REMEDIAL ACTION WORK PLAN FOR THE MAYWOOD SITE

APRIL 1985

Prepared by
U.S. DEPARTMENT OF ENERGY
OAK RIDGE OPERATIONS OFFICE

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FOR THE

MAYWOOD SITE

APRIL 1985

UNITED STATES DEPARTMENT OF ENERGY

OAK RIDGE OPERATIONS

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1.0 INTRODUCTION AND OBJECTIVES

1.1 BACKGROUND

The United States Government initiated the Formerly Utilized Sites Remedial Action Program (FUSRAP) in 1974 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. It is currently being managed by the Department of Energy (DOE). The objectives of FUSRAP (Ref. 1) include:

- Identification of candidate sites
- Determination of whether authority exists for DOE to undertake work, and, if so, characterization of radiological conditions
- Stabilization and/or decontamination of sites as required and pursuant to authorization and appropriation by Congress
- Development of acceptable stabilization and disposal sites in cooperation with the affected states, and ultimately
- Certification of the acceptability of the sites for future use

1.2 SITE IDENTIFICATION

The Maywood Site is a DOE FUSRAP site located in the Boroughs of Lodi and Maywood and the Township of Rochelle Park, New Jersey, consisting of an interim storage site and a number of vicinity properties (Figure 1-1). The interim storage site is on part of the property owned by the Stepan Company (SC) (land which DOE expects to acquire). The vicinity properties include eight residential properties on Davison and Latham Streets in Maywood; nine residential properties on Grove Avenue and Park Way in Rochelle Park; four residential properties in the Borough of Lodi; commercial properties identified as the Scanel property, Ballod property, New York Susquehanna and Western Railroad property, and Sears area properties; and one commercial property and one state-owned property

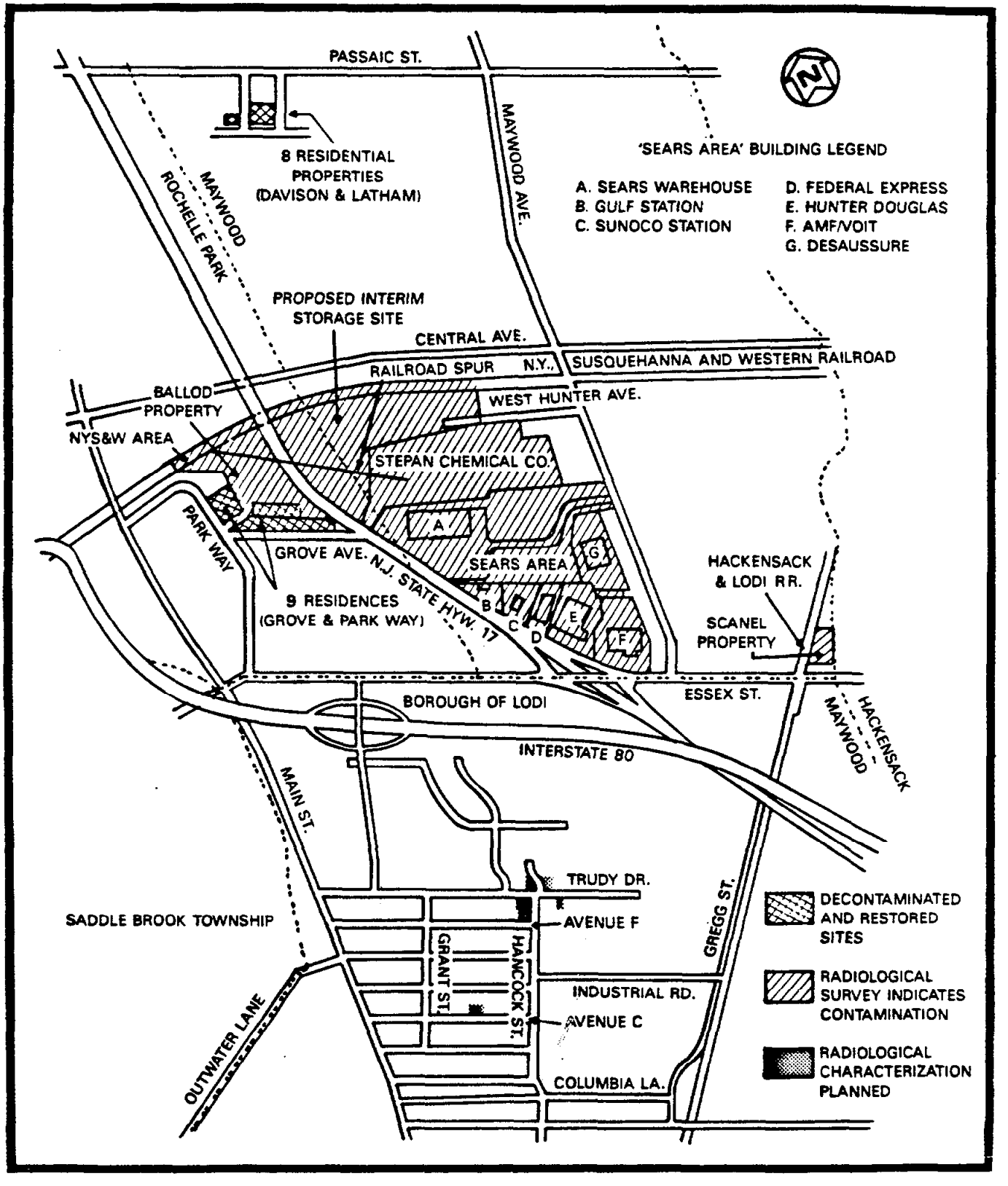

FIGURE 1-1 MAYWOOD INTERIM STORAGE SITE AND VICINITY PROPERTIES

in the Borough of Lodi. The properties at Davison and Latham Streets, Grove Avenue, and Park Way, and part of the Ballod property were decontaminated in FY 1984.

1.3 PURPOSE

This document describes the engineering design, construction, radiological survey/monitoring, and associated plans for remedial action on the vicinity properties and interim storage site during 1985. These plans include:

- Excavating the above-guideline radioactive materials on the vicinity properties
- Designing and constructing required facilities for the interim storage site
- Preparing the interim storage site to receive these contaminated materials
- Transporting the contaminated materials to the interim waste storage stockpile
- Preparing necessary schedules for accomplishing the remedial actions

2.0 SITE DESCRIPTION

2.1 SITE LOCATION AND DESCRIPTION

The Maywood Interim Storage Site (MISS) and vicinity properties (Figure 1-1) are located in a highly developed area in the Boroughs of Maywood and Lodi, and the Township of Rochelle Park in the County of Bergen, New Jersey. The MISS is partially on property presently owned by the SC, formerly the Maywood Chemical Works, an area of approximately 12.1 ha (30 acres) bounded by New Jersey Route 17 on the west, a railroad line on the north and east, and commercial/industrial areas on the south and east.

The vicinity properties consist of the following:

- Ballod property -- This area of approximately 7 acres is located west of the MISS on the west side of New Jersey Route 17 in Rochelle Park. This area was once part of the Maywood Chemical Works and was used for waste storage.
- Residential properties -- Eight residences are located on Davison and Latham Streets in Maywood; nine residences are on Grove Avenue and Park Way in Rochelle Park, all of which were decontaminated in FY 1984; and a number of residences in the Borough of Lodi have been identified for further radiological investigation in FY 1985. To date, four of these have been designated; the designation of the others will be determined in the future.
- Sears area properties -- This industrial/commercial area of approximately 20 ha (50 acres) borders the SC site on the south side and is in Maywood.
- Scanel property -- This commercial area is located approximately 0.8 km (0.5 mi) south of the SC site in Maywood.
- Railroad property -- The New York Susquehanna and Western Railroad adjacent to the MISS, Ballod property, and the Stepan Company plant on the north and east.
- Lodi commercial and state-owned properties -- Two properties have been identified to date.

2.2 RADIOLOGICAL DESCRIPTION

The SC site was formerly owned by the Maywood Chemical Works. From 1916 through 1956, Maywood Chemical processed thorium for use in the manufacture of gas mantles for various lighting devices. During this time, process wastes from the operations were pumped to diked areas west of the plant. Additional material was placed in two piles surrounded by earthen dikes. In 1932, Route 17 was built through this disposal area.

The Atomic Energy Commission (AEC) in 1954 issued License R-103 to the Maywood Chemical Works to possess, process, manufacture, and distribute radioactive materials. This license allowed those activities which had been conducted to continue under the Atomic Energy Act of 1954. The Maywood Chemical Works stopped thorium processing in 1956 and was subsequently sold to the SC in 1959.

In 1961, the SC was issued an AEC radioactive materials license (STC-130). Based on AEC inspections and information related to the property on the west side of New Jersey State Route 17, the SC agreed to take remedial action. In 1963, residues and tailings (also known as "slurry pile") were partially stabilized. In 1966, 6390 m^3 (8358 yd^3) of waste were removed from the area east of Route 17 and were buried on-site (Burial Site #1) under an area which is now a lawn. In 1967, 1570 m^3 (2053 yd^3) of waste were removed from the same general area and buried on-site (Burial Site #2) under what is now a parking lot. In 1968, the SC obtained permission from the AEC to relocate additional waste from the west side of Route 17. The licensee transferred 6575 m^3 (8600 yd^3) of waste from the south dike area and buried it on-site (Burial Site #3) in an area where a warehouse was later built (Ref. 2). Figure 2-1 shows the approximate locations of these burial sites. The location of an additional area known to be contaminated is also shown.

