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

CHARACTERIZATION PLAN FOR THE HAZELWOOD INTERIM STORAGE SITE

Hazelwood, Missouri

October 1986

Bechtel National, Inc.
Advanced Technology

DOE/OR/20722-106

CHARACTERIZATION PLAN FOR THE HAZELWOOD INTERIM STORAGE SITE

OCTOBER 1986

Prepared for

UNITED STATES DEPARTMENT OF ENERGY

OAK RIDGE OPERATIONS OFFICE

Under Contract No. DE-AC05-81OR20722

By

Bechtel National, Inc.

Advanced Technology

Oak Ridge, Tennessee

Bechtel Job No. 14501

048533

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1986
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U.S. Department of Energy
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Oak Ridge, Tennessee 37831

Attention: J. F. Wing
Technical Services Division

Subject: Bechtel Job No. 14501, FUSRAP Project
DOE Contract No. DE-AC05-81OR20722
Publication of the Characterization Plan for the Hazelwood Interim Storage Site
File No. 140, 148

Dear Mr. Wing:

Enclosed are five final copies of the subject document. If you need additional copies, please contact Tom Dravecky at 576-3043.

Very truly yours,

Joseph F. Nemec
Program Manager - FUSRAP

ms
Enclosures: As Stated

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1.0 INTRODUCTION

Characterization of the Hazelwood Interim Storage Site (HISS) is necessary to estimate the horizontal and vertical boundaries of radioactive contamination exceeding remedial action criteria and to determine the magnitude and nature of the contamination since these factors will affect design engineering for remedial action at the site. The intent of this report is to document the scope of the characterization effort and the methods to be used.

1.1 HISTORICAL OVERVIEW

The HISS occupies the eastern half of the property located at 9200 Latty Avenue in northern St. Louis County within the city limits of Hazelwood, Missouri, approximately 2 mi northeast of the control tower of the Lambert-St. Louis International Airport (Figure 1-1). The property is owned by Jarboe Realty and Investment Company and leased to Futura Coatings, Inc. The HISS is separated by a chain link fence from the western half of 9200 Latty Avenue, known as the Futura Coatings site (Figure 1-2).

In 1966, ore residues as well as uranium- and radium-bearing process wastes stored at the St. Louis Airport Site (SLAPS) were purchased and moved to storage at 9200 Latty Avenue by the Continental Mining and Milling Company of Chicago, Illinois. These wastes had been generated by a St. Louis plant from 1942 through the late 1950s under contracts with the Atomic Energy Commission (AEC) and its predecessor, the Manhattan Engineer District (MED). Residues at the SLAPS at that time included pitchblende raffinate residues, Colorado raffinate residues, radium-bearing residues, and barium sulfate cake. The Commercial Discount Corporation of Chicago, Illinois, purchased the residues in January 1967; much of the material was then dried and shipped to the Cotter Corporation facilities in Canon City, Colorado. The source material remaining at the Latty Avenue site was sold to the Cotter Corporation in December 1969. During

