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REMEDIAL ACTION WORK PLAN FOR THE MAYWOOD SITE

JULY 1984

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

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UNITED STATES DEPARTMENT OF ENERGY
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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. 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 Maywood and 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 Stepan Company (land which DOE expects to purchase). The vicinity properties are seven residential properties on Davison and Latham in Maywood, eight residential properties on Grove and Park in Rochelle Park, and commercial properties identified as the Scanel property, Ballod property, New York Susquehanna and Western Railroad property, and Sears area properties.

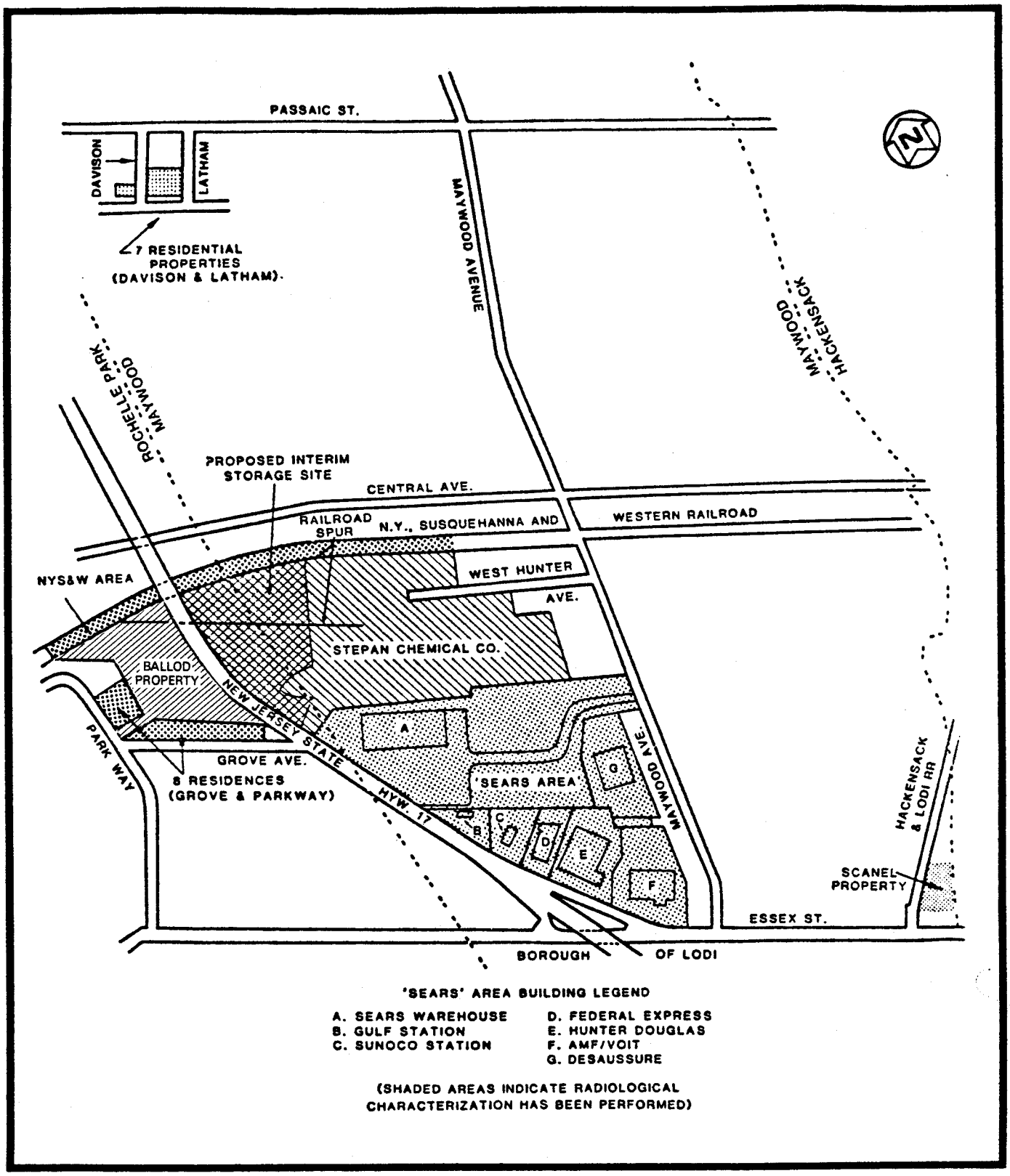

FIGURE 1-1 MAYWOOD INTERIM STORAGE SITE AND VICINITY PROPERTIES

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. These plans include:

- Excavating the above-guideline radioactive wastes on the vicinity properties
- Preparing the interim storage site to receive these contaminated materials
- Transporting the contaminated materials to the interim waste storage stockpile
- Designing and constructing required facilities for the interim storage site
- 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 Borough of Maywood and the Township of Rochelle Park, which is about 19 km (12 mi) northeast of Newark, in the County of Bergan, New Jersey. The MISS is on part of property presently owned by the Stepan Company (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 seven 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 - Seven residences are located on Davison and Latham Streets in Maywood and eight residences are on Grove Avenue and Park Way in Rochelle Park.
- Sears area properties - This industrial/commercial area 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.

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 Stepan Company 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, 6,390 m^3 (8,358 yd^3) of waste were removed from the area east of Route 17 and was buried on-site (Burial Site #1) under an area which is now a lawn. In 1967, 1,570 m^3 (2,053 yd^3) of waste were removed from the same general area and was buried on-site (Burial Site #2) under what is now a parking lot. In 1968, the SC obtained permission from the Atomic Energy Commission (AEC) to relocate additional waste from the west side of Route 17. The licensee transferred 6,375 m^3 (8,600 yd^3) of waste from the south dike area and buried the waste on-site (Burial Site #3) in an area where a warehouse was later built (Ref. 2a, c, d). Figure 2-1 shows the approximate locations of these burial sites. The location of an additional area of suspected contamination is also shown.