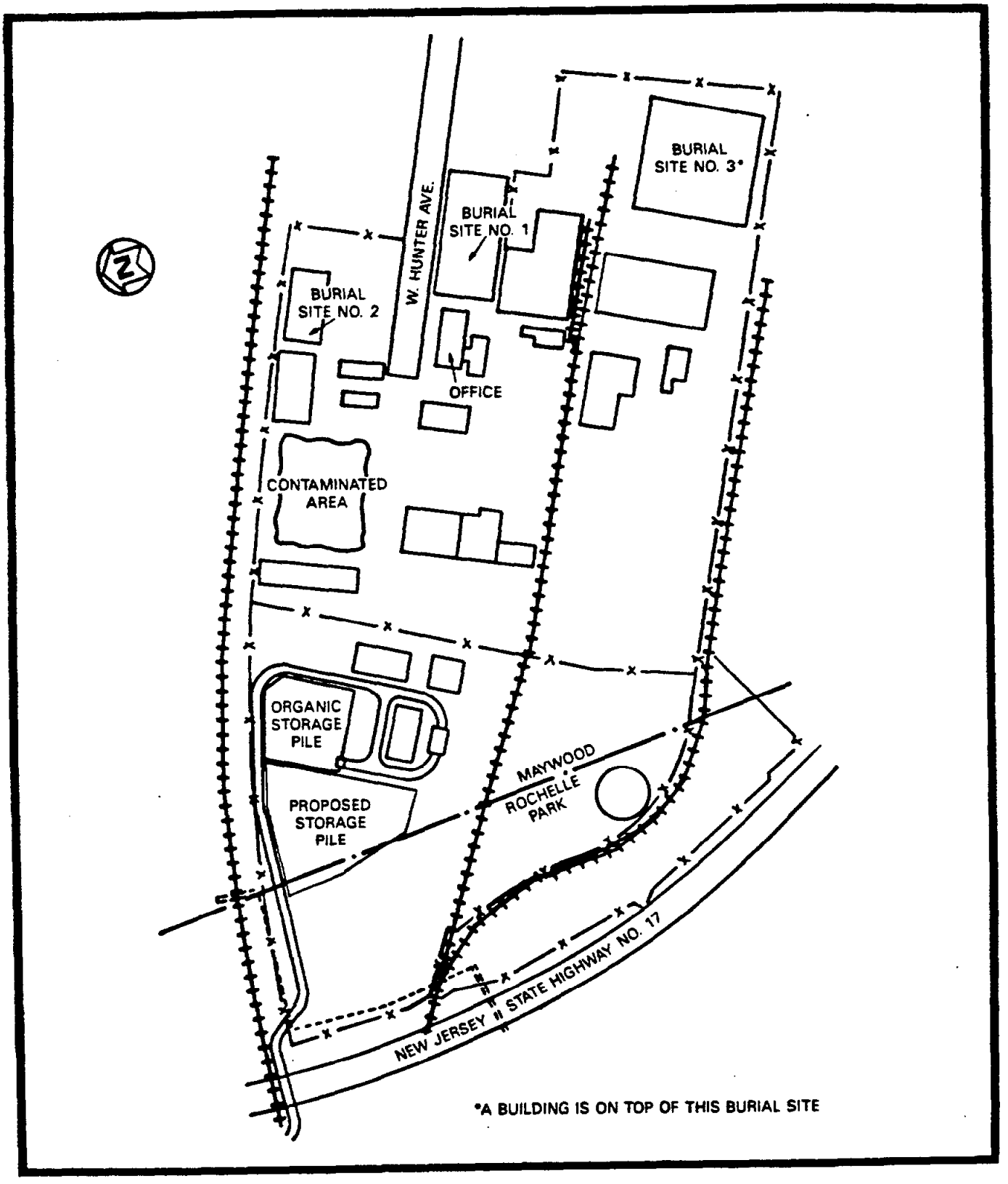

FIGURE 2-1 WASTE BURIAL SITES ON STEPAN COMPANY PROPERTY

At the request of the licensee, a radiological survey of the south dike area was made by the AEC. Based on the findings of that survey, clearance was granted for release of the property for unrestricted use. At the time of the survey, the AEC was not aware of waste material existing in the northwest corner. Late in 1968, this portion of the SC site was sold by SC and later resold to the current owners, Ballod and Associates. Over the past few years, the property has been used for unauthorized trash disposal by the local residents and local youths play on the property.

In 1980, the U.S. Nuclear Regulatory Commission (NRC) was notified of elevated radiation levels on the Ballod and Associates property. This information prompted the NRC to request a comprehensive survey to assess the radiological conditions of the property. The survey was performed by Oak Ridge Associated Universities (ORAU) with the assistance of a representative from the Region I office of the NRC in February 1981 (Ref. 3). In addition, the NRC requested that an aerial radiological survey be conducted on the SC site, the Ballod and Associates property, and the surrounding area. This survey was conducted by EG&G for the NRC in January 1981 (Ref. 4). This aerial radiological survey resulted in the discovery of other anomalies (i.e., readings distinctly higher than those of surrounding areas). Elevated gamma readings (over the local background level) were detected directly over the Stepan Plant and immediately to the west and south of the chemical plant. Two other points of elevated gamma background radiation were detected about 0.5 mile from the center of the plant: one northeast of the plant and the other south of the plant. Followup ground surveys were taken to determine the nature of the anomalies at the northeast location (Refs. 5 through 11). A followup ground survey was also done at the southern location (Ref. 12).

In 1983 elevated gross alpha contamination was discovered in water wells in the Borough of Lodi. In 1984 Oak Ridge National Laboratory (ORNL) surveyed the area with a mobile van. Additional properties contaminated with materials from the SC plant were identified during this survey.

2.3 SITE GEOLOGY AND HYDROLOGY

The MISS is centrally located within the Piedmont Plateau of north central New Jersey. The geology of the Piedmont Plateau in this area of New Jersey is characterized by thick sedimentary rocks deposited during the Late Triassic Period concurrently intruded by a diabase sill and dikes, and covered by several flows of basalt. Collectively, this group of sedimentary and associated igneous rocks of Triassic age are known as the Newark Group. Bedrock in the area is comprised of consolidated deposits of the Brunswick Formation, consisting of mudstones, sandstones, and thin-bedded shales (Ref. 2).

During October-November 1984, 17 geologic boreholes and monitoring-observation wells were installed on the Maywood site. The locations of these boreholes are shown in Figure 2-2. The data collected from these boreholes included drill logs derived from examining samples, and bedrock cores and water levels taken after the wells were completed and cleaned. Permeability measurements were taken in the boreholes as part of the investigation.

Information collected from the new borings, together with data from previous work, indicate that bedrock lies near the ground surface under 3.1 to 7 m (4 to 23 ft) of unconsolidated material and weathered bedrock. The unconsolidated material overlying the bedrock is comprised largely of stratified drift which exhibits considerable variability both areally and with depth. A weathered zone between 0.6 and 2.4 m (2 and 8 ft) in depth commonly overlies hard bedrock. In addition, borings indicate that considerable amounts of fill material have been placed on this site during its many years of industrial use.

Groundwater has generally been observed 2 to 3 m (7 to 10 ft) below the ground surface.

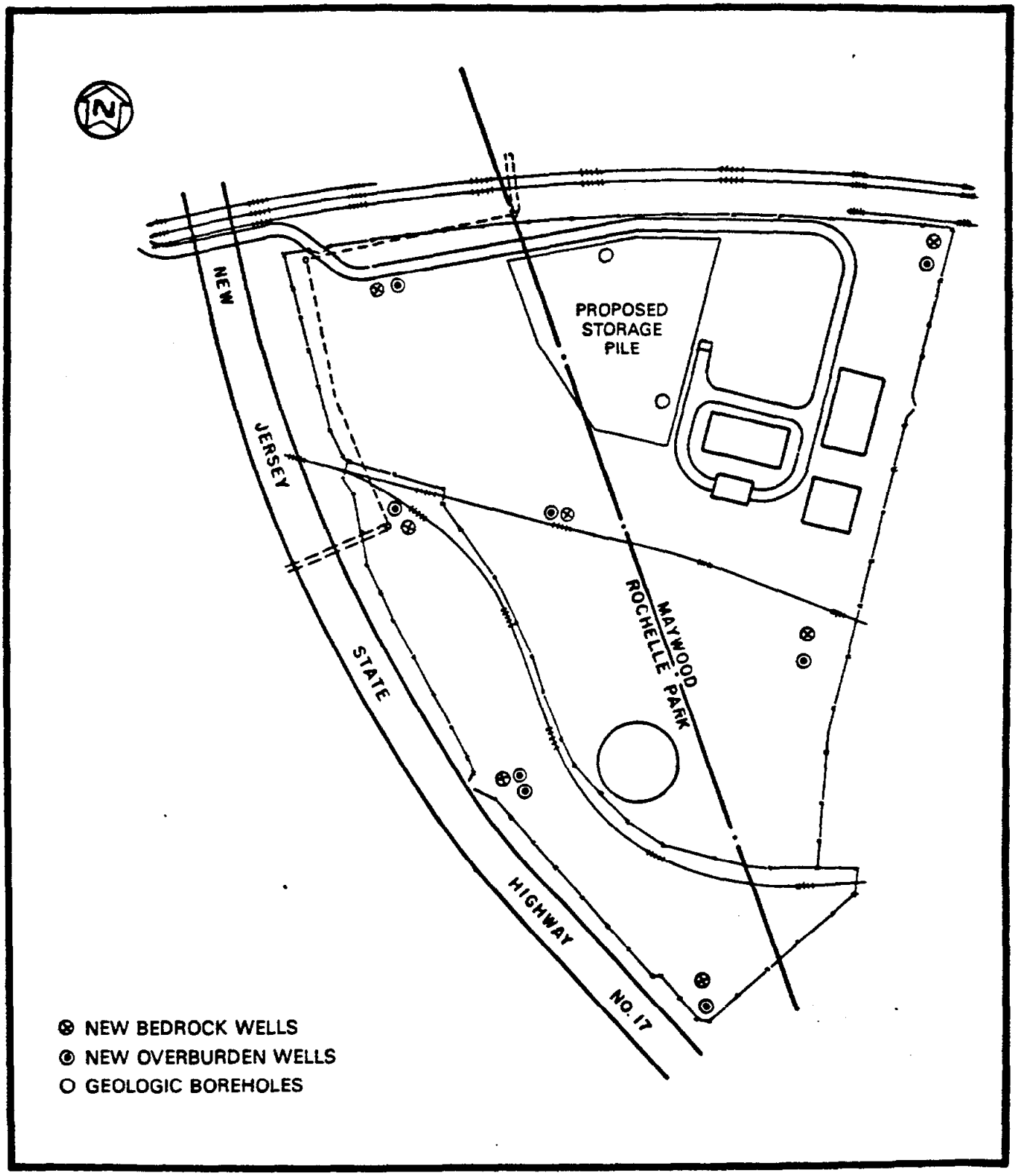

FIGURE 2-2 GENERAL LOCATION OF MONITORING WELLS AT MISS

3.0 MANAGEMENT APPROACH

All FUSRAP sites are under the direction of the DOE Assistant Secretary for Nuclear Energy, through the Office of Terminal Waste Disposal and Remedial Action, and the Division of Remedial Action Programs (DRAP).

