986-1987
LODI, NEW JERSEY

JANUARY 1987

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

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

Based on designation survey data collected by the Oak Ridge National Laboratory (ORNL), the Department of Energy (DOE) has designated nine properties in Lodi, New Jersey, for remedial action. Bechtel National, Inc. (BNI) has been tasked by the DOE to conduct comprehensive characterization surveys to determine the extent of contamination on these properties (Ref. 1). In addition, BNI will characterize other Lodi properties as assigned by DOE based on preliminary data from ORNL designation surveys. This work is part of BNI's responsibility as the Project Management Contractor for the Formerly Utilized Sites Remedial Action Program (FUSRAP). FUSRAP is a DOE program to identify, clean up, or otherwise control sites where low-level radioactive contamination (exceeding current guidelines) remains from the early years of the nation's atomic energy program. Although the contamination at these properties did not result directly from the atomic energy program, Congress assigned the Maywood Interim Storage Site (MISS) and its vicinity properties to DOE with the 1984 Energy and Water Appropriations Act to expedite the decontamination process. The properties in Lodi are included in FUSRAP as vicinity properties.

1.1 HISTORICAL OVERVIEW

The material contaminating the Lodi properties is thought to have originated on the property now owned by the Stepan Company. This contamination resulted from the processing of thorium ores between 1916 and 1956 by the Maywood Chemical Works and is known to consist primarily of thorium-232 and its daughters with some elevated concentrations of uranium-238 and its daughters. Figure 1-1 shows the location of the MISS and vicinity properties.

1.2 REVIEW OF EXISTING INFORMATION

Before field activities for the characterizations commence, BNI will evaluate any pathways by which the contamination could have migrated from the Stepan Company property. For example, BNI is presently