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 Associates. Over the past few years, the

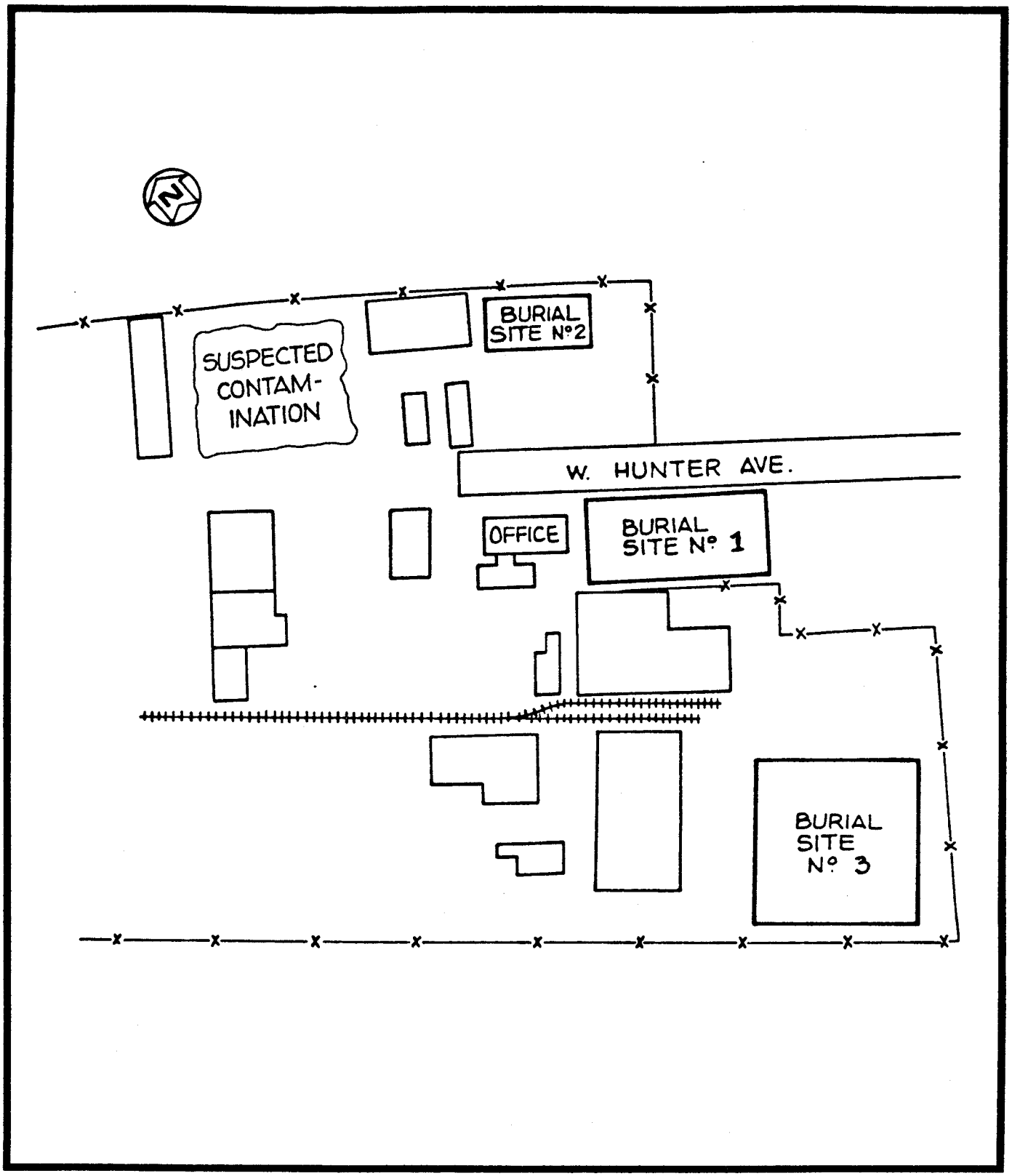

FIGURE 2-1 WASTE BURIAL SITES ON STEPAN COMPANY PROPERTY

property has been used for unauthorized trash disposal by the local residents and as a convenient playground by local youths.

In 1980, the U.S. Nuclear Regulatory Commission (NRC) was notified of elevated radiation levels on the Ballod Associates property. This information prompted the NRC to request a comprehensive survey to assess the radiological conditions on 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 Associates property, and the surrounding area. This survey was conducted by Edgerton, Germeshausen, and Grier (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 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 were detected about one-half mile from the center of the plant: one northeast of the plant and the other south of the plant. Follow-up ground surveys were taken to determine the nature of the anomalies at the northeast location (Ref. 5-11). A follow-up ground survey was also done at the south location (Ref. 12).

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 and 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. 2b).

Borings made at the plant site indicate that bedrock lies close to the surface, with 0.9 to 4.5 m (3 to 15 ft) of weathered rock and unconsolidated soil deposits overlying the bedrock. A weathered zone between 0.6 and 2.4 m (2 and 8 ft) in depth commonly overlies hard bedrock. Unconsolidated material overlying the bedrock is comprised largely of stratified drift which exhibits considerable variability both areally and with depth. 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 2-3 m (7-10 ft) below the ground surface.

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 the development of overall policy applicable to the FUSRAP. DOE-HQ provides broad guidance and establishes the program budget.