DOE Headquarters (DOE-HQ) has the responsibility for developing overall policy applicable to the FUSRAP. DOE-HQ provides broad guidance and establishes the program budget.

The Oak Ridge Operations Office, Technical Services Division (ORO-TSD), manages the FUSRAP on a day-to-day basis and oversees the work of the Project Management Contractor (PMC) chosen to implement project activities. In addition to the technical and administrative management of the FUSRAP, ORO-TSD manages the authorized project budget.

The PMC, Bechtel National, Inc. (BNI), acts as DOE's representative in the planning, management, and implementation of the FUSRAP. As PMC, BNI is responsible for analyzing site conditions and planning, recommending, and engineering remedial actions for the various FUSRAP sites. Upon approval from ORO-TSD, BNI implements remedial actions as required. BNI administers construction subcontracts, coordinates the sequence of operations, controls the relationships among subcontractors, and assures completion of each authorized project according to plan.

In implementing approved remedial actions at a specific site, BNI will focus on subcontracting in the local region to the extent that it is cost effective and expedient to the program.

At each FUSRAP site, BNI is responsible for defining and implementing quality assurance procedures and environmental monitoring, safety, and radiological programs. BNI is responsible for monitoring and controlling all activities at the site through

close cooperation with its radiological support subcontractor, Eberline Analytical Corporation (EAC), and all remedial action subcontractors.

Argonne National Laboratory (ANL) is responsible for the National Environmental Policy Act (NEPA) documentation process as outlined in the Council on Environmental Quality NEPA regulations and implementing DOE guidelines. Through the NEPA process, DOE will advise federal, state, and local agencies and the public of the results of preliminary engineering evaluations, environmental analyses, and conclusions regarding options for disposition of contaminated materials. As part of its NEPA responsibilities, ANL will perform the required types and levels of environmental assessment necessary to support work activities.

4.0 WORK PLAN

4.1 REMEDIAL ACTION GUIDELINES

The radiological guidelines established by DOE for the cleanup of radioactive materials under the FUSRAP are summarized in Table 4-1. The Design Criteria for Formerly Utilized Sites Remedial Action Program (FUSRAP) and Surplus Facilities Management Program (SFMP) Project presents additional information regarding applicable federal regulations (Ref. 13).

The radiological guidelines for remedial action at FUSRAP sites are based on conservative calculations of the potential dose to the public. These dose calculations take into account the following exposure pathways: direct external exposure, inhalation of radioactivity in the form of dusts and gases, and ingestion of radioactivity by drinking contaminated water or by eating plants and animals grown in the contaminated environment. Dose calculations assume uniform soil contamination over the entire site including underneath a habitable structure.

For many sites being evaluated for remedial action, most of the exposure pathways considered in setting these guidelines are not applicable for a calculation of a realistic estimate of dose (and therefore risk). The most common instance is where the contamination is localized in a few small areas, thus greatly reducing the potential for exposure. In some instances, the cost of engineered remedial action may exceed the worth of any benefit (cost/risk) derived from that action.

In all of the remedial action activities, the DOE policy to maintain radiation exposures to individuals and population groups to as low as reasonably achievable (ALARA) will be followed. The radiological guidelines are considered as target upper limits that are not to be exceeded for any 100-m^2 (1076-ft^2) area of properties that are to be released for unrestricted use. For small areas of residual

TABLE 4-1

SUMMARY OF RESIDUAL CONTAMINATION GUIDELINES

FOR THE MAYWOOD SITE

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)

Indoor Radon Decay Products

For Rn-222 and Ra-220 concentrations in buildings, the average annual radon decay product concentration (including background) due to uranium or thorium byproducts should not exceed 0.02 WL after remedial action. When remedial action has been performed and it would be unreasonably difficult and costly to reduce the level below 0.03 WL, the remedial action may be terminated and the reasons for termination should be documented. Remedial action shall be undertaken for any building which exceeds an annual average radon decay product concentration (including background) of 0.03 WL.

Indoor Gamma Radiation

The indoor gamma radiation after decontamination shall not exceed 20 microroentgen per hour (20 μR/h) above background in any occupied or habitable building.

Indoor/Outdoor Structure Surface Contamination

	Allowable Surface Residual Contamination[d] (dpm/100 cm^2)		
Radionuclide[e]	Average[f,g]	Maximum[f]	Removable[f]
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	200
U-Natural, U-235, U-238, and associated decay products	5,000	15,000	1,000

TABLE 4-1 (Continued)

Indoor/Outdoor Structure Surface Contamination (continued)

Radionuclide[e]	Allowable Surface Residual Contamination[d] (dpm/100 cm^2) Average[f,g]	Maximum[f]	Removable[f]
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above	5,000	15,000	1,000

[a]In the event of occurrence of mixtures of radionuclides, the fraction contributed by each radionuclide to its limit shall be determined, and the sum of these fractions shall not exceed 1.

[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 100 m^2 is not exceeded.

[d]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.

[e]Where surface contamination by both alpha- and beta-gamma-emitting radionuclides exists, the limits established for alpha- and beta-gamma-emitting radionuclides shall apply independently.

[f]Measurements of average contaminant 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.

[g]The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h at 1 cm and 1.0 mrad/h at 1 cm respectively, measured through not more than 7 mg/cm^2 of total absorber.

contamination, field procedures (see Appendix A, Section 4.3) have been developed that ensure the adequacy of the decontamination, i.e., that the residual guidelines for 100 m^2 (1076 ft^2) are met.

The decontamination/remedial action process includes excavating, loading, and hauling material to the interim storage pile located at the MISS.

4.2 SITE CHARACTERIZATION

The following radiological surveys have been performed on the SC site and vicinity properties.

- January 1981 -- An aerial radiological survey (by EG&G for NRC) identified elevated gamma readings over the SC site and immediately to the west (Ballod property) and south (Sears area). Two other locations were also identified within 0.5 mile of the SC site: one to the northeast (residential property) and one south of the plant (Scanel property). Followup ground surveys verified these readings.

- February 1981 -- An ORAU survey identified and mapped the contamination on the Ballod site where waste had been stored.

- June 1981 -- An ORNL survey of the eight lots on Davison and Latham Streets identified and mapped the contamination on these lots. It was reported that the source of radioactive contamination was from chemical by-product wastes from the Maywood Chemical Works. In the early days, the plant allowed removal of processing wastes from their operations, charging only minimal fees for transportation. Much of the by-product material from other operations was in the form of tea and cocoa leaves (nonradioactive) mixed with other fill material. In many instances, this material was used as a rich organic mulch for topsoil and gardens, and as a general fill material for lawns. This material was also used for fill in a ditch that traversed the back of several of the residential lots between Davison and Latham Streets. One lot did not have a dwelling on it until after the radioactively contaminated by-product material from the plant had been placed on the surface of the property.

- Summer 1981 -- A Nuclear Safety Associates, Incorporated, survey of the gamma level inside and around the buildings on the SC site concluded that workers were not being exposed to gamma radiation in excess of NRC regulations.

- August 1983 -- An NUS Corporation survey of the Sears and Scanel properties identified and mapped the depth of the contamination on these two sites (Ref. 12). The Sears area property was probably used by Maywood Chemical for storage of thorium process waste, with the contamination being moved about during the construction of the various buildings on the site. It is not known at this time how the contamination came to exist at the Scanel site.

- Supplemental radiological characterization surveys were performed by BNI/Eberline on the residential properties on Park Way and Grove Avenue during November and December 1983. This was done because of the proximity of these residences to the contaminated materials on the adjacent Ballod property. Fifteen properties were surveyed, revealing that 8 of them were above the guidelines and required remedial action. During remedial activities, two additional residential properties were found to be contaminated: one on Davison Street in Maywood and one on Grove Avenue in Rochelle Park.

- In 1984, four residential, one commercial property, and one state-owned property in Lodi were designated for cleanup.

4.3 PRELIMINARY ENGINEERING

Remedial action consists of Phase I and Phase II work activities. Phase I consists of the cleanup of contaminated materials at residential (first priority) and commercial vicinity properties and storing them at the interim storage site for a period of not more than 25 years. Phase II includes cleaning up the interim storage site and transporting all contaminated materials, including those from Phase I, to a permanent disposal facility, or alternatively, permanent in situ storage on-site.

Before starting the Phase I cleanup, preliminary engineering studies considered several alternative actions. These included:

- Defining the boundaries of the interim storage site and siting of the storage area

- Developing alternative locations for access roads and a decontamination facility

The conclusions reached as the result of studies to date are:

- The interim storage site should include as much as possible of the fenced area between the Stepan Plant and NJ Rt 17 where buried contamination exists, but should exclude the water storage tank area and other easements.
- Access to the storage site should provide a link with the Sears property and provide flexibility for access to NJ Rt 17.
- Approximately 46,600 m^3 (61,000 yd^3) of contaminated materials can be stored in the area north of the SC railroad spur east of NJ Rt 17.
- Some Stepan Plant area may be required for temporary use during remedial action.
- Access to the interim storage site can be achieved from Central Avenue across railroad property from the north, from the Sears property or NJ Rt 17 from the south, or from Park Way across the Ballod property from the west. The access for 1985 work is from Central Avenue; this route uses an existing railroad crossing and signal installed in 1984 adjacent to the north-west SC property corner. For 1986 work, access will be from the Sears property.
- The geological findings completed in the fall of 1984 must be assessed to determine whether the MISS is suitable as a permanent storage site; this includes in situ stabilization of existing buried wastes.