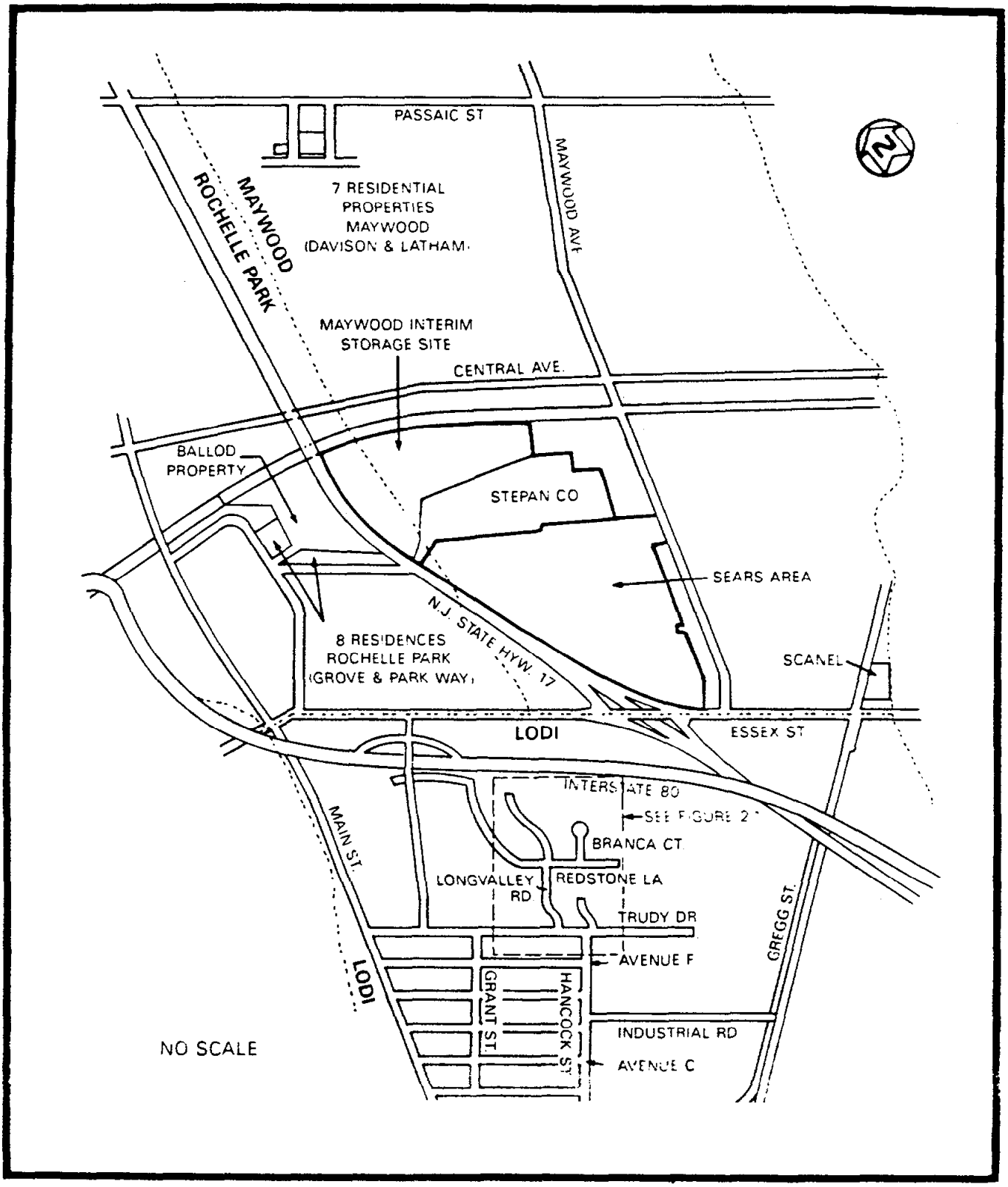

FIGURE 1-1 LOCATION OF THE MISS AND VICINITY PROPERTIES

reviewing historical aerial photography of the area surrounding the Stepan Company plant for potential pathways. The information from this review should provide historical knowledge of site property conditions and suspect areas. Findings from this review are being used by the field characterization team in performing these surveys.

1.3 SCHEDULE

The radiological characterization of the Lodi properties began in November 1986 and will continue through March 1988. The characterizations will be accomplished as directed by DOE.

1.4 SUPPORTING SERVICES

Accomplishing this characterization necessitates two supporting subcontracts in addition to radiological support:

- Surveying services to establish property lines, property corners, and the locations of gravel, asphalt, concrete surfaces, and buildings.
- Drilling services to provide equipment and the necessary personnel to drill the characterization holes and to grout the holes after drilling.

2.0 RADIOLOGICAL CHARACTERIZATION

2.1 SCOPE/PURPOSE

A radiological characterization of properties in Lodi, New Jersey, is being conducted to determine the approximate vertical and horizontal boundaries of contamination. To date, nine properties have been surveyed by ORNL and designated by DOE. Additional surveys will be conducted according to this plan based on DOE decisions resulting from the current ORNL survey work. The DOE guidelines used to determine the need for remedial action at these properties are given in Table 2-1.

Individual activities designed to cost effectively accomplish these goals are delineated in a checklist presented in Appendix A. The following subsections provide more detail associated with the checklist. The planned level of effort for the radiological subcontractor, Thermo Analytical/Eberline (TMA/E), is uncertain since the total number of properties to be assigned by DOE is unknown at this time.

2.2 CHARACTERIZATION ACTIVITIES

2.2.1 Site Grid System

A master grid was established by the surveyor; TMA/E established a grid on individual properties. The size of the grid blocks is adjusted to adequately characterize each property. Figure 2-1 shows the nine properties designated to date, as well as the location and probable disposition of other residential properties being evaluated for possible designation. Figure 2-2 shows the location of what was formerly Lodi Brook; additional designation surveys are being conducted by ORNL in the general area of the brook. Depending on the results of these surveys, additional properties may require characterization by BNI.