The Oak Ridge Operations Office (ORO), Technical Services Division (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 Instrument Corporation (EIC), 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 FUSRAP Design Criteria present details regarding applicable federal regulations, including: design codes, guides, and standards; radiation protection; land disposal of radioactive wastes; and handling, transportation, and storage of wastes. Water quality guidelines are also presented (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 and 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 (1,076 ft^2) area of properties that are to be released for unrestricted use. For small areas, or "hot

TABLE 4-1

SUMMARY OF RESIDUAL CONTAMINATION GUIDELINES

FOR THE MAYWOOD SITE

1. Soil (land) Guidelines (Maximum Limits for Unrestricted Use)

Radionuclide	Soil Concentration (pCi/g) above background(1)(2)(3)
Natural Uranium	75

A curie of natural uranium means the sum of 3.7×10^{10} dis/s from uranium-238 plus 3.7×10^{10} dis/s from uranium-234 plus 1.7×10^{5} dis/s from uranium-235. One curie of natural uranium is equivalent to 3,000 kg or 6,600 lb of natural uranium.

Uranium-238	150

Assumes that no other uranium isotopes are present.

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.

2. Structure Guidelines (Maximum Limits for Unrestricted Use)

a. 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.

b. 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.

(1) 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.

(2) 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.

(3) Localized concentrations in excess of these limits are allowable provided that the average over 100 m^2 is not exceeded.

TABLE 4-1 (Continued)

SUMMARY OF RESIDUAL CONTAMINATION GUIDELINES

FOR THE MAYWOOD SITE

c. Indoor/Outdoor Structure Surface Contamination

Radionuclide[2]	Allowable Surface Residual Contamination[1] (dpm/100 cm^2) Average[3][4]	Maximum[4][5]	Removable[4][6]
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 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 β-λ	15,000 β-λ	1,000 β-λ

(1) 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.

(2) 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.

(3) 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.

(4) 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.

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

The decontamination process will include excavation, loading, and hauling to the interim storage stockpile located at the MISS.

4.2 SITE CHARACTERIZATION

The following radiological characterizations 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 properties) and one south of the plant (Scanel property). Follow-up 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 Oak Ridge National Laboratory (ORNL) survey of the seven 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 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 - 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 - A NUS Corporation survey of the Sears area 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/December 1982. This was done because of the close proximity of these residences to the contaminated materials on the adjacent Ballod property. All fifteen properties were surveyed, revealing that eight of them were above the guidelines and required remedial action (Ref. 14). A survey has been made of the railroad property; this report is currently in preparation.

4.3 PRELIMINARY ENGINEERING

Remedial action consists of Phase I and Phase II work activities. Phase I consists of cleanup of contaminated materials at vicinity properties and storing them at the interim storage site for a period of not more than 25 years. Phase II includes cleanup of the interim storage site and transporting all contaminated materials, including those from Phase I stored on the SC site, to a permanent disposal facility.

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

1. Defining the boundaries of the interim storage site and siting of the storage area.

2. 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 contamination exists, but should exclude the water storage tank area and other easements.

- Access to the storage site should provide linkage 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 preferred access for 1984 work is from Central Avenue. For 1985 and 1986 work, it is from the Sears property.

The work currently planned for 1984 involves only cleanup of residential vicinity properties, a portion of the Ballod property, 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 the purposes of this work plan, it is assumed that the NEPA process will support these planned interim activities. Additional preliminary engineering studies may be performed 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 NEPA assessment to select the preferred alternative for the final disposition of the contaminated materials.

4.4 NEPA

Planned interim remedial actions and final disposition of all of the contaminated material will be evaluated through the NEPA process as outlined in the applicable Council on Environmental Quality NEPA regulations and implementing DOE guidelines. The DOE, through this process, will advise the appropriate Federal, State, and local agencies and the public of their planned interim actions, the environmental analysis, and alternatives being considered for MISS final disposition.

4.5 DESIGN ENGINEERING

In October 1983, BNI started design engineering to support the NEPA activities and started development of the engineering subcontract packages necessary to support the remedial action (detailed cost estimates, drawings, specifications, schedules, and requisitions) as described in Section 4.7 below. Design engineering will continue through 1986.

4.6 ACCESS AGREEMENTS

Bechtel will obtain access agreements for all required radiological surveys and remedial action work. For the remedial action planned during 1984, access agreements will be signed with:

- Stepan Company for use of a selected area of their property for interim storage of all contaminated materials from vicinity properties, and for water and electrical services
- New York Susquehanna and Western Railroad for access to the storage area
- Eight residents on Park Way and Grove Avenue and the railroad for radiological surveys
- Four residents on Davison Street, three residents on Latham Street, two residents on Park Way, and six residents on Grove Avenue for cleanup of the properties
- Ballod property for remedial action and access to the Park Way and Grove Avenue properties.

These agreements will be negotiated before the start of work on the sites.

4.7 REMEDIAL ACTIONS

4.7.1 Previous Work

As described in Section 2.0 the Stepan Company processed monazite sands whose radioactive component was primarily thorium-232. During this period, the residues were buried or stockpiled on the plant

site and the adjacent west field. The radiological surveys identified these areas and other areas where these residues were later deposited. Section 2.2 describes these radiological surveys. No remedial actions on these wastes have been undertaken.

4.7.2 1984 Work

Remedial actions for 1984 include the following:

(1) Decontaminating and restoring vicinity properties consisting of a section of the Ballod property, two residents on Park Way, six residents on Grove Avenue, four residents on Davison Street and three residents on Latham Street (See Fig. 1-1 for property locations).

(2) Transporting and disposing of excavated contaminated materials in a stockpile at the interim storage site.

(3) Constructing access roads and necessary site preparation including a decontamination facility.

(4) Closing the stockpile with placement of a low-permeability cover over the stockpile.