Additional preliminary engineering studies will be performed during 1985 to assess the feasibility of permanent on-site storage versus removal of contaminated materials to a waste storage site in the state of New Jersey. DOE will evaluate the results of such studies, legal requirements of governing legislation, and conduct the appropriate level of NEPA assessment to select the preferred alternative for the final disposition of the contaminated materials.

The work currently planned for 1985 involves the cleanup of only the residential vicinity properties in Lodi, a portion of the Ballod property (Ballod cleanup depends on funding levels), and interim storage of the resulting contaminated materials. The details of the work plan for the interim work are presented in Section 4.7 of this document. For this work plan, it is assumed that the NEPA documentation will support these planned interim activities.

4.4 NEPA

The National Environmental Policy Act promotes environmental considerations in federal decision making. DOE implementing guidelines for NEPA will be followed in evaluating proposed interim remedial actions and final disposition of all the contaminated material. Through the NEPA process, the DOE will conduct the applicable level of environmental analysis and will advise appropriate federal, state, and local agencies and the public of proposed interim actions.

4.5 DESIGN ENGINEERING

During 1985, design engineering will continue to support the NEPA activities and to develop the engineering subcontract packages necessary to support the remedial action and required environmental groundwater monitoring (detailed cost estimates, drawings, specifications, schedules, and requisitions) as described in Section 4.7. Design engineering will continue through 1986.

4.6 ACCESS AGREEMENTS

BNI will obtain access agreements for all required radiological surveys and remedial action work. During 1985, access agreements will be signed with:

- Four residential property owners in the Borough of Lodi whose property has been designated for remedial action.
- Six residential property owners in the Borough of Lodi whose property adjoins designated properties and may be contaminated.
- The Borough of Lodi for part of public rights-of-way (e.g., sidewalks) that are affected by remedial work.
- Ballod and Associates.
- Scanel and the Sears area property owners whose properties will be designated for characterization.

- o One commercial property owner in the Borough of Lodi whose property has been designated for remedial action (optional).
- o State of New Jersey for its vehicle inspection station in Lodi that has been designated for remedial action (optional).
- o Unidentified property owners adjacent to property that may require radiological surveys (optional).

The current agreement with the New York, Susquehanna, and Western Railway Company will be continued to provide an access route into the MISS and to conduct radiological surveys on railroad property. The access agreement with the Stepan Company for use of the MISS site will continue pending transfer of the property to DOE.

4.7 REMEDIAL ACTIONS

4.7.1 Previous Work

As described in Section 2.0, the Maywood Chemical Company processed monazite sands whose radioactive component was primarily thorium-232. During a 40-year period, the residues were buried or stockpiled on the plant site. The radiological surveys (described in Section 2.2) identified these and other areas where these residues were later deposited.

From June to December 1984, the following vicinity properties were decontaminated and restored and the material transported to MISS for interim storage.

Rochelle Park Resident Address	Maywood Resident Address
86 Parkway	459 Latham Street
90 Parkway	461 Latham Street
10 Grove Avenue	467 Latham Street
22 Grove Avenue	454 Davison Street
26 Grove Avenue	459 Davison Street
30 Grove Avenue	460 Davison Street
34 Grove Avenue	464 Davison Street
38 Grove Avenue	468 Davison Street
42 Grove Avenue	
Ballod Commercial Property (partial)	

A total of 4700 yd^3 of contaminated material from the vicinity properties was stockpiled at the MISS during 1984.

4.7.2 1985 Work

Remedial actions for 1985 include the following:

- Decontaminating and restoring the four residences in the Borough of Lodi listed below and a section of the Ballod property (cleanup of Ballod depends on funding levels). See Figure 1-1 for property locations.

  58 Trudy Drive
  59 Trudy Drive
  61 Trudy Drive
  59 Avenue C

  Note: Depending on the results of a designation survey additional residences may be included.

- Transporting and disposing of excavated contaminated materials in a stockpile at the MISS.

- Constructing additional access roads and preparing the site for the additional material. This site preparation may include installing a bottom liner and a leachate collection system. The storage pile resulting from 1984 remedial action would be transferred onto the bottom liner in the late fall of 1985 if the bottom liner is actually installed and if the necessary funds are available.

- Closing the stockpile by placing a low-permeability cover over it.

As part of Phase I work scheduled for 1985, the following subcontract packages will be initiated:

- On-site geologic investigation
- Chemical sampling and analysis
- Land surveying
- Remedial action
- Material testing
- Radiological subsurface characterization drilling

On-Site Geological Investigation

The on-site geological investigation subcontract consists of conducting subsurface investigations at the MISS. This subsurface investigation program consists of drilling boreholes and installing observation wells. In addition, radiological boreholes were drilled obliquely into the embankment of NJ State Route 17. Analysis has indicated that there is radioactive contamination under the highway. Observation wells have been installed into the overburden and bedrock to determine groundwater characteristics. Geological boreholes have been drilled to determine substrata characteristics for evaluating alternatives for in situ storage of the existing buried waste at MISS. All subsurface borings will be completed in accordance with the New Jersey Department of Environmental Protection (NJDEP) Division of Water Resource requirements.

Chemical Sampling and Analysis

Chemical sampling of the groundwater monitoring wells will be conducted on a routine schedule to meet NJDEP permit requirements. In addition, on-site surface drainage and storm drains will be sampled. Samples will be analyzed for priority pollutants and radionuclides of concern, and certain other parameters in accordance with the site New Jersey Pollutant Discharge Elimination System (NJPDES) permit.

Surveying

Surveying for the interim storage site will provide a radiological grid survey, legal property surveys for the vicinity properties, inventories of residences' and other properties' landscaping that may be damaged or removed during excavation, and support services for the remedial action package.

Remedial Action

The site preparation at the MISS will be necessary to support the excavation and interim storage effort. It includes connecting the existing decontamination facility and associated utilities, land clearing, installing culverts in the storage area, and constructing additional haul roads.

The vicinity property remedial action subcontract includes the removal, transportation, and interim storage of contaminated materials. Removing the contaminated materials involves possible building demolition, excavation, and backfilling controlled by radiological requirements. Restoration and landscaping will be required. Restoration activities include replacing structures, backfilling, landscaping, and replacing damaged driveways and fences. Excavated or damaged front lawns will be restored with sod. Backyards will be seeded. Plants, trees, and fences that must be removed will be restored to their original configuration to the extent possible.

Depending on funding, remedial action on part or all of the remaining Ballod property will be completed. The excavated areas may not be backfilled and the site will be restored to a final condition that is acceptable to the property owner, but not to exceed normal turf establishment. During excavation of this area and subsequent to confirmation of the adequacy of cleanup, immediate backfill of selected excavated stages will be made to minimize the accumulation of rainwater. Rainwater from excavations will be pumped out and released through straw bale sediment barriers into the natural drainage pattern of the Ballod property. A radiological monitoring program for releasing water will be maintained. If radioactive contamination exceeds DOE release criteria, the water will be treated before release. This water management activity is being conducted in accordance with the Bergen County Soil Conservation District guidelines for soil erosion and sediment control. The Soil Erosion and Sediment Control Plan for the site

remedial action was approved in September 1984. No additional requirements for permits have been identified for this water management activity.

The wastes will be transported to the interim storage site and stockpiled. Truck beds will be watertight and wastes will be covered with a tarpaulin before entering public roads. After depositing each load at the storage pile, the trucks will be surveyed for radioactivity and decontaminated as necessary. Water collected during decontamination activities will be tested and discharged into natural drainage pathways if it is found to be below release criteria. Contaminated water will be recycled; any excess water or water too contaminated to recirculate will be sprayed on the storage pile for moisture conditioning or on contaminated areas on-site.

The existing storage pile will be expanded: The existing dump structure at the storage pile will be relocated to accommodate this extension. The stockpile will be graded to a maximum elevation of 25 ft above the existing ground level and will have side slopes of 2.5 horizontal to 1 vertical. If it is deemed necessary, a bottom liner and leachate system will be installed. When completed, the storage pile will be covered with a low-permeability membrane to minimize radon/thoron emissions and wetting and/or erosion of the stored materials. If a bottom liner is used, the top cover will be connected to the bottom liner to form an encapsulated storage pile that will be protected from the environment. If a bottom liner is not used, the top cover will be anchored into a trench surrounding the storage pile.

The planned access route for haul trucks for the Lodi properties will be to use Main Street in Lodi, continue north on Rochelle Avenue in Rochelle Park, proceed east on Central Avenue to the existing access road, and cross the railroad property into the MISS.

The storage pile contains approximately 3600 m^3 (4700 yd^3) of excavated soil from the Phase I remedial action in FY 1984. The contaminated soil was placed directly on the ground in an area already contaminated (Ref. 2), and piled to a maximum height of 3 m (10 ft) with 2.5:1 side slope. This pile covers an area of approximately 1800 m^2 (19,500 ft^2). Additional contaminated soil, up to 11,500 m^3 (15,000 yd^3), will be excavated and stockpiled in FY 1985 as weather permits. Figure 4-1 shows the storage pile area proposed for 1985. Table 4-2 lists the projected volumes of contaminated material.

Material Testing

The material testing subcontract will provide quality assurance services for testing concrete mix designs, concrete test cylinders, and soil testing. The contract will be performed for the duration of excavation work.