TABLE 2-1

SUMMARY OF RESIDUAL CONTAMINATION GUIDELINES FOR

THE MAYWOOD VICINITY PROPERTIES

SOIL (LAND) GUIDELINES (MAXIMUM LIMITS FOR UNRESTRICTED USE)

Radionuclide	Soil Concentration (pCi/g) above background[a,b,c]
Radium-226 Radium-228 Thorium-230 Thorium-232	5 pCi/g, averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over any 15-cm-thick soil layer below the surface layer.
Other radionuclides	Soil guidelines will be calculated on a site-specific basis using the DOE manual developed for this use.

STRUCTURE GUIDELINES (MAXIMUM LIMITS FOR UNRESTRICTED USE)

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.[d] 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.

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 uR/h.

Indoor/Outdoor Structure Surface Contamination

	Allowable Surface Residual Contamination[e] (dpm/100 cm^2)		
Radionuclide[f]	Average[g,h]	Maximum[h,i]	Removable[h,j]
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	220

TABLE 2-I

(continued)

Indoor/Outdoor Structure Surface Contamination (continued)

Radionuclide[f]	Allowable Surface Residual Contamination[e] (dpm/100 cm^2) Average[g,h]	Maximum[h,I]	Removable[h,J]
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]These guidelines take into account ingrowth of radium-226 from thorium-230 and of radium-228 from thorium-232, and assume secular equilibrium. If either thorium-230 and radium-226 or thorium-232 and radium-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.

[b]These guidelines represent unrestricted-use residual concentrations above background averaged across any 15-cm-thick layer to any depth and over any contiguous 100-m^2 surface area.

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

[d]A working level (WL) is any combination of short-lived radon decay products in 1 liter of air that will result in the ultimate emission of 1.3×10^5 MeV of potential alpha energy.

[e]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.

[f]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.

[g]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.

[h]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.

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

[J]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.