As part of Phase I work scheduled for 1984, the following subcontract packages will be initiated:

- Land surveying
- Site preparation
- Remedial action excavation
- Material testing

Surveying

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

Site Preparation

The site preparation subcontract provides support services to the excavation and interim storage effort. It includes constructing a decontamination facility; setting up trailers; providing utilities for the decontamination facility and trailers; clearing; and installing culverts, a railroad crossing, gates, and haul roads. The decontamination facility for equipment and transport vehicles will have a wooden ramp over a membrane-lined pit filled with crushed stone. The cleaning unit will be a combination water/steam unit which will use water recycled through a sand filter and stored bladder tank.

Remedial Action Excavation

The vicinity property excavation subcontract includes the removal, transportation, and interim storage of contaminated materials. The removal of the contaminated materials is straightforward earthwork excavation at all but one residence where removal of the basement slab and excavation of underlying soil is required. The residents of this house will be temporarily relocated and the contents of the house will be removed and stored before work inside the basement begins. The ceiling of the basement will be sealed to prevent dust from entering the upstairs portion of the house. Removal of the floor and contaminated material beneath the floor is expected to be a hand operation. If the contamination extends under the foundation of the house, it will be excavated in short sections and backfilled with grout before excavating adjacent sections.

The Ballod property excavation area is approximately 14 m x 65 m (45 ft. x 215 ft) to a depth of 1.8 m (6 ft). Backfill material will be installed to prevent drainage of the Ballod property onto the adjacent residential properties. During excavation of this area, subsequent to confirmation of the adeqacy of cleanup, immediate backfill of 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. No requirements for permits have been identified for this water management activity. Additional areas on the Ballod property may be excavated in late 1984 as weather permits.

Restoration of the properties is also included in this subcontract; the properties will be returned to their present grade and conditions. Restoration activities include backfilling, landscaping, replacement of damaged driveways and fences, replacement of the basement slab, and refinishing the basement area. Front lawns which are excavated or damaged will be restored with sod. Backyards will be seeded. Plants, trees, and fences which must be removed will be restored as they were, to the extent possible.

The wastes will be transported to the interim storage site and stockpiled. Truck beds will be water tight and wastes will be covered with a tarpaulin before going on 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 storage pile, when completed, will be covered using a low-permeability membrane to minimize radon emissions and erosion of the stored materials.

The storage pile will contain approximately 2,300m^3 (3,000 yd^3) of excavated soil after Phase I remedial action in FY 1984. The contaminated soils will be placed directly on the ground in an area already contaminated (Ref. 2a), and when piled to a maximum height of 3m (10 ft) with a 2:1 side slope will cover an area of approximately 1,200 m^2 (13,000 ft^2). Additional contaminated

soils, up to 7,600 m^3 (10,000 yd^3), will be excavated and stockpiled in early FY 1985 as weather permits. Figure 4-1 shows the area in which the 2,300 m^3 (3,000 yd^3) storage pile will be located. The 10,000m^3 (13,000 yd^3) will cover an area approximately 50 percent larger than shown.

Material Testing

The material testing subcontract will provide quality assurance services for testing of 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 will be instituted prior to the beginning of remedial action. This program will monitor for radioactivity in air (radon and particulates) and surface water and for external radiation levels. Groundwater monitoring wells will also be installed and included in the monitoring program in 1984. The monitoring plan is currently undergoing a final review.

4.7.4 Future Work

The principal work scheduled for 1985 and 1986 is the remedial action cleanup of remaining vicinity properties: Ballod, the adjacent railroad, Sears area, and Scanel.

Supporting work will include completing an engineering study of options for final disposition of the waste and continuing environmental monitoring and NEPA support.