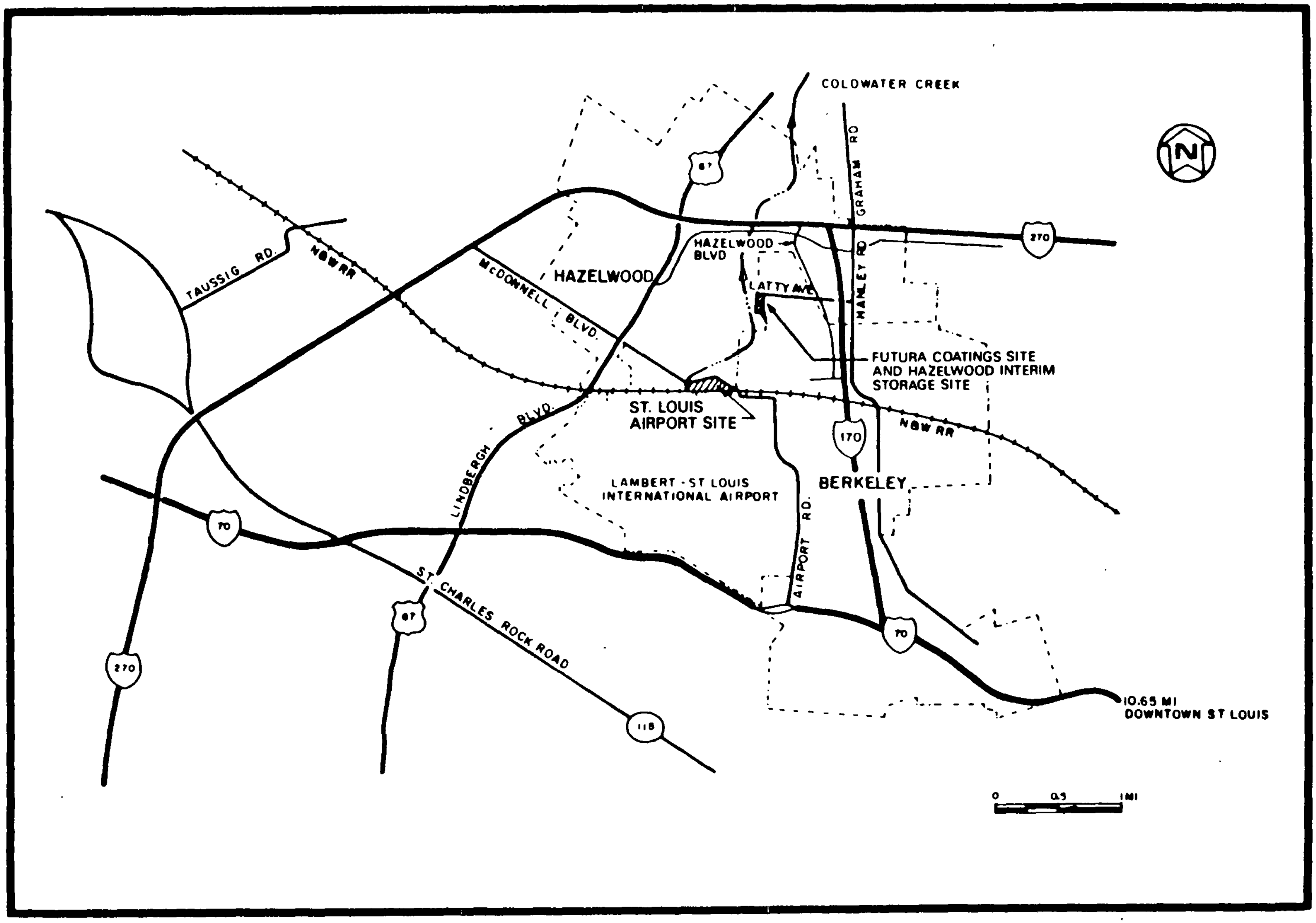

FIGURE 1-1 LOCATION OF THE HISS

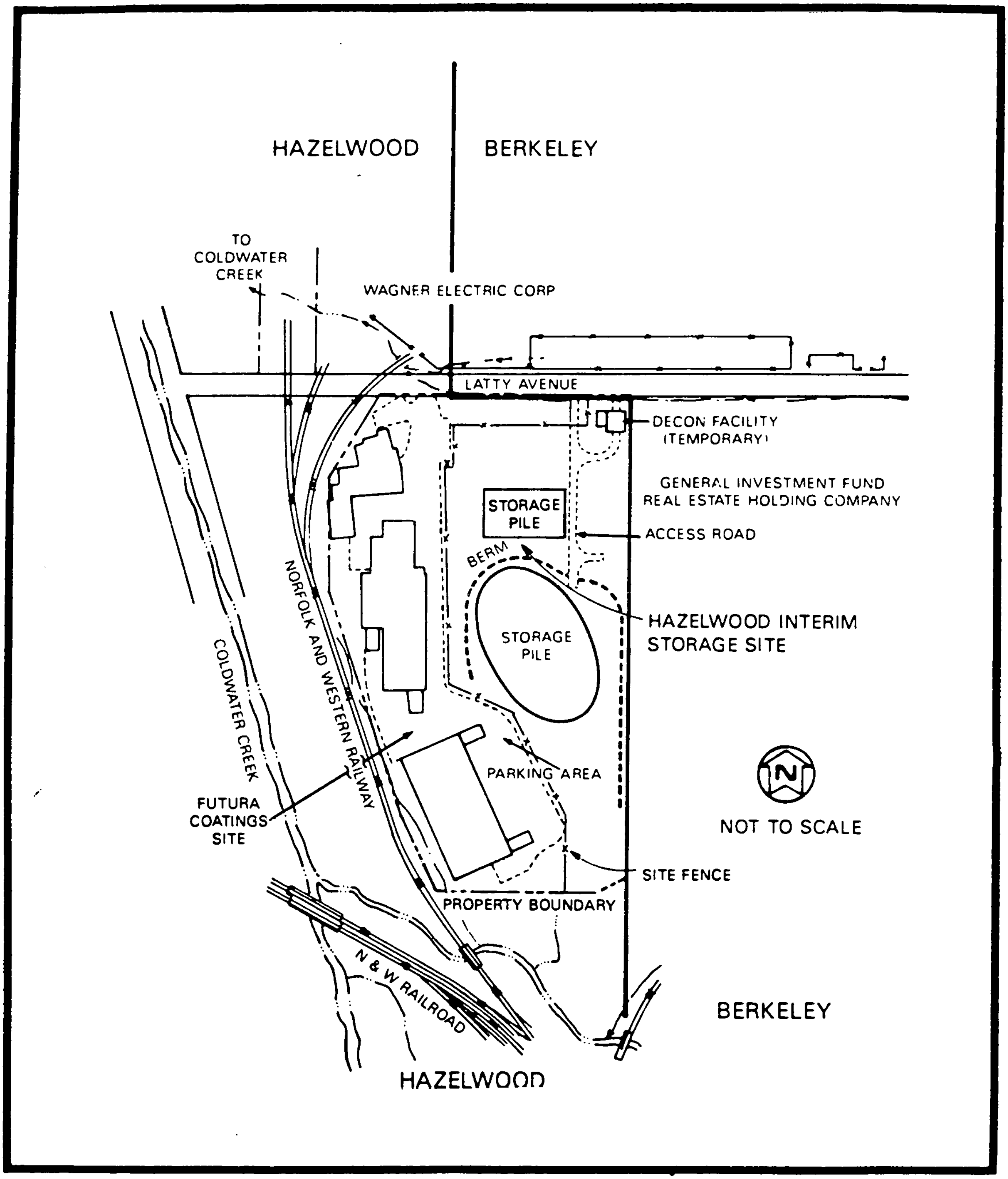

FIGURE 1-2 THE HISS AND ITS IMMEDIATE VICINITY

the period of August through November 1970, Cotter Corporation dried some of the remaining residues at the site and shipped them to its mill in Canon City.

In April 1974, the newly established Nuclear Regulatory Commission (NRC) was informed by Cotter Corporation that the remaining Colorado raffinate had been shipped in mid-1973 to Canon City without drying and that the barium sulfate residues had been diluted with site soil and transported to a landfill area in St. Louis County. Reportedly, 12 to 18 in. of topsoil had been removed with the residues.

In 1976, measurements taken by the NRC of radionuclide concentrations in the soil and of radiation levels indicated that residual uranium and thorium concentrations and exposure levels at 9200 Latty Avenue exceeded existing guidelines for release for unrestricted use (Ref. 1). A radiological characterization of the site was also performed by the Oak Ridge National Laboratory (ORNL) in the summer of 1977 prior to occupation of the site by the current owner (Ref. 2). Thorium and radium contamination in excess of Department of Energy (DOE) guidelines was found in and around the buildings and in the soil to depths of as much as 18 in. Consequently, in preparing the western half of the property for commercial use, the owner demolished one building, excavated several areas, paved several others, and erected a number of new buildings. The materials excavated during these activities (approximately 13,000 yd^3) were piled on the eastern half of the property.

In 1981, Oak Ridge Associated Universities (ORAU) characterized the pile and surveyed the northern and eastern boundaries of the property for radioactivity (Ref. 3). Levels of contamination (principally thorium-230) similar to those on the property were found in both areas. As a followup to this survey, ORNL conducted a detailed radiological survey of the north and south shoulders of Latty Avenue for the DOE in January and February 1984. Results indicated that contamination in excess of DOE guidelines was present along the road almost all the way to Hazelwood Avenue. Properties adjacent to the HISS were also found to be contaminated.