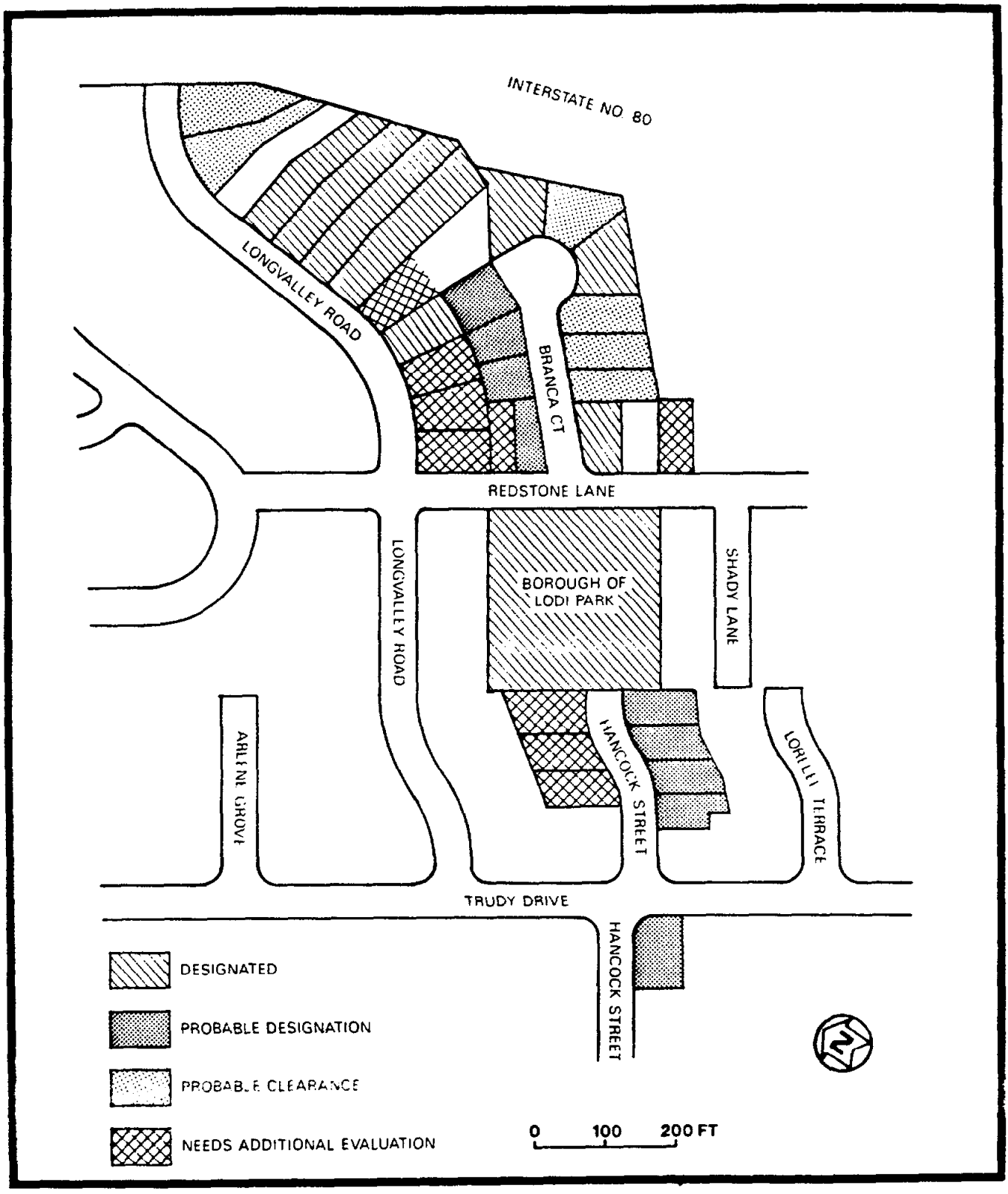

FIGURE 2-1 LOCATION OF LODI RESIDENTIAL PROPERTIES

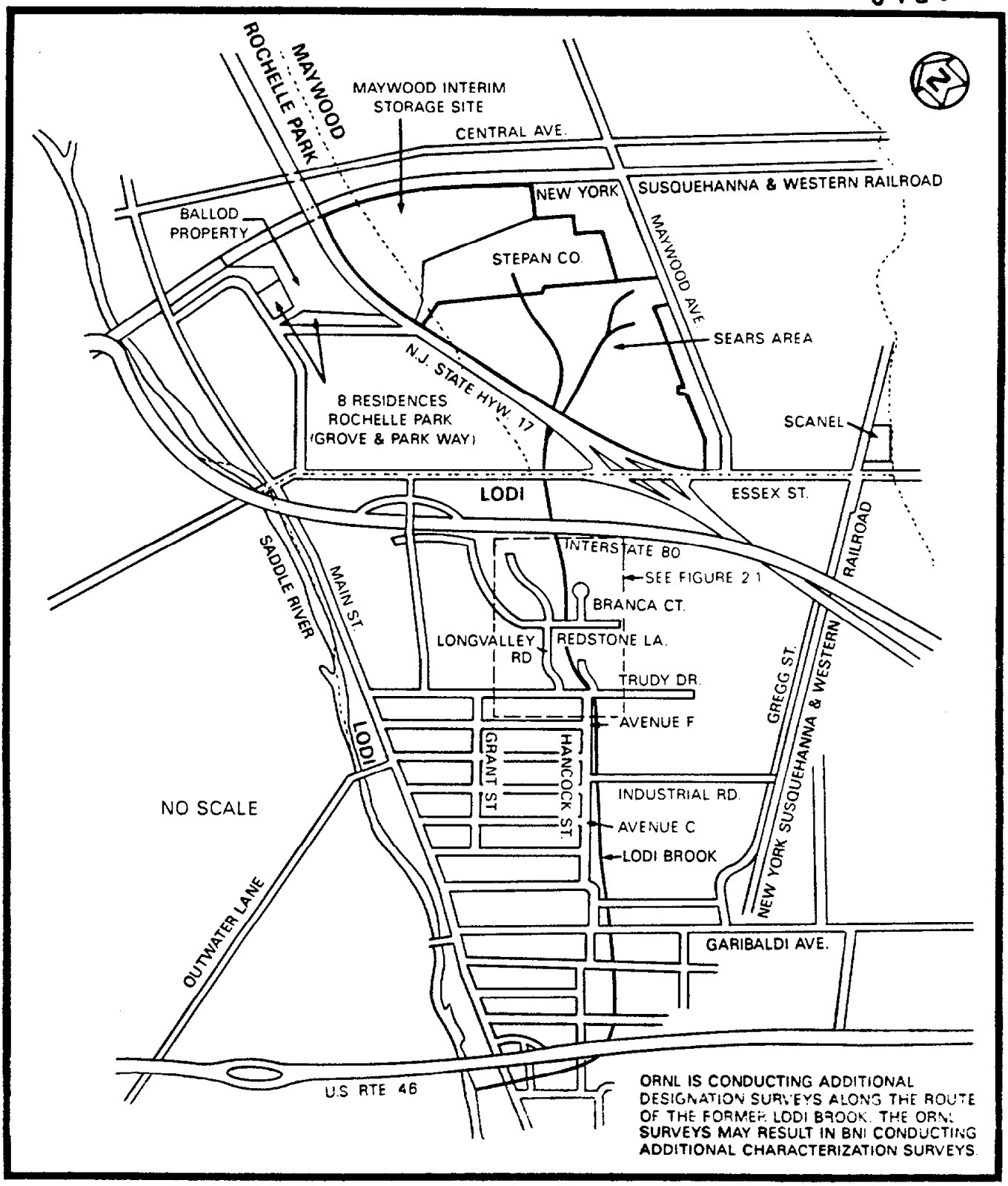

FIGURE 2-2 AREA OF ADDITIONAL DESIGNATION SURVEYS

2.2.2 Surface Characterization

Surface characterization includes the following activities:

- Walkover surveys between grid points. Areas exceeding twice background are mapped and selected gamma intensities are noted. The walkover survey covers essentially 100 percent of the ground surface and ensures that hotspots between grid points are detected.

- Cone-shielded gamma scintillator measurements are made to verify mapped areas generated during the walkover surveys. This minimizes any discrepancy in the size of these areas that might have been influenced by lateral gamma flux (shine) from other contaminated areas nearby. Data obtained from this survey helps refine the boundaries of contaminated areas established on the basis of the walkover scans.

- Surface soil samples (0 to 6 in.) are collected, if warranted, from selected locations on both systematic and biased spacing. Surface soil sample locations are selected after review of the gamma scanning data. Soil samples are analyzed for uranium-238, thorium-232, and radium-226.

- Sediment samples are taken from drainage pathways including ditches, swales, berms, culverts, and creeks. These samples will be analyzed for uranium-238, thorium-232, and radium-226.

- Measurements for radon-220 and radon-222 are obtained in all habitable structures where occupants grant entry.

2.2.3 Subsurface Investigation

Subsurface investigation is conducted by augering 3- or 6-in. diameter boreholes at selected locations. A sufficient number of boreholes will be augered in each area where elevated surface radioactive contamination is found to determine the depth of the contamination. The depth of each borehole is determined in the field based on guidance from the geological and radiological support representatives. All boreholes will reach natural soil and will extend completely through all layers of contamination. Gamma logging is being conducted in the boreholes by lowering a gamma scintillator into the hole. This detector will be calibrated to allow a correlation from counts per minute to picocuries per gram

(pCi/g). Gamma radiation measurements are made typically at 6-in. vertical intervals; however, the interval may be smaller near the boundaries of contamination.

After gamma logging, the depth of contamination in the hole is compared with depths of contamination in other boreholes in the area. If a significant difference is noted, additional boreholes are augered at a closer spacing to better define the areas of contamination. These boreholes are logged in the manner described above. Once logged, the bottoms of boreholes in contaminated areas are grouted, and the spoils are returned to the borehole so that contaminated soil is returned to the same depth from which it was taken.