4.8 OCCUPATIONAL EXPOSURE

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

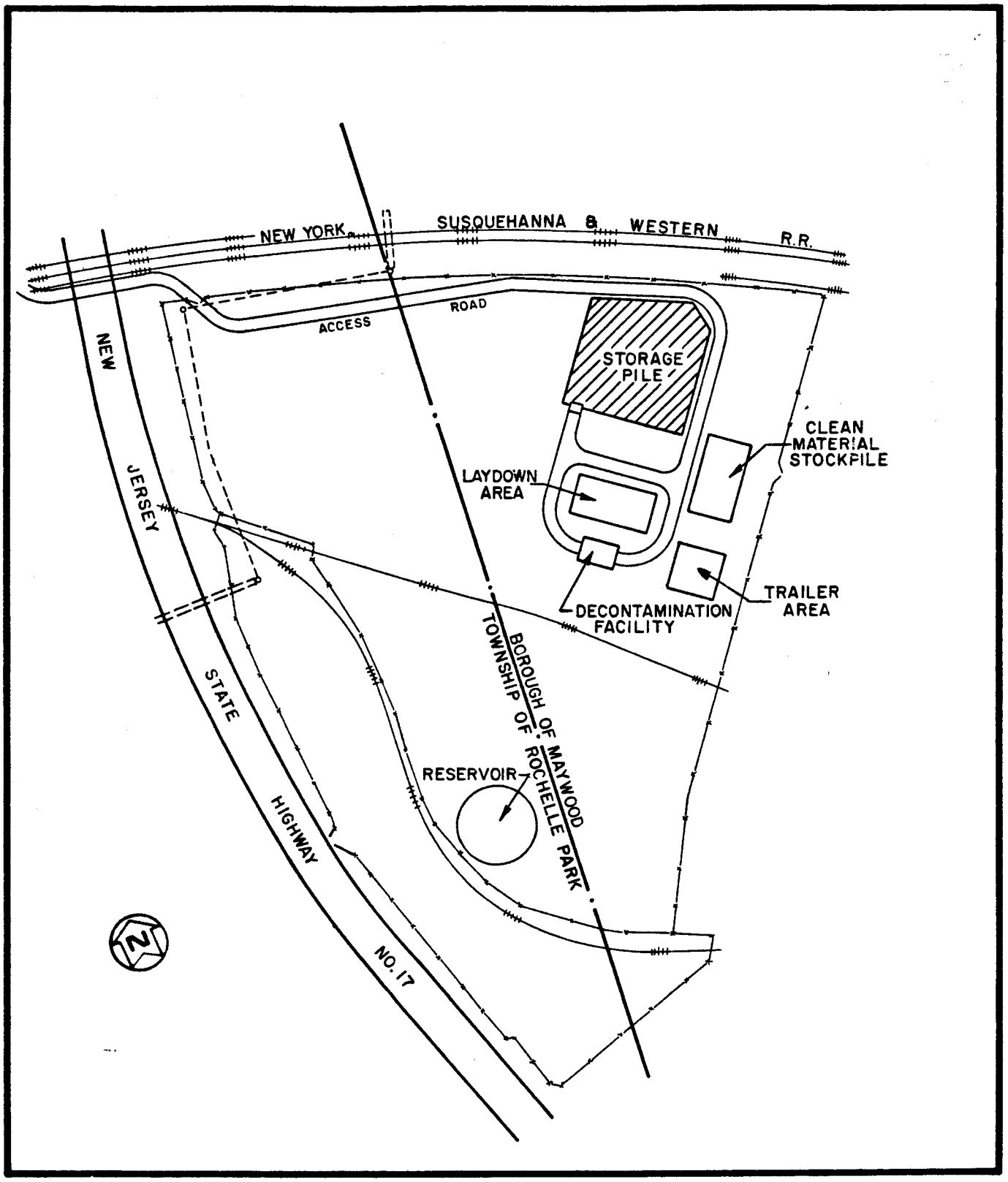

FIGURE 4-1 PROPOSED STORAGE PILE AT THE MISS

4.9 VERIFICATION SAMPLING AND ANALYSIS

Radiological measurements are required to identify the material that is contaminated above remedial action criteria and to certify that the remedial action is complete after it has 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 measurements. If the extent of contamination, as determined in the field, differs significantly* from the extent shown in the remedial action access agreements with the property owners, DOE will advise the owner, and excavation will proceed only after a suitable revised agreement has been reached.

Primary Excavation Control

Excavation will proceed downward in each affected area by removal of 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 taken with a directionalized (downward looking) scintillation probe with 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 single channel analyzer (Eberline PRS-1) and counting times of 1-3 minutes will be required. An iterative process of soil removal and near-surface gamma measurements will continue until the measurements indicate a level equal to or less than the applicable remedial action guideline for the soil has been reached (see Table 4-1 and Appendix A).

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*A "significant" variation is defined as one which affects structures, other improvements, or actions not included in the original property owner/DOE Memo Agreement.

In conjunction with the near-surface measurements, a surface gamma scan will continuously follow and indicate the excavation required for removal of small areas or "hot spots." This scan will be conducted with an unshielded 2 x 2 in. sodium iodide detector (Eberline SPA-3) connected to a pulse rate meter with aural monitoring capability (Eberline PRM-6 or equivalent) (see Appendix A, Section 4.3).

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 Post Decontamination 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 post decontamination survey will consist of ground level beta-gamma measurements, near-surface gamma ray measurements, and systematic soil sampling. Soil samples will be evaluated in the field laboratory using a rapid scan technique. Aliquots of soil samples will also be sent to the radiological support subcontractor laboratory for a standard isotopic 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 Certification Report

During the cleanup operations, Bechtel will collect and document data from analyses of soil samples and in situ radiological measurements to certify the adequacy of the remedial action.

Results of measurements and sample analyses documenting the final radiological condition will be presented in a final report for each designated property.

4.10 WASTE VOLUME PROJECTION

The waste volume projections for the project are contained 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 as PMC, to subcontractors, architect-engineers, construction and service subcontractors, and other subcontractors as may be identified (Ref. 15).

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

4.12 SURVEILLANCE AND MAINTENANCE

In order 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 State of New Jersey and Federal regulatory agencies are met.

TABLE 4-2

APPROXIMATE WASTE VOLUME PROJECTIONS*

1.	Waste Volume Projection for FY 84	Volume Yd^3**
	o Davison/Latham residences	1,000
	o Parkway/Grove residences	100
	o Ballod property (partial)	2,000
	Subtotal	3,100
2.	Waste Volume Projections for FY85 and FY86	
	o Ballod property (remainder)	12,000
	o Scanel property	2,200
	o Sears area property	48,000
	Subtotal	62,200
3.	Waste Volume Projection Beyond FY86	
	o Contaminated material at SC plant outside the interim storage area	23,000
	o SC burial sites	
	Pit 1	11,000
	Pit 2	3,000
	Pit 3	12,000
	o Buried material at the interim storage site	64,000
	Subtotal	113,000
	TOTAL	178,300

*Volume estimates are minimum and do not reflect expected increases due to recently revised criteria.

**For equivalent m^3, multiply by .7646.

5.0 SCHEDULE AND COST

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

Cost estimates are provided for DOE fiscal years 1984, 1985, and 1986. Costs estimates and the schedule beyond 1986 are dependent on when a disposal site can be identified and made available for final cleanup of the site.

12. NUS. Radiological Study of Maywood Chemical, Maywood, New Jersey. 1983.

13. U.S. Department of Energy, Oak Ridge Operations, Remedial Action Program (FUSRAP) and Surplus Facilities Management (SFMP) Projects. Design Criteria for Formerly Utilized (MED/AEC) Sites, Bechtel 14501-00-DC-01) 1984.

14. DOE/OR/207-22-11. Radiological Survey Report for Maywood Vicinity Properties on Grove Avenue and Park Way. 1984.

15. U.S. Department of Energy. Order 5700.6, Quality Assurance - ORO Site Implementation Plan, March 3, 1982.

A P P E N D I X 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 verification 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 if 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 verification survey. The remedial action sequence is shown as a flow diagram in Figure A-1.