The 1984 Energy and Water Appropriations Act directed DOE to conduct a decontamination research and development project at four sites throughout the nation, including 9200 Latty Avenue and properties in its vicinity. The work is being performed under the Formerly Utilized Sites Remedial Action Program (FUSRAP), 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 in Hazelwood did not result directly from the atomic energy program, the Hazelwood properties were added to FUSRAP by congress to expedite the decontamination process. Bechtel National, Inc. (BNI) is the Project Management Contractor for FUSRAP. The DOE guidelines governing the remedial action at Hazelwood are presented in Table 1-1.

The remedial action project at the HISS is divided into two phases, Phase I, which was conducted in 1984 and 1985, consisted of radiological characterization and cleanup of Latty Avenue, and storage of the contaminated materials (an additional 13,500 yd^3) in the interim storage pile on the HISS. During Phase II, vicinity properties and the HISS itself will be decontaminated.

1.2 REVIEW OF HISTORICAL INFORMATION

Before field activities for the characterization commence, available information on the HISS will be reviewed. These reviews will include, but will not be limited to, all known previous characterization reports by various organizations, documents describing AEC operations that generated the waste stored at 9200 Latty Avenue, topographic surveys, aerial photographs, and eyewitness accounts.

As a result of this effort, a reasonable knowledge of expected site conditions and suspect areas will be obtained. This information will be used to help direct biased sampling activities and will result in a more accurate projection of site conditions while

TABLE 1-1

SUMMARY OF RESIDUAL CONTAMINATION GUIDELINES FOR THE HISS

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

Radionuclide	Soil Concentration (pCi/g) above background[a,b,c]
Radium-226 Radium-228 Thorium-230	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.

[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.

minimizing costs. Review of this information will be completed in time for findings to be made available to the field characterization team for use in performing the survey.

1.3 SCHEDULE

The radiological characterization of the HISS is scheduled to start on October 1, 1986, and be complete on November 1, 1986.

1.4 SUPPORT SERVICES

Accomplishment of this characterization will necessitate one support subcontract for surveying services to establish a 50-ft grid system before the start of characterization activities. All other field support will be provided by Thermo Analytical/Eberline (TMA/E), the BNI radiological support contractor.

2.0 RADIOLOGICAL CHARACTERIZATION

2.1 SCOPE/PURPOSE

Radiological characterization of the HISS will be conducted to determine approximate horizontal and vertical limits of contamination, to determine ranges of radionuclide concentrations, and to estimate the volume of contaminated material presently on-site. The storage piles, however, will not be characterized. 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 field work by TMA/E is documented in Appendix B.

2.2 CHARACTERIZATION ACTIVITIES

2.2.1 Site Grid System

With the exception of the storage piles, a civil surveyor will establish a 50-ft grid over the entire HISS by staking the intersections of a series of mutually perpendicular lines. The grid origin used during 1984 remedial action along the Latty Avenue right-of-way will be reestablished (Figure 2-1). Each stake will be marked with grid coordinates. A 2-in.-square wooden hub stake will also be installed at each alternate stake (every 100 ft) along each line. All property boundaries will be located and set. A drawing showing the property boundaries, fences, roads, gravel, asphalt, landmarks, grid intersections, and other improvements will be provided by the surveyor. This drawing will help identify surface obstructions and ground elevations, as well as problem areas that will significantly affect the cost of remedial action. A topographic survey of the HISS will also be performed.