2.2.4 Data Review

Meetings of the field characterization team are held periodically to review and discuss findings to date. At these meetings, problem areas and inconsistencies are identified, and a strategy for continued investigation is developed to structure the characterizations so that information collected is built upon and clarified throughout the course of the survey.

2.3 DOCUMENTATION

All radiological data collected during the surveys are transmitted to the BNI Oak Ridge office via the TMA/E Oak Ridge office in an approved format. Before the start of on-site activities, the field team is provided with blank grid drawings on which to plot field measurements. The field team assigns a scale to the grid blocks, which permits later interpretation of the drawings. For each property, these drawings will show:

- All areas identified during surface walkovers and cone-shield readings verifying the size and shape of these isopleths

- Locations of all surface soil and sediment samples, identified in such a way that the results of laboratory analyses for each location can be clearly associated with the corresponding point on the drawing

- Locations of all boreholes with identification number corresponding to gamma logs and soil samples

- Sketches of surface obstructions, irregularities, drainage pathways, culverts, fences, roads, landmarks (to rough scale)

2.4 REPORTING

The radiological characterization data collected and an evaluation of the results for each property will be presented in a letter report. The objective of the report is to present the current radiological conditions for each property.

3.0 PERSONNEL HEALTH AND SAFETY

The health and safety of site personnel performing characterization activities is protected through the implementation of the FUSRAP Occupational Health/Industrial Hygiene Plan (PI 26.0) (Ref. 2). This plan is based on prudent practices that are designed to minimize the hazards posed by substances that may be present on-site.

A brief description of the FUSRAP Occupational Health/Industrial Hygiene Plan follows.

- General Policy, Organization, and Responsibility - Delineates the responsibilities of key FUSRAP personnel for implementing the plan, including coordinator and management review of the overall health protection system.
- Medical Screening - Establishes scope of and criteria for pre-work, periodic, and followup medical assessment to ensure the evaluation of site personnel health status during performance of project work.
- Personnel Protective Apparel and Equipment - Discusses specific health protection systems, including personnel protective apparel and equipment requirements; environmental hygiene monitoring equipment; equipment/personnel decontamination procedures; radiological health protection systems; availability of first-aid, safety, and fire protection equipment on an emergency basis; and rationale for identification of certain on-site conditions as health hazards.
- Conduct of On-site Workers and Visitors - Itemizes general health and safety procedures as well as prohibited practices for performing work on-site.
- Field Personnel Health and Safety Training - Sets forth training objectives and proposed instructional outline to ensure comprehensive health and safety training of site personnel; reviews the personnel protection program in detail; and delineates emergency procedures, prohibited procedures, and general safety requirements for conducting site work.
- Special Conditions for Specific Operations - Details the potential health hazards present during drilling and excavation operations (i.e., gases, volatile organics, and hydrogen sulfide).

REFERENCES

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

2. Bechtel National, Inc. Generic Occupational Health/Industrial Hygiene Plan for FUSRAP/SFMP Sites, FUSRAP Project Instruction 26.0, Oak Ridge, TN, January 1985.

APPENDIX A
RADIOLOGICAL CHARACTERIZATION CHECKLIST FOR THE LODI PROPERTIES - 1986-1987

APPENDIX A
RADIOLOGICAL CHARACTERIZATION CHECKLIST
FOR THE LODI PROPERTIES - 1986-1987

Action	Completed	
	Initials	Date
1. Review of Historical Information		
a. previous radiation surveys	_____	_____
b. operations descriptions	_____	_____
c. photos	_____	_____
d. interviews		
1) operations personnel (hire as consultants?)	_____	_____
2) neighbors	_____	_____
3) others	_____	_____
e. Aero Space Research resources	_____	_____
f. others	_____	_____
2. Property Surveys		
a. obtain blank grid drawings	_____	_____
b. obtain old and new topographical drawings	_____	_____
c. confirm that the property is staked at appropriate intervals	_____	_____
3. Walkover Tour of Properties (note on drawings)		
a. rubble	_____	_____
b. surface obstructions	_____	_____
c. buried utility lines	_____	_____
d. utility poles	_____	_____
e. culverts	_____	_____
f. stockpiles	_____	_____
g. grates, drains	_____	_____
h. others (wells, etc.)	_____	_____