1.0 GENERAL

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

- The designation surveys were adequate in scope to ensure that all major surface and sub-surface deposits of radioactivity exceeding guidelines have been identified. Should supplemental surveys be required after DOE designation to verify this and other boundary conditions, their results shall be documented and shall be the basis for added work as appropriate.
- 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 clean-up based upon analysis of radiation measurements at defined grid points.

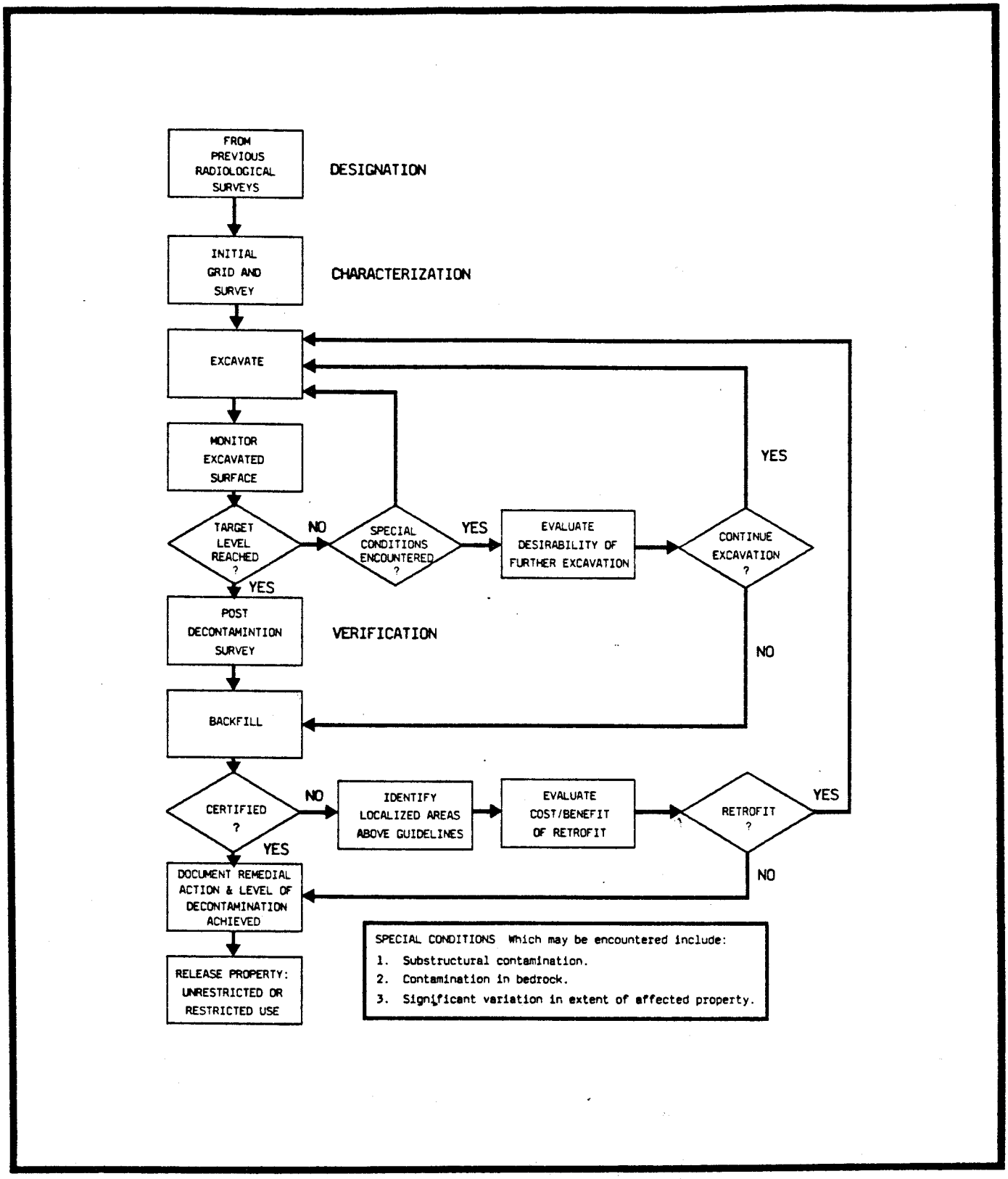

FIGURE A-1 REMEDIAL ACTION SEQUENCE

- 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 verification 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 will be established over the affected properties. This grid system consists of 10 x 10 m (33 x 33 ft) grid blocks (Fig. A-2) which are further divided into 16 smaller areas by lines spaced 2.5 m (8.2 ft) apart (Fig. A-3).

The grid system will be used during excavation to provide accurate location 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) sub-grid following completion of excavation to provide the reference system for the verification 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 sub-grid system will be extended to those areas and measurements as described in the following sections will be made.