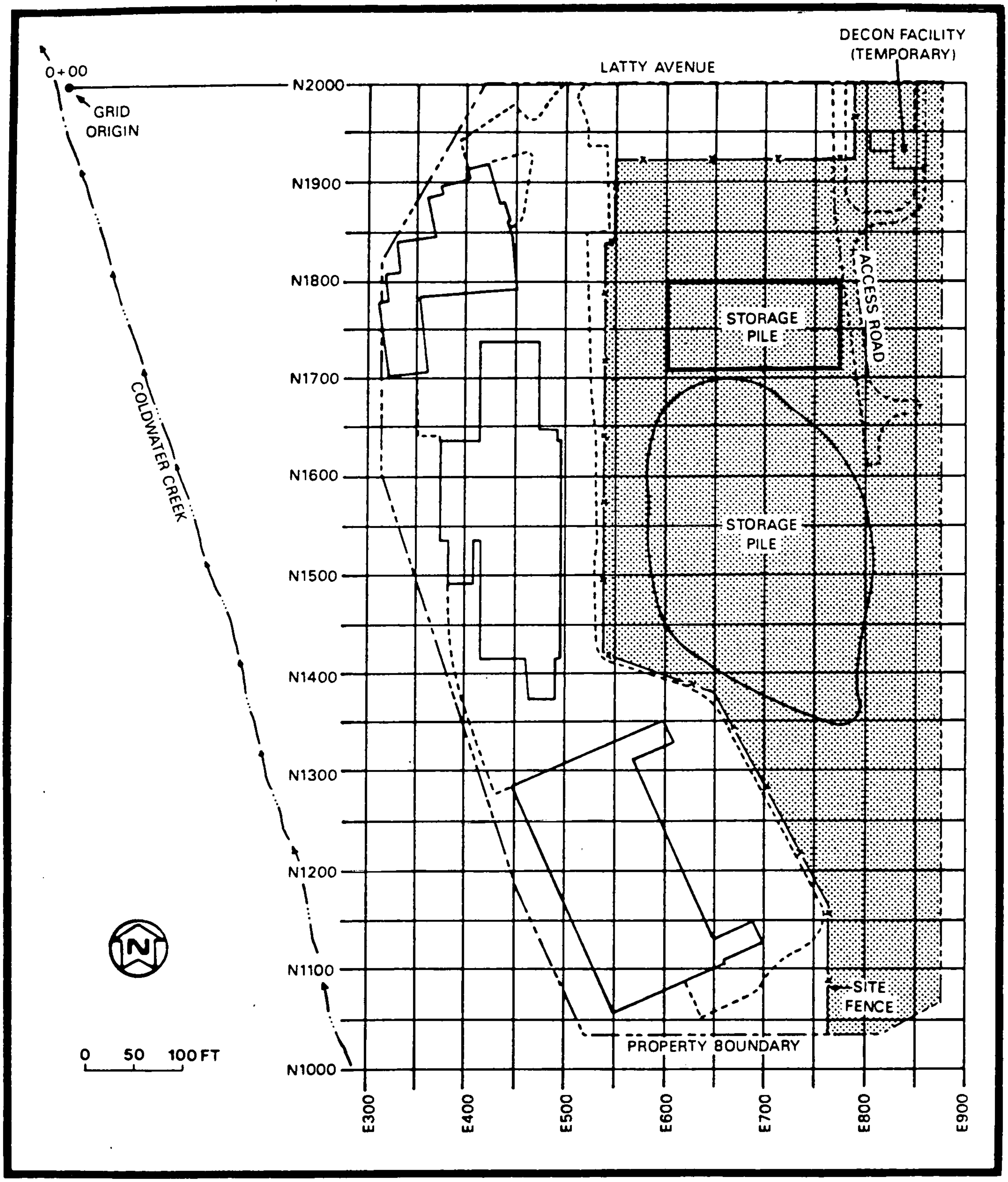

FIGURE 2-1 GRID FOR THE HISS

2.2.2 Surface Characterization

Surface characterization will precede subsurface investigations so that an understanding of contamination patterns is gained before biased borehole locations are selected. This will ensure that the depth of all surface contamination is known.

Surface characterization will consist of the activities listed below.

- Walkover surveys will be performed that consist of gamma radiation scans of individual 50-ft by 50-ft grid blocks. Although the storage piles will not be scanned, the gamma radiation scanning will be performed up to the perimeter of the storage piles. Areas in which readings exceed twice normal background levels will be marked on a site drawing. The walkover survey covers essentially 100 percent of the ground surface and ensures that hotspots between grid points are detected.

- Cone-shielded gamma scintillometer measurements will be made at no greater than 12.5-ft intervals in areas of contamination identified during the walkover survey. These measurements will minimize discrepancies in the size of a given area that might have been created by lateral gamma flux (shine) from other contaminated areas nearby. Data obtained from this survey will permit refinement of the boundaries of contaminated areas established on the basis of the walkover scans.

- Gamma exposure rate measurements will be made 3 ft above the surface at 10 selected grid points on the site using a pressurized ionization chamber (PIC). These measurements will be used to determine field calibration factors for the 2-in. by 2-in. sodium iodide (NaI) gamma scintillation detectors. The factors allow conversion of measured count rates to an exposure rate for direct comparison with DOE guidelines.