4. Characterization Team Review of Preliminary Information
   a. compare old and new topographic maps for changes _____ _____
   b. develop sketches of properties from historical information _____ _____

5. Surface Gamma Surveys
   a. walkover with unshielded gamma scintillometer _____ _____
   b. cone-shielded gamma survey to define boundaries of contaminated areas _____ _____

6. Team Meeting to Review Gamma Scans
   a. map areas exceeding preselected limits with unshielded scan _____ _____
   b. map areas exceeding preselected limits with cone-shield results _____ _____
   c. check consistency of surface scans with historical information _____ _____
   d. plan locations for systematic and biased surface soil samples _____ _____
   e. plan initial locations for systematic boreholes _____ _____
   f. plan locations for sampling around Item 3 problem areas _____ _____
   g. plan sediment sampling locations
      1) culverts _____ _____
      2) drainage ways _____ _____
      3) inside storm sewers _____ _____
      4) outfalls _____ _____
      5) others _____ _____

7. Surface Soil Sampling (if warranted) _____ _____

8. Sediment Sampling (as planned in 6g) _____ _____

9. Subsurface Investigations (as planned in 6e)
   a. drill systematic boreholes to depth of undisturbed soil _____ _____

b. drill systematic boreholes inside habitable structures if warranted _____ _____

c. obtain surface elevation of boreholes _____ _____

d. gamma log boreholes _____ _____

e. sample as required from boreholes _____ _____

f. review gamma logs for uniformity of contamination layers _____ _____

g. plan biased borehole locations to resolve inconsistencies between systematic holes _____ _____

h. repeat steps a. through d. for biased boreholes _____ _____

10. Team Meeting to Review Sampling

a. were all planned samples collected? _____ _____

b. were sufficient samples collected to

1) establish background? _____ _____

2) calibrate cone shield? _____ _____

3) calibrate unshielded gamma walkover survey? _____ _____

4) calibrate borehole gamma logs? _____ _____

c. were problem areas from Item 3 characterized?

1) sides? _____ _____

2) bottoms? _____ _____

3) tops? _____ _____

d. was a borehole drilled in each area of surface contamination? _____ _____

e. identify all areas that are unmeasurable _____ _____

f. graphically review data to ensure that all areas have been characterized _____ _____

11. Review of Data for Consistency with Historical Information _____ _____

12. Field Sample Collection Forms

a. do coordinates on samples match those on forms? _____ _____

b. are all samples on collection forms? _____ _____

c. were all logged samples shipped? _____ _____

d. was copy of field sample collection sent to TMA/E Oak Ridge office? _____ _____

e. was copy of collection form sent with samples to laboratory? _____ _____

13. Transmit all Field Notes, Data, and Drawings to TMA/E Oak Ridge Office _____ _____

14. BNI/EH&S Interpretation of Characterization Data

a. surface

1) Develop surface contamination isopleths _____ _____

2) Compare BNI and characterization team isopleths _____ _____

b. subsurface

1) develop contamination isopleths at various depths _____ _____

a) map all borehole logs that exceed criteria _____ _____

b) map all borehole logs with increasing trends regardless of magnitude _____ _____

15. Comparison of Contamination Limits and Historical Information for Consistency _____ _____

16. Transmittal of Data for Review to BNI Engineering Department with Copies to Construction and the Characterization Team _____ _____

17. Site Tour to Review Characterization Findings with

a. lead health physicist _____ _____

b. lead engineer _____ _____

c. lead construction representative _____ _____

d. lead member of characterization team _____ _____