4.7.3 Environmental Monitoring

An environmental monitoring program is maintained at the MISS to meet the requirements of DOE Order 5480.1A and the NJDEP. A scheduled monitoring program is being carried out to monitor for radioactivity in air (radon and thoron), surface water, groundwater, and for external radiation levels. During remedial action work, an operations monitoring program will be established on an activity-specific basis. Typically, monitoring will be conducted for air (radon and particulate), surface water, sediments, and external radiation as appropriate.

4.7.4 Future Work

The principal work for 1986 and 1987 is the decontamination and restoration of the remaining commercial vicinity properties in Maywood and Rochelle Park, i.e., Ballod, the adjacent railroad, Scanel, Lodi, and Sears area.

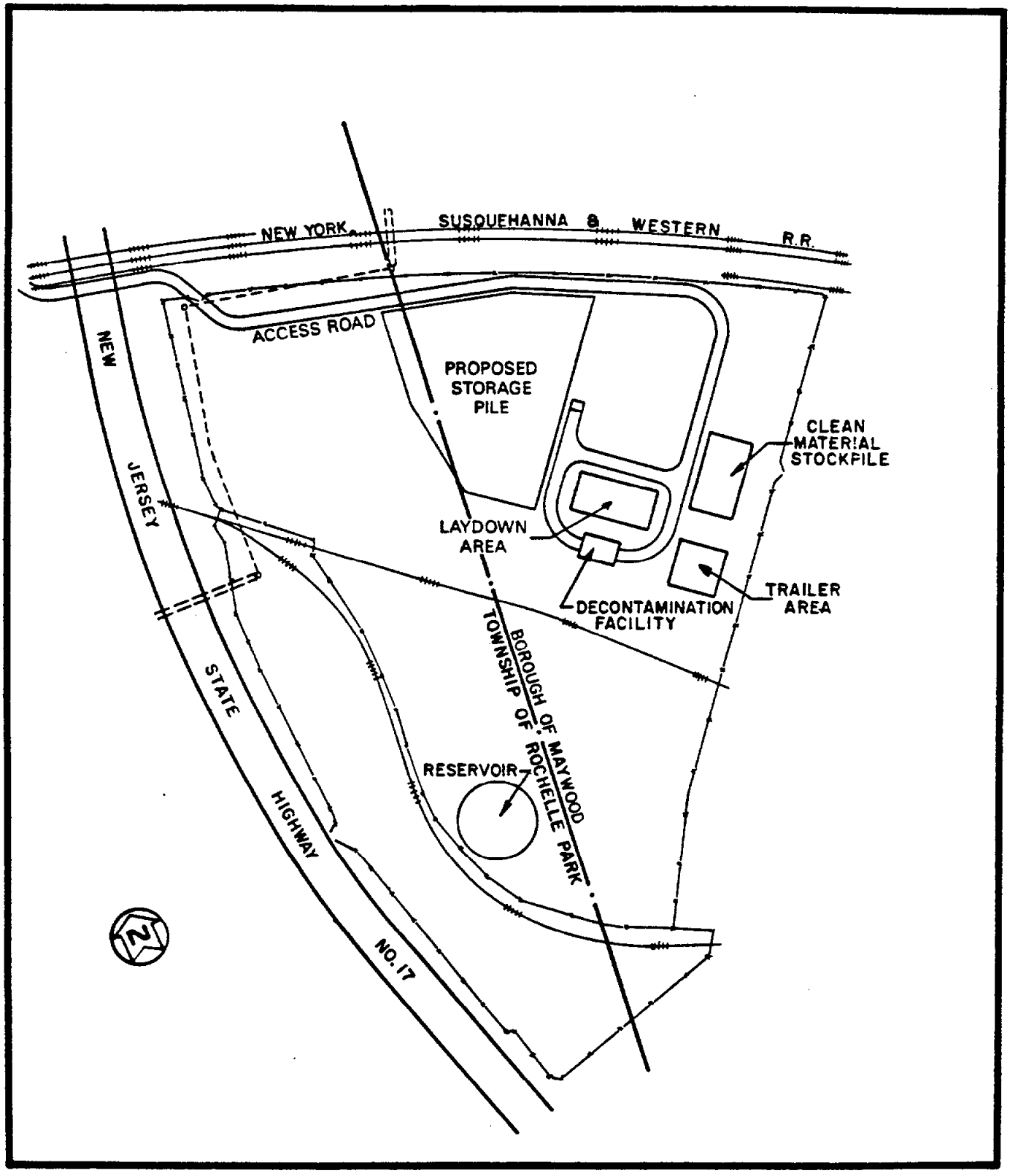

FIGURE 4-1 PROPOSED STORAGE PILE AT THE MISS

Radiological characterization and engineering required for the decontamination and restoration of the Lodi commercial properties will be completed.

Radiological and chemical characterization of the on-site burial areas will be completed and will provide the data necessary to begin an engineering study of options for final disposition of the waste.

Supporting work in the future will include continuing NEPA documentation and environmental monitoring programs.

4.8 OCCUPATIONAL EXPOSURE

An evaluation of the occupational exposure potential from decontaminating vicinity properties has led to the conclusion that, from a radiological and chemical standpoint, the health risks are insignificant.

4.9 CONFIRMATION SAMPLING AND ANALYSIS

Radiological measurements are required to confirm that all soils contaminated in excess of remedial action guidelines have been removed (see Appendix A).

4.9.1 Excavation Monitoring and Control

Excavation will proceed downward and laterally until the applicable soil decontamination guidelines are met, as determined by the subsequent field radiological measurements. If the extent of contamination differs significantly from the extent shown in the remedial action access agreements with the property owners, DOE will apprise the owner, and excavation will proceed only after a suitable revised agreement has been reached. A significant variation is defined as one that affects structures, other improvements, or actions not included in the original property owner/DOE Memo Agreement.

Primary Excavation Control

Excavation will proceed downward in each affected area by removing soil to the contour indicated by the preliminary soil coring and logging data. As material is removed to the specified depths, primary "real-time" excavation control will be provided by near-surface gamma measurements made with the primary excavation control instrument (PECI). The PECI comprises a directional (downward-looking) scintillation probe with a 2- x 2-in. sodium iodide (NaI) crystal (Eberline SPA-3) mounted 30 cm (12 in.) above the ground. The detector will be connected to a digital scaler/ratemeter (Eberline PRS-1) and counting times of 0.1 to 1 minute will be required. An iterative process of soil removal and PECI measurements will continue until the measurements indicate a level equal to or less than the applicable remedial action guideline for the soil.

In conjunction with the PECI, a surface gamma scan will continuously follow and indicate the excavation required for removal of small areas of residual contamination. This scan will be conducted with an unshielded 2- x 2-in. NaI detector (Eberline SPA-3) connected to a pulse ratemeter with aural monitoring capability (Eberline PRM-6 or equivalent) (See Appendix A).

Supplementary Soil Sampling Analysis

Soil samples will occasionally be collected from the excavated area and evaluated in the field laboratory using a rapid gamma spectrometry counting technique. These measurements will be used as a continuing calibration check on the primary radiation detection instrument (see Appendix A).

4.9.2 Confirmation Survey

When the remedial action guidelines have been reached as determined by measurements by the primary radiation detection instrument and

field soil sample analysis, the radiological status of the cleaned area will be documented prior to backfilling. The confirmation survey will consist of ground level beta-gamma measurements, near-surface gamma measurements, and systematic soil sampling. Soil samples will be dried, pulverized, and evaluated in the field laboratory using gamma spectrometry. Up to 10 percent of these soil samples will also be sent to the radiological support subcontractor laboratory for quality control purposes using the same type of radiological analysis. Aliquots of soil samples will also be made available to federal, state, and other agencies for their independent evaluation of the remedial action (see Appendix A).

Where remedial action involves structures, the necessary radiological measurements will be made to ensure that all structure guidelines have been met (see Table 4-1).

4.9.3 Post-Remedial Action Report

During the cleanup operations, BNI will collect and document data from analyses of soil samples and in situ radiological measurements to confirm the adequacy of the remedial action. Data documenting the final radiological condition will be presented in a final report for each designated property.

4.10 WASTE VOLUME

Actual and projected waste volumes for the MISS are provided in Table 4-2.

4.11 QUALITY ASSURANCE

The provisions of the DOE FUSRAP Plan for Quality Assurance comply with DOE Order 5700.6, and apply to BNI, subcontractors, architect-engineers, construction and service subcontractors, and other subcontractors as may be identified (Ref. 14).

Quality assurance requirements apply to all work being performed. BNI will carry out the Project Quality Assurance Program in accordance with the above parameters. The effectiveness of the implementation will be appraised by BNI's quality assurance organization and by DOE-ORO as it deems appropriate.

4.12 SURVEILLANCE AND MAINTENANCE

To ensure the health and safety of the public and site personnel and to protect the environment, BNI is developing a maintenance and surveillance program. The program will be designed to ensure adequate containment of contamination, regular sampling and monitoring of effluents and surface/subsurface water migrations, and physical safety and security controls. This program will include plans for site security, surface and well water monitoring on-site and in the general area, air monitoring, grass mowing, and fence repair. The program will be carried out until completion of total site cleanup and will ensure that applicable requirements of the DOE, the State of New Jersey, and other federal regulatory agencies are met.

TABLE 4-2

WASTE VOLUME PROJECTIONS

FOR THE MAYWOOD SITE

Fiscal Year	Property	Projected Volume[a] (yd^3)[b]	Actual Volume (yd^3)
1984	Davison/Latham residences	1,000	2,100
	Parkway/Grove residences	100	1,000
	Ballod property (partial)	2,000	1,600
	SUBTOTAL	3,100	4,700
1985	Lodi residences	3,000	
	Ballod property (partial)	13,000	
	SUBTOTAL	16,000	
1986	Ballod property (remainder)	3,000	
	Scanel property and railroad	3,300	
	SUBTOTAL	6,300	
Out Years	Sears area properties	60,000	
	Lodi commercial properties	10,000	
	Contaminated material at SC plant outside the MISS (unlicensed burial area)	26,000	
	SC burial sites		
	Site 1	11,000	
	Site 2	3,000	
	Site 3	12,000	
	Buried material at the MISS	81,000	
	SUBTOTAL	203,000	
	TOTAL	230,000[c]	

[a]Projected volume estimates are based on current information, but are not definitive. For example, the volumes may change as the extent of contamination is defined by radiological characterization.