- Soil samples (0 to 6 in.) will be collected from selected locations on biased spacing. Locations will be selected after review of the gamma scanning data. Samples will be analyzed for uranium-238, thorium-230, and radium-226. The samples will be selected to determine radionuclide concentrations in areas where the surface scan data are ambiguous. Since thorium-230 analyses are costly, the number of these samples will be minimized.

- Sediment samples will be collected from all drainage pathways including ditches, swales, culverts, and creeks. These samples will be analyzed for total uranium, thorium-230, and radium-226. Sample locations will be selected to determine routes of contaminant migration from the HISS.

2.2.3 Subsurface Investigation

Systematic subsurface investigation will be conducted by pushing two 5-ft-long, 4-in.-diameter shelby tube samplers at most 100-ft grid intersections. Based on information gained during Phase I remedial action activities at the HISS, the depth of subsurface contamination is suspected to be less than 10 ft. Therefore, 10-ft-deep shelby tube samples are considered adequate to characterize subsurface conditions. Systematic subsurface investigation is necessary to 1) define vertical excavation limits, 2) estimate the volume of waste, and 3) provide assurance to the Independent Verification Contractor that major subsurface deposits have been identified. The grid interval of 100 ft has been selected on the basis of budgetary constraints. A decision will be made to determine whether a particular grid point lies close enough to the perimeter of the storage piles to necessitate an additional sampling location at the perimeter. The analysis results from samples taken at or near the perimeter of the storage piles will be used to estimate the volume of contamination under the pile. Each grid block could potentially contain 3700 yd^3 of waste. Biased subsurface samples may be taken to gain additional information from areas of suspected contamination and to reduce some uncertainties in the waste volume estimates. At least one set of shelby tubes will be pushed in each area where elevated concentrations of surface radioactive contamination are found so that the depth of the contamination can be determined.

Although gamma logging is typically used to determine subsurface contamination depths, thorium-230 (a principal contaminant) cannot be detected in situ; therefore, subsurface soil samples will be collected continuously from the surface to a depth of 10 ft by pushing two 5-ft-long shelby tube samplers. Once the shelby tubes are removed, each resulting characterization hole will be gamma logged. All boreholes drilled for chemical sampling or hydrogeological investigation will also be gamma logged. Gamma logging will be conducted by lowering a gamma scintillometer into the hole. This detector will be calibrated to allow correlation from counts per minute to picocuries per gram (pCi/g). Gamma radiation measurements will be made typically at 1-ft vertical intervals; however, the interval may be smaller near the boundaries of contamination to more accurately determine the boundary between clean and contaminated soil.

After each hole is systematically logged, the depth of gamma-emitting radionuclide contamination in it will be compared with depths of contamination in other holes in the area. If a significant difference is noted, it may be necessary to push additional shelby tubes at a closer spacing to better define the areas of contamination. If additional biased holes cannot be pushed because of funding or schedule limitations, the entire 100-ft^2 grid block would be assumed to be contaminated, representing up to 3700 yd^3 of assumed waste. These holes would be logged and sampled in the manner described above. Once gamma logged and sampled, all holes will be sealed using bentonite and/or cement bentonite grout.

Although continuous samples will be taken from each hole, the cost of analyzing all samples for thorium-230 is prohibitive (approximately $90/sample). Previous experience has shown that the concentration of thorium-230 typically exceeds the concentration of radium-226 by a factor of at least 5 (in similar residues from a uranium feed materials plant in St. Louis). Therefore, as long as radium-226 is detectable using the gamma scintillometer, it is reasonable to assume that the thorium-230 concentration exceeds the guideline of 15 pCi/g. Samples suspected of containing thorium-230 will first be subjected to high resolution gamma spectrometry analysis for radium-226 and uranium-238. Based on these results, selected samples will be analyzed for thorium-230. For holes where the gamma logs do not indicate any contamination, the surface soil sample will be analyzed.

It is important to note that the budget for soil sample analysis for this characterization assumes an average of one sample per hole.

2.2.4 Data Review

Meetings of the field characterization team will be held after each successive stage of the characterization to review and discuss the findings to date. At these meetings, problem areas and inconsistencies with current and historical data will be identified, and a strategy for continued investigation will be developed. The meetings will serve to structure the characterization sequentially so that information collected in each phase is built upon and clarified throughout the course of the survey.