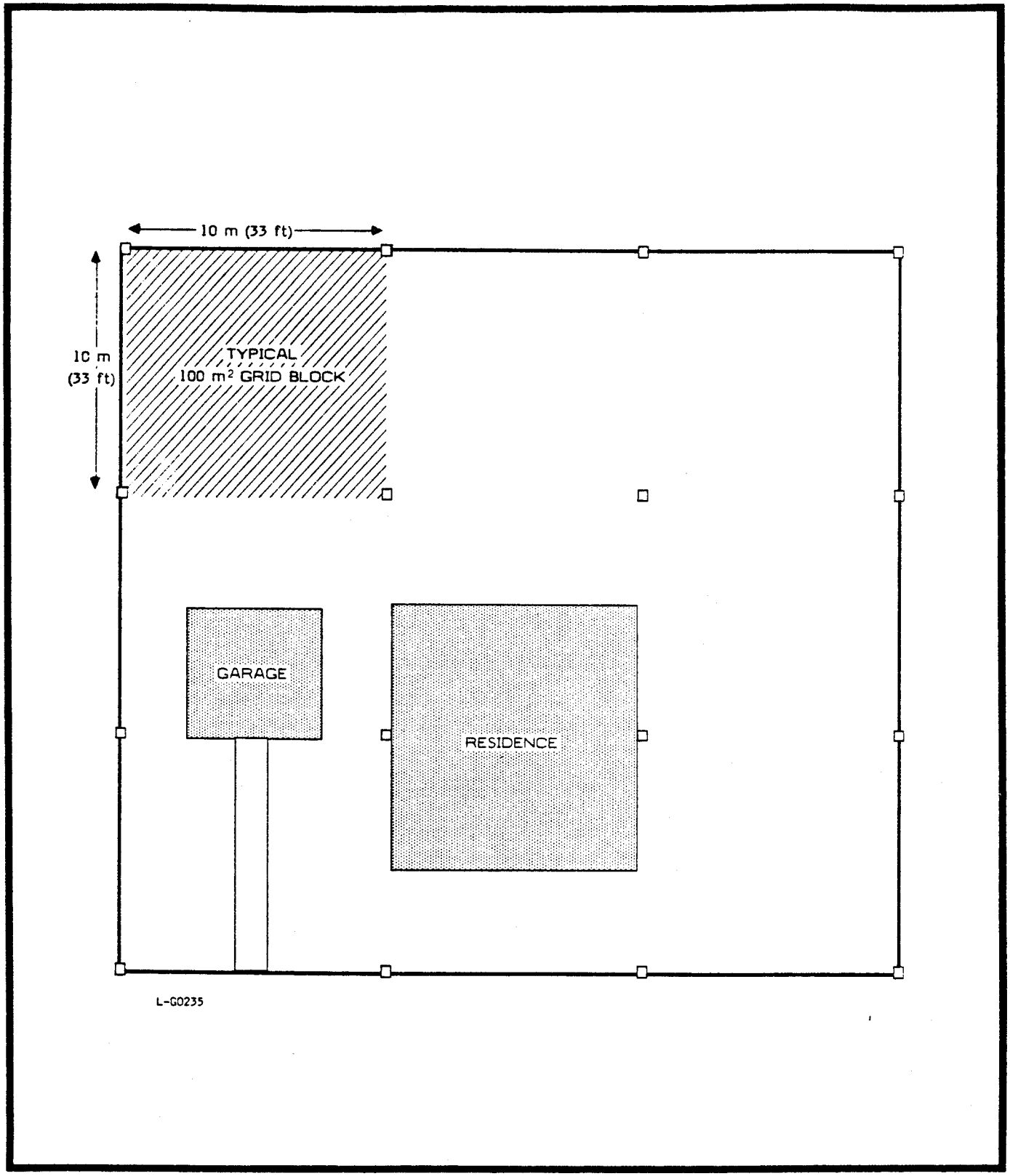

FIGURE A-2 SAMPLE PLAN VIEW OF REMEDIAL ACTION CANDIDATE PROPERTY

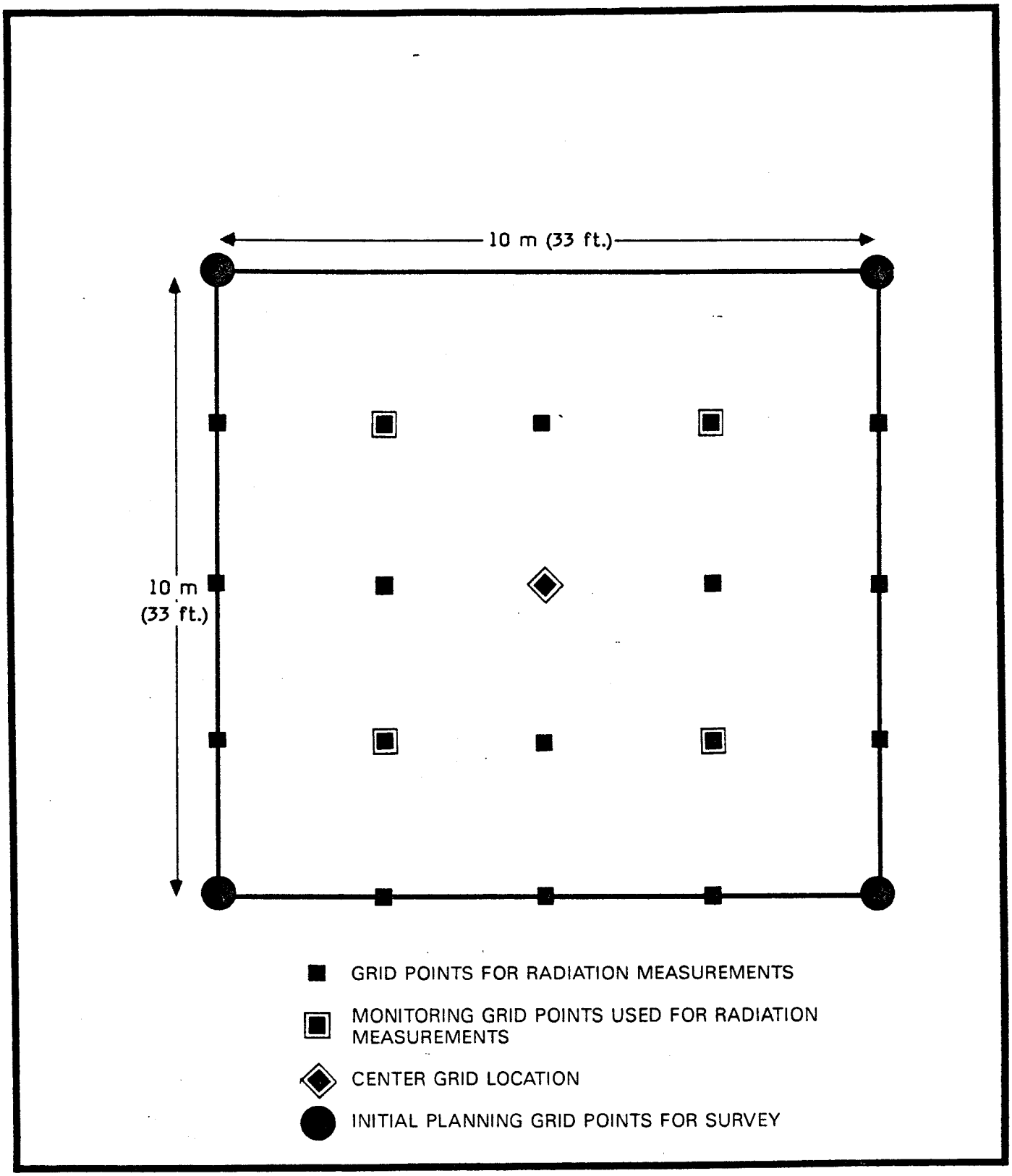

FIGURE A-3 SAMPLE 10m x 10m GRID BLOCK TO BE ESTABLISHED FOR POST REMEDIAL ACTION MEASUREMENTS

3.0 CHARACTERIZATION

Designation radiological surveys have shown that the radiological conditions at the site exceed remedial action guidelines and estimated 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 contaminaton 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 the extent of contamination and mark it 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 in the surrounding area with a pressurized ion chamber to determine the background gamma-ray exposure rate for the area in which the remedial action site is located. At each of these measurement locations, a sample of soil will be collected from the surface (surface to 15 cm deep) to establish the background Ra-226 and Th-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, as determined in the field, 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 agreement has been reached.

4.1 PRIMARY EXCAVATION CONTROL

Excavation will proceed downward in each affected area by removal of 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 taken with a directionalized (downward looking) scintillation probe with 2 x 2 in. sodium iodide (NaI) crystal (Eberline SPA-3) mounted 30 cm (12 in.) above the ground and connected to a single channel analyzer (Eberline RSP-1). An iterative application of soil removal and near-surface gamma 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 occasionally be collected from the excavated area and evaluated in the field laboratory using a rapid scan counting technique on a 4 x 4 in. NaI detector (ND 6600 gamma spectrometer). These measurements will be used as a continuing calibration check on the primary excavation control instrument.

*A "significant" variation is defined as one which affects structures, other improvements, or accesses not included in the original property owner/DOE Memo Agreement

4.3 HOT SPOT DETECTION

As soon as practicable after the designed excavation of contaminated soil is completed, the following procedure for the identification and removal of "hot" spots will be initiated to ensure meeting cleanup guidelines.

1. Ambient background for the area will be obtained by taking several (at least 5) readings at random locations in the area of construction and arithmetically averaging these readings.

2. 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 by swinging the probe back and forth over the ground just a few inches above the ground and observing count rate increases.

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

4. Each spot so marked will be measured by the tripod mounted and shielded 2 x 2 in. NaI detector (Eberline SPA-3) attached to the Eberline PRS-1 to estimate the pCi/g concentration of Ra-226 in the marked area.

5. 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 (1 min. count time).

6. All results will be reported to the resident BNI engineer and, as appropriate, the DOE engineer for consideration as to remedial action based on the ALARA principle and as required to ensure that the residual guidelines for $100m^2$ (1076 ft^2) are met.

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

8. In those areas where additional soil is removed, the area will be rescanned to confirm that the hot spots have been removed and document the level remaining.