[b]For equivalent m^3, multiply by 0.76.

[c]Total includes actual volume for FY 1984.

5.0 SCHEDULE AND COST

Figure 5-1 summarizes the preliminary schedule for actions required to implement the cleanup of vicinity properties and interim storage operations. The schedule for other remedial action activities will be developed when the final disposal option has been defined. The later decontamination work will be scheduled after a disposal site for the State of New Jersey has been identified and scheduled for construction.

Cost estimates provided for fiscal years 1985, 1986, and 1987. Costs estimates and the schedule beyond 1987 will depend on the location of the selected disposal site and the time of the transfer of materials from the MISS to final storage.

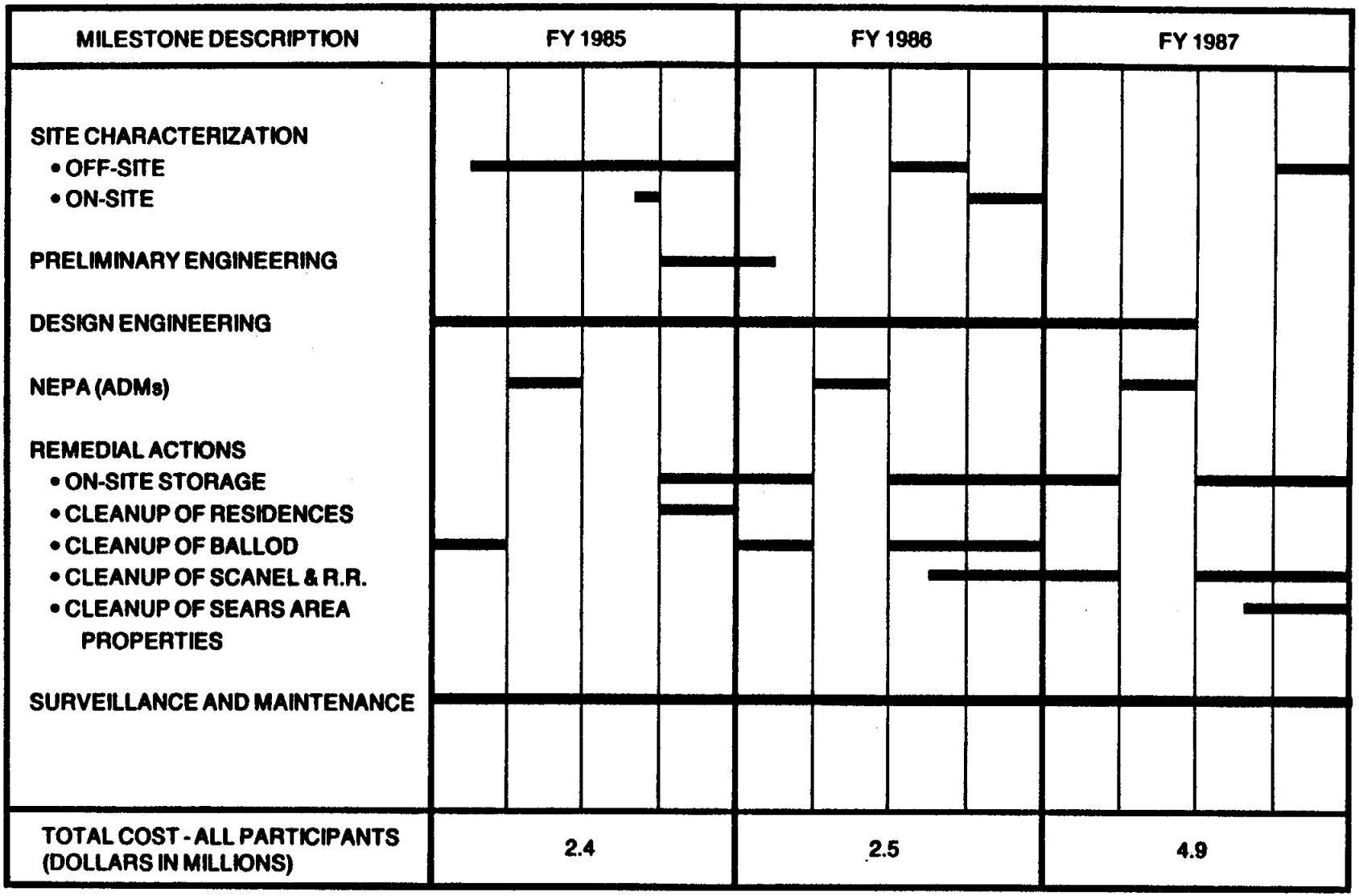

FIGURE 5-1 MAYWOOD SITE SCHEDULE & COST SUMMARY

REFERENCES

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3. Oak Ridge Associated Universities. Radiological Assessment of Ballod and Associates' Property (Stepan Chemical Company), Maywood, New Jersey, Oak Ridge, TN, July 1981.

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5. Oak Ridge National Laboratory. Results of the Radiological Survey at 459 Davison Avenue, Maywood, New Jersey, Oak Ridge, TN, September 1981.

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APPENDIX A

RADIOLOGICAL SURVEY/MONITORING PLAN

FOR MAYWOOD SITE

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RADIOLOGICAL SURVEY/MONITORING PLAN

The following plan provides detailed procedures for site characterization, excavation guidance, and site radiological status confirmation and documentation following remedial action at Maywood, New Jersey.

Radiological surveys at FUSRAP sites are done for three purposes. The first purpose is to determine whether radioactivity exists on a property in concentrations exceeding the remedial action guidelines and to determine the approximate boundaries of these concentrations. This is a designation survey and properties in this category are "designated" by DOE for remedial action. The second survey is to determine more accurately the horizontal and vertical boundaries of the contaminated material so that design engineering for cleanup can be completed. This is a characterization survey. The third is to ensure that the cleanup removed all contamination exceeding the guidelines. This is a confirmation survey. The remedial action sequence is shown as a flow diagram in Figure A-1.

1.0 GENERAL

In implementing applicable guidelines (see Section 4.1), the following assumptions apply:

- The characterization surveys are adequate in scope to ensure that all major surface and subsurface deposits of radioactivity exceeding guidelines have been identified.
- Elements of this plan are applicable to exposed ground surfaces (floor and walls of cuts) which result from the removal of materials (soil and rubble) containing natural radioactivity.
- On-site decisions will be made regarding the adequacy of cleanup based upon analysis of radiation measurements at defined grid points.

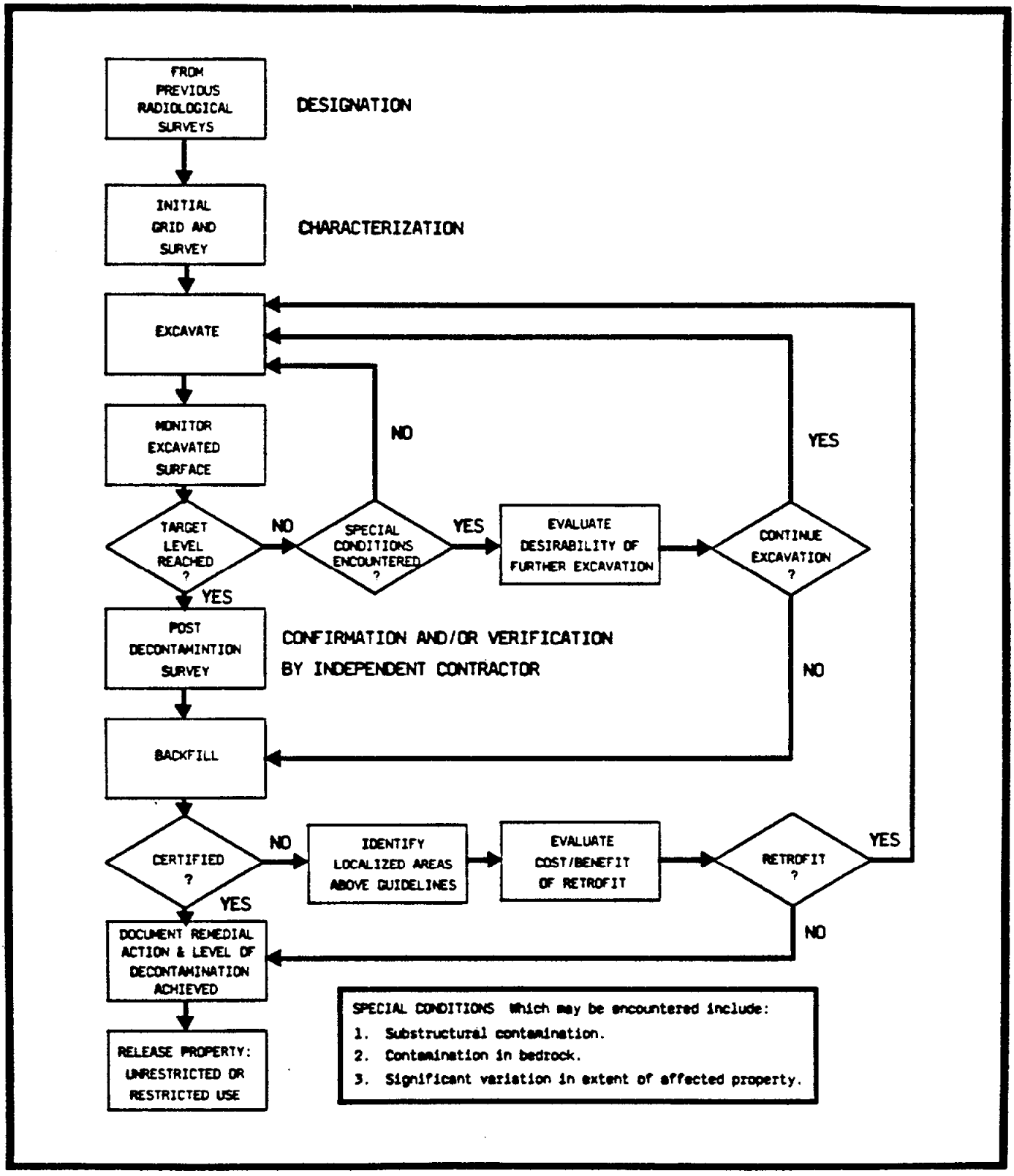

FIGURE A-1 REMEDIAL ACTION SEQUENCE

- Soil samples will be collected and analyzed on-site, to the extent possible, by the radiological services subcontractor to expedite the remedial action. The frequency of sampling depends on area radioactivity levels and shall be determined by the radiological subcontractor site manager.