Field data will be submitted to the BNI Oak Ridge office on a daily basis for interpretation by the BNI health physics staff. This will allow monitoring of progress and near real-time resolution of problems. Changes in methodology can be implemented to refine the characterization and gain better information in a cost-effective manner.

2.3 DOCUMENTATION

All data collected during the survey will be transmitted to the BNI Oak Ridge office via the TMA/E Oak Ridge office in an approved format (graphically whenever possible). Before the start of field activities, the field team will be provided with blank grid drawings on which to plot field measurements. The field team will assign a scale to the grid blocks, which will permit later interpretation of the drawings. These drawings will show:

- Surface walkover scan findings in the form of grid blocks showing radiation levels greater than twice background

- All cone-shield readings in counts per minute
- 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 shelby tube holes 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

A radiological characterization report will be prepared to present the data collected and an interpretation of the results. The main objectives of the report will be to present the current radiological conditions at the HISS and to provide an evaluation of these conditions.

3.0 PERSONNEL HEALTH AND SAFETY

The health and safety of site personnel performing characterization activities will be protected through the implementation of the FUSRAP Occupational Health/Industrial Hygiene Plan (PI 26.0) (Ref. 4). 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.

- <u>General Policy, Organization, and Responsibility</u>: Delineates the responsibilities of key FUSRAP personnel for implementing the plan, including coordinator and management review of the overall health protection system.
- <u>Medical Screening</u>: Establishes scope of and criteria for pre-work, periodic, and follow-up medical assessment to ensure the evaluation of site personnel health status during performance of project work.
- <u>Personnel Protective Apparel and Equipment</u>: 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.
- <u>Conduct of On-site Workers and Visitors</u>: Itemizes general health and safety procedures as well as prohibited practices for performing work on-site.
- <u>Field Personnel Health and Safety Training</u>: 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.
- <u>Special Conditions for Specific Operations</u>: Details the potential health hazards present during drilling and excavation operations (i.e., gases, volatile organics, and hydrogen sulfide).

REFERENCES

1. No report available. Information obtained from NRC docket file.

2. Oak Ridge National Laboratory. Radiological Survey of the Property at 9200 Latty Avenue, Hazelwood, Missouri, Oak Ridge, TN, September 1977.

3. Oak Ridge Associated Universities. Radiological Evaluations of Decontamination Debris Located at the Futura Chemical Company Facility, 9200 Latty Avenue, Hazelwood, Missouri, Oak Ridge, TN, September 1981.

4. 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 HISS

APPENDIX A

RADIOLOGICAL CHARACTERIZATION CHECKLIST FOR THE HISS

Action	Completed: Initials	Completed: 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 50-ft intervals	______	______
3. Walkover Tour of Site (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 locations for systematic subsurface soil samples ________ ________
   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 (as planned in 6d) ________ ________

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

9. Subsurface Investigations (as planned in 6e)
   a. push two 5-ft-long shelby tube samplers at each planned location ________ ________

b. obtain surface elevation of shelby tube holes ______ ______

c. gamma log shelby tube holes ______ ______

d. review gamma logs for uniformity of contamination layers ______ ______

e. plan biased shelby tube locations to resolve inconsistencies between systematic holes ______ ______

f. repeat steps a. through d. for biased shelby tube holes ______ ______

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 shelby tube hole gamma logs? ______ ______

c. were problem areas from Item 3 characterized?

1) sides? ______ ______

2) bottoms? ______ ______

3) top? ______ ______

d. was a shelby tube pushed 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 ______ ______

g. select depths of each shelby tube where thorium-230 samples should begin

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) correlate soil samples and borehole gamma logs to determine cpm/pCi/g ______ ______

2) develop contamination isopleths at various depths ______ ______

a) map all shelby tube logs that exceed criteria ______ ______

b) map all shelby tube 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 ______ ______

APPENDIX B

STAFFING/BUDGET FOR THERMO ANALYTICAL/EBERLINE FOR THE CHARACTERIZATION OF THE HISS

APPENDIX B

STAFFING/BUDGET FOR THERMO ANALYTICAL/EBERLINE FOR THE CHARACTERIZATION OF THE HISS

Funding has not yet been appropriated for support of the HISS characterization, which will be performed in FY 1987. It is anticipated that funding of approximately $75,000 for TMA/E will be required to provide the level of support necessary to accomplish the characterization.