9. After the above procedure has been completed, the verification and documentation measurements will be made and four certification soil samples collected.

5.0 VERIFICATION SURVEY

When the guideline limits have been reached, as determined by the primary excavation control instrument 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 verification (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 Fig. 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-ray 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 Fig. A-3 using the tripod mounted 2 x 2 in. shielded NaI detector described earlier. These measurements will be recorded by grid point location and will be used to estimate the radionuclide concentrations in hot spots and to estimate the average radionuclide concentrations for any 100 square meter area. The average radionuclide concentration will be determined from the mean of the 25 individual readings within any continguous 100 m^2 (1,076 ft^2) area. Any set of 25 adjacent 2.5 x 2.5 m (8.2 x 8.2 ft) grid point readings may be used to determine the average concentration for the area described by those 25 grid point readings.

If the average soil radionuclide concentration exceeds the DOE residual contamination guidelines (Work Plan 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 LAB ANALYSIS)

Soil samples will be collected in the excavated areas from exposed surfaces (floor and walls). These samples will be taken for the purpose of confirming the estimates of radionuclide(s) soil concentration based on the near-surface gamma measurements, and will be collected in the center of the four 25 m^2 (270 ft^2) blocks contained within each 100 m^2 (1,076 ft^2) area as shown in Fig. A-3. Sampling for verification of the guideline limit(s) shall not be initiated until radiological surveys demonstrate that no significant concentrations of residual radioactivity are present on the walls and floors 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 hot spot 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 5 x 5 m (16.5 x 16.5 ft) 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 determination of 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:

1. From each sample a 500 ml beaker 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.

2. 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.

3. Standard sample custody procedures will be followed throughout the sampling and analytical process. All aliquots remaining after Step 1 and Step 2 will be retained for one year following completion of the certification process on the property from which the samples were taken.

During the course of the remedial action verification 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 Bechtel/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 restoration of the area. This authorization should occur within a few days of completion of excavation.

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 and in situ radiological measurements to determine the adequacy of the remedial action. Concurrently and independently, the DOE may from time to time collect and analyze spot soil samples and make in situ radiological measurements.

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

Results of the verification survey will be presented in a final 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 instruction 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 EIC Quality Assurance Manual requirements.