- Post-remedial action radiological measurements and sampling (the confirmation survey) will be coordinated with applicable regulatory groups (e.g., DOE, state and local groups).

- Measurements and analytical data will be documented in a uniform format for subsequent certification and archival purposes.

2.0 SURVEY GRID SYSTEM

Prior to the characterization survey, a grid system tied to the state coordinate system will be established on the affected properties. This grid system nominally consists of 10- x 10-m (33- x 33-ft) grid blocks (Figure A-2) which are further divided into 16 smaller areas by lines spaced 2.5 m (8.2 ft) apart (Figure A-3). In some cases, slightly different grid spacing may be used, e.g., 9-m (30-ft) or 15-m (50-ft) grids. In any case, subgrid lines should not be more than 3 m (10 ft) apart.

The grid system will be used during excavation to provide accurate locations of initial characterization sample points. The grid system will be reconstructed incorporating the 2.5- x 2.5-m (8.2- x 8.2-ft) subgrid following completion of excavation to provide the reference system for the confirmation survey required to document that the site's radiological condition meets the remedial action guidelines.

Should soil removal result in an excavated area with exposed side walls, the subgrid system will be extended to those areas and measurements as described in the following sections will be made.

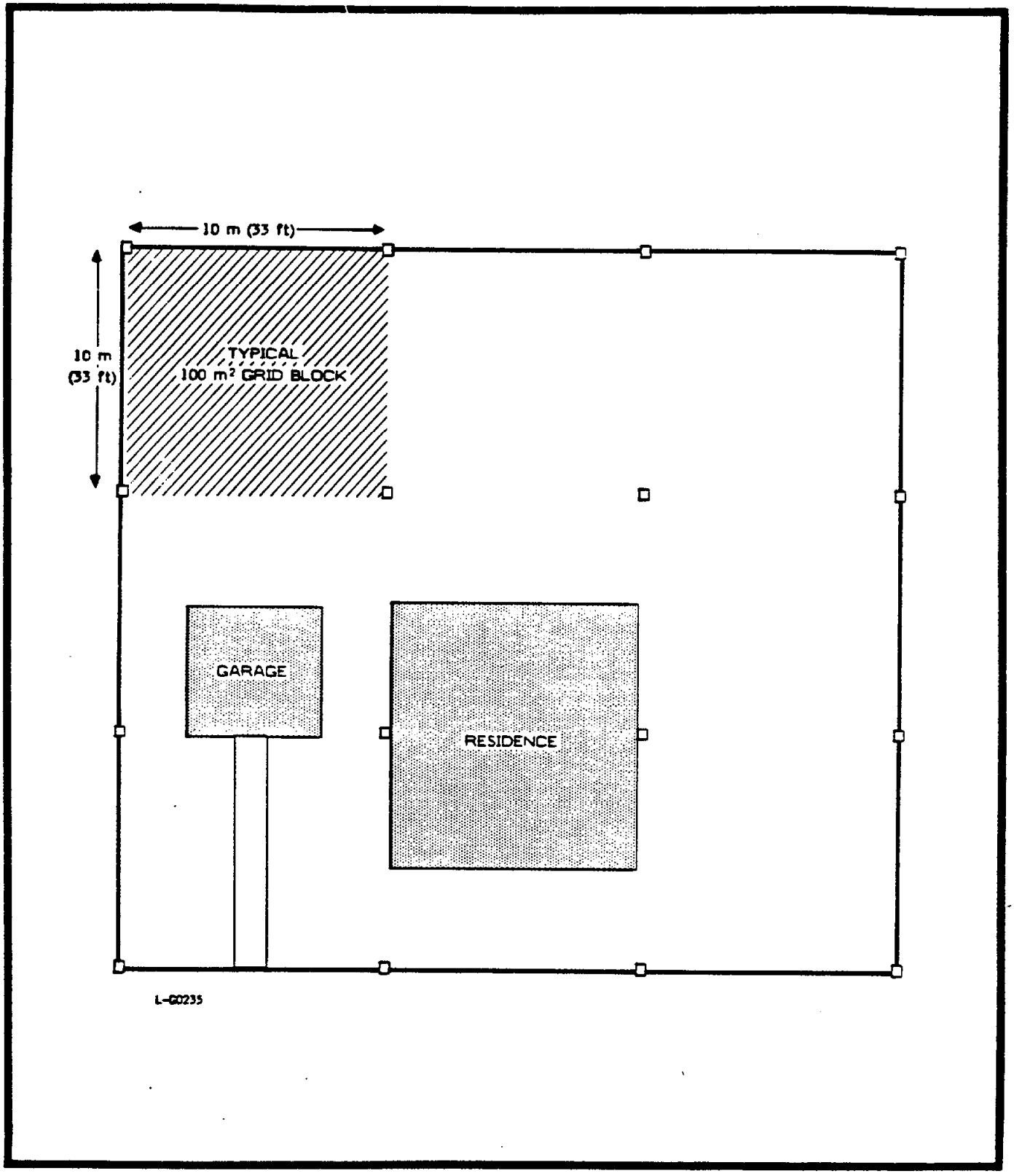

FIGURE A-2 SAMPLE PLAN VIEW OF REMEDIAL ACTION CANDIDATE PROPERTY

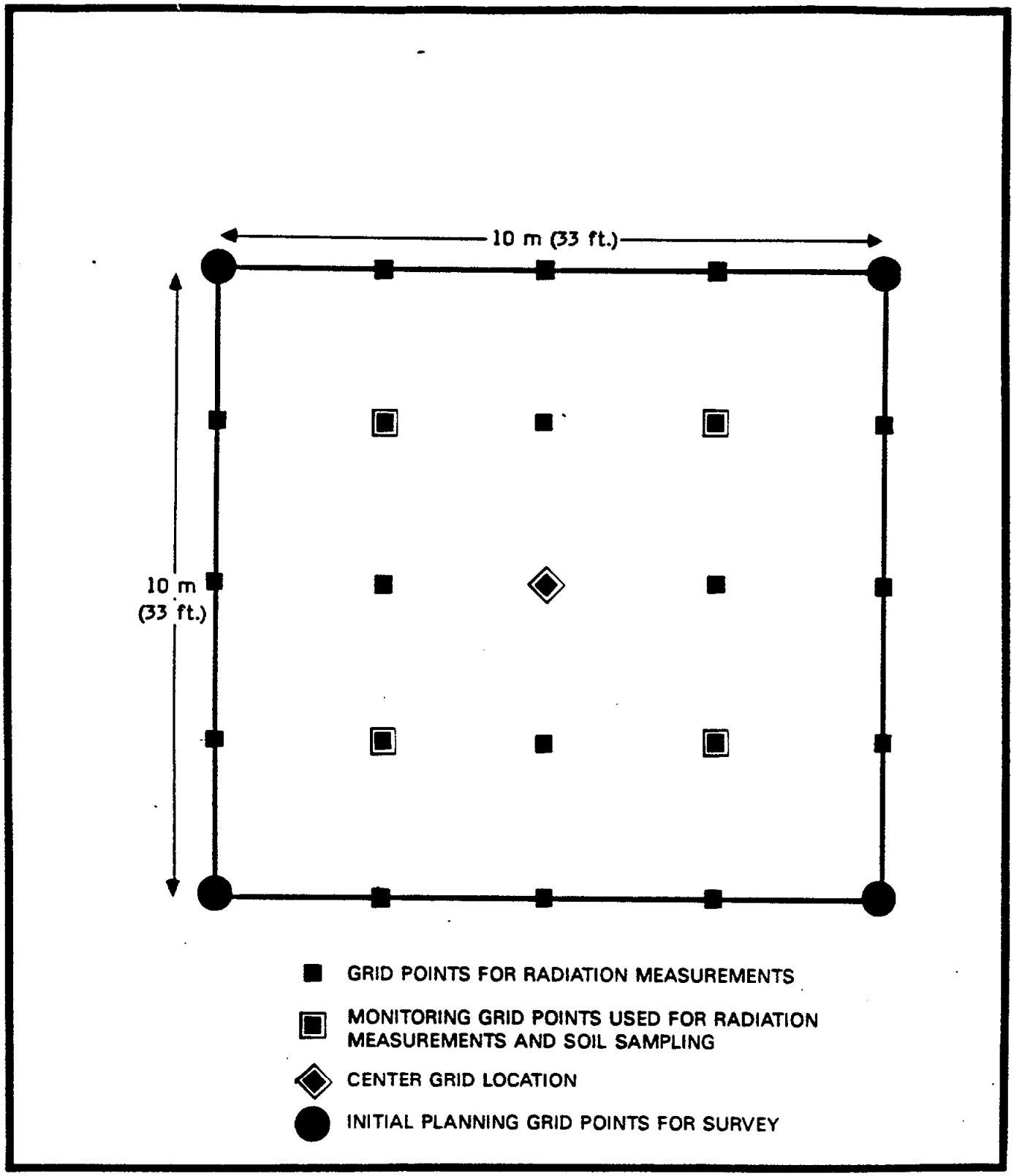

FIGURE A-3 SAMPLE 10 m x 10 m GRID BLOCK TO BE ESTABLISHED FOR POST-REMEDIAL ACTION MEASUREMENTS

3.0 CHARACTERIZATION

Designation radiological surveys have shown that the radiological conditions at the site exceed remedial action guidelines and have indicated the general extent of contamination. The objective of the characterization is to specifically identify those areas and depths on the property that require remedial action. The survey will consist of:

3.1 DEPTH CHARACTERIZATION

Soil contamination profile data will be obtained as necessary from soil core samples. Core holes will be gamma logged with a shielded 2- x 2-in. NaI gamma scintillation detector (Eberline SPA-3) and sections of soil cores will be analyzed by gamma spectrometry.

3.2 CONTAMINATION BOUNDARY CHARACTERIZATION

Using the estimated extent of contamination as a guide, the radiological support subcontractor will conduct an initial boundary survey at each excavation site to accurately locate and mark the extent of contamination and to provide guidance for the operators of excavation equipment. Hand held gamma and beta-gamma survey instruments will be used for this survey.

3.3 BACKGROUND MEASUREMENTS

A series of measurements will be made off-site in the surrounding area with a pressurized ion chamber to determine the background gamma exposure rate for the area in which the remedial action site is located. At each of these measurement locations, a soil sample will be collected from the surface (surface to 15 cm deep) to establish the background radium-226 and thorium-232 soil concentration for the area. These measurement and sample locations will be in the general area of remedial action activities, but far enough removed so as to be unaffected by radiological conditions at the site.

4.0 EXCAVATION MONITORING AND CONTROL

Excavation will proceed downward and laterally until the soil decontamination guidelines are met, as determined by field measurements. If the extent of contamination differs significantly from the extent shown in the agreements with the property owners, DOE or their contractor will advise the owner, and excavation will proceed only after a suitable revised agreement has been reached. A significant variation is defined as one that affects structures, other improvements, or actions not included in the original property owner/DOE Memo Agreement.

4.1 PRIMARY EXCAVATION CONTROL

Excavation will proceed downward in each affected area by removing soil to the contour indicated by the characterization survey soil coring and logging data. As material is removed to the specified depths, primary "real-time" excavation control will be provided by near-surface gamma measurements made with the primary excavation control instrument (PECI). The PECI comprises a directionalized (downward-looking) scintillation probe with 2- x 2-in. NaI crystal (Eberline SPA-3) mounted 30 cm (12 in.) above the ground and connected to a digital scaler/ratemeter (Eberline PRS-1). An iterative application of soil removal and PECI measurements will continue until the measurements indicate that the remedial action guidelines for soil have been reached.

4.2 SUPPLEMENTARY SOIL SAMPLING ANALYSIS

Soil samples will be collected periodically at selected grid coordinates in the excavated area. They will be evaluated for radionuclide concentrations in the field laboratory using a rapid scan counting technique on a 8- x 8-in. NaI detector coupled to a Nuclear Data 6610 multi-channel analyzer. The radionuclide concentrations (pCi/g) will then be compared with the PECI count rate (cpm) measured at the same coordinates. Such comparison serves

as a continuing check on the cpm to pCi/g correlation factor, which is used to estimate the radionuclide concentrations in the soil at all points where PECI measurements are made.

4.3 RESIDUAL CONTAMINATION DETECTION

As soon as practicable after the initial removal of contaminated soil is completed, the following procedure for identifying and removing residual contamination will be initiated.

a. Background for the area will be obtained by taking several (at least five) readings at random locations in the area of construction and arithematically averaging these five readings.

b. Using a count rate meter with a 2- x 2-in., unshielded NaI detector (Eberline SPA-3), the entire area of excavation will be scanned in accordance with Project Instruction 22.02 in the BNI FUSRAP Radiological Protection Program.

c. All spots found to significantly exceed background will be marked by stakes or spray paint directly on the ground.

d. Each spot so marked will be measured by the PECI. The pCi/g concentration of radium-226 and thorium-232 in the marked area is estimated from the count rate recorded by the PECI.

e A soil sample of the top 15 cm (6 in.) of soil in the marked area will be taken and evaluated in the laboratory on a quick turnaround basis (2-min. count time).

f. All results will be reported to the resident BNI engineer and, as appropriate, to the DOE engineer for consideration as to additional remedial action based on the ALARA principle and the remedial action guidelines.

g. Guidance will be provided for soil removal in areas where soil removal has been decided upon.

h. In those areas where additional soil is removed, the area will be rescanned to confirm that the residual contamination has been removed, and the remaining level of contamination will be documented.

i. After this procedure has been completed, the confirmation and documentation measurements will be made and soil samples collected.

5.0 CONFIRMATION SURVEY

When the guideline limits have been reached as determined by the PECI measurements and field soil sample analysis, the radiological status of the cleaned area will be documented prior to backfilling. Collection of the following measurements, which will constitute the confirmation (post-decontamination) survey, will be conducted by the radiological support subcontractor. Field-logged records will be recorded in a manner to be readily auditable by independent agents.

5.1 BETA-GAMMA SURVEY

Ground level beta-gamma measurements will be made at each 5- x 5-m (16.5- x 16.5-ft) grid point shown in Figure A-3. These measurements will be made with a thin window G-M detector with digital readout (Eberline HP-210 and PRS-1).

5.2 NEAR-SURFACE GAMMA MEASUREMENTS

A gamma measurement will be made approximately 30 cm (12 in.) above each 2.5- x 2.5-m (8.2- x 8.2-ft) grid point shown in Figure A-3 using the PECI described earlier. These measurements will be recorded by grid point location and will be used to estimate the average radionuclide concentrations for any 100-m^2 area. The average radionuclide concentration will be determined from the mean of individual readings within any continguous 100-m^2 (1076-ft^2) area. Any set of adjacent grid point readings may be used to determine the average concentration for the area described by those grid point readings.

If the average soil radionuclide concentration exceeds the DOE residual contamination guidelines (Table 4-1), further soil removal may be required. Guidance for further soil removal will be based on the procedure described in Section 4.3.

5.3 SOIL SAMPLES (FIELD LABORATORY ANALYSIS)

Soil samples will be collected in the excavated areas from exposed surfaces (floor and walls). These samples will be taken to confirm the estimates of radionuclide(s) soil concentration based on the near-surface gamma measurements, and will be collected in the center of the four blocks contained within each 100-m^2 (1076-ft^2) area as shown in Figure A-3. Sampling for confirmation of the guideline limit(s) shall not be initiated until radiological surveys demonstrate that no significant concentrations of residual radioactivity are present on the sides and bottom of soil excavation cuts. There will be at least a statistical minimum of confirmatory samples (i.e., 30) collected from each vicinity property undergoing remedial action. Each of these samples will be evaluated in the field laboratory using a rapid scan counting technique.

If the radionuclide(s) concentration in an individual sample is less than the residual contamination guidelines, the sample may be included in a mathematical composite of at least a statistical minimum of adjacent samples within the boundaries of a single property to determine the average radionuclide concentration for the area described by those samples. If the average of those samples exceeds the appropriate guidelines, further soil removal may be required. Results of analyses of soil samples from the grid will not be used to derive average radionuclide concentrations for areas containing fewer than 30 sample points due to the statistical limitations of small sample size, but will be used in conjunction with the near-surface gamma measurements for determining the need for further excavation.

5.4 SOIL SAMPLE CONTENT (CONFIRMATORY ANALYSIS)

Samples taken for field analysis after the last excavation cut will be prepared (dried, pulverized, and screened) and split into aliquots for analysis or disposition, including the following:

- From each sample, a 500-ml beaker (Marinelli type) will be filled, then capped and sealed. This sealed aliquot is for analysis by high resolution gamma spectrometry and/or other non-destructive methods by the radiological support subcontractor. Following this analysis, any or all aliquots will be available for analysis by state or other agencies.

- From every tenth sample, a reserve aliquot containing a minimum of 200 ml will be taken. The reserve aliquot will be held for additional study needs by state or other agencies.

- Standard sample custody procedures will be followed throughout the sampling and analytical process. Following completion of the confirmation process on the property from which the samples were taken, a portion (no more than 10 percent) of the aliquots prepared in Step 1 may be selected by the independent verification contractor for archival purposes.

During the course of the remedial action confirmation process, federal, state, and other agencies will be given the opportunity to perform independent measurements, including soil sampling and analysis. Each agency will also have the opportunity to review BNI/Eberline soil sample collection, preparation and analytical procedures, and the resulting data.

6.0 BACKFILLING

When the guideline level has been reached as determined by results from field soil sample analysis coupled with data from the last series of measurements by the survey instruments, the remedial action subcontractor will be authorized to begin backfilling and restoring the area. This authorization should occur within a few days of excavation completion.

The results of radiological tests relating to remedial action guidelines shall be reported to specified DOE and state (and local where appropriate) representatives. In the event that test results reveal a failure to meet guideline limits, DOE will direct and cause to be implemented such activities as may be necessary to remedy the situation.

7.0 CERTIFICATION

During the cleanup operations, the radiological support subcontractor will collect and document data from analyses of soil samples to determine the adequacy of the remedial action. Concurrently and independently, an independent verification contractor will periodically collect and analyze soil samples and make in situ radiological measurements.

After completion of the remedial action, all measurement procedures and data will be evaluated by DOE which will then certify the radiological status of the site.

The conclusions of the verification survey, conducted by the independent verification contractor, will be presented in the post-remedial action report for each designated site.

8.0 QUALITY CONTROL

Only calibrated instruments shall be used and calibration procedures, results, and frequency logs shall be retained at the site for review.

All measurements and analyses shall be done using applicable project instructions on quality control (see for example, PI-23.01, "Quality Controls for Sample Analysis in the Mobile Counting Laboratory"). Similarly, all measurements and analyses by Eberline shall conform to the EAC Quality Assurance Manual requirements.