ACTION DESCRIPTION MEMORANDUM

PROPOSED 1984 REMEDIAL ACTIONS AT MAYWOOD, NEW JERSEY

Prepared by

Environmental Research Division
Argonne National Laboratory
Argonne, Illinois

Draft: February 1984
Final: March 16, 1984
Revised Final: May 18, 1984

Prepared for

U.S. Department of Energy
Oak Ridge Operations
Technical Services Division
Oak Ridge, Tennessee

35820

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May 21, 1984

Arthur J. Whitman
Division of Remedial Action Projects
NE-24
U.S. Department of Energy
Washington, D.C. 20545

SUBJECT: REVISED FINAL ACTION DESCRIPTION MEMORANDUM (ADM), PROPOSED 1984 INTERIM REMEDIAL ACTIONS AT MAYWOOD, NEW JERSEY

Dear Mr. Whitman:

As you requested, we have revised the Final Maywood ADM to incorporate the most recent version of the radiological guidelines and to make a few minor editorial corrections.

Sincerely,

Pamela Merry-Libby

Pamela Merry-Libby
Maywood Project Leader
Environmental Research Division

PML:mz

Encl.

cc: (w/encl)

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CONTENTS

1. SUMMARY OF PROPOSED ACTIONS AND RELATED ACTIVITIES

As part of a specially authorized research and development project (U.S. Congress 1983), the U.S. Department of Energy (DOE) proposes to carry out some remedial actions during 1984 at various sites near Maywood, New Jersey (Figures 1.1 and 1.2). The work will be conducted under DOE's Formerly Utilized Sites Remedial Action Program (FUSRAP). The proposed 1984 actions include cleanup of several vicinity properties and interim storage of the contaminated materials at a property to be acquired by DOE. The major proposed actions include:

- Removal of about 1000 m^3 (1300 yd^3) of radioactively contaminated soils from seven residential properties on Davison Street and Latham Street.
- Removal of about 230 m^3 (300 yd^3)* of contaminated soils from eight residential properties on Grove Street and Park Way.
- Removal of part of the contaminated soils (about 8700 m^3 [11,400 yd^3])* that are located on an empty lot known as the Ballod property
- Construction of access roads, a vehicle decontamination area, and other support facilities on an empty lot that will be acquired by DOE (termed herein, the Maywood Storage Site)
- Placement of the 10,000 m^3 (13,000 yd^3)* of contaminated soils in an interim-storage pile on the Maywood Storage Site.

Details of the various activities are given in Section 4 (Proposed Action and Alternatives).

The contaminated materials will be removed from the vicinity properties according to DOE's radiological guidelines for residual radionuclide concentrations in soil at FUSRAP sites (Appendix A). Following removal of contaminated materials, the extent of residual contamination will be determined and DOE will make another decision regarding release of the properties for unrestricted use.

The proposed 1984 actions are the beginning of remedial actions involving cleanup of several contaminated sites in the Maywood area (Figure 1.2).

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*These volumes are being revised as detailed engineering progresses. As of March 11, 1984, the estimates for volumes have been reduced as follows: Grove Street/Park Way, 80 m^3 (100 yd^3); Ballod property, 8000 m^3 (10,000 yd^3); and total to be placed at the Maywood Storage Site, 9,000 m^3 (12,000 yd^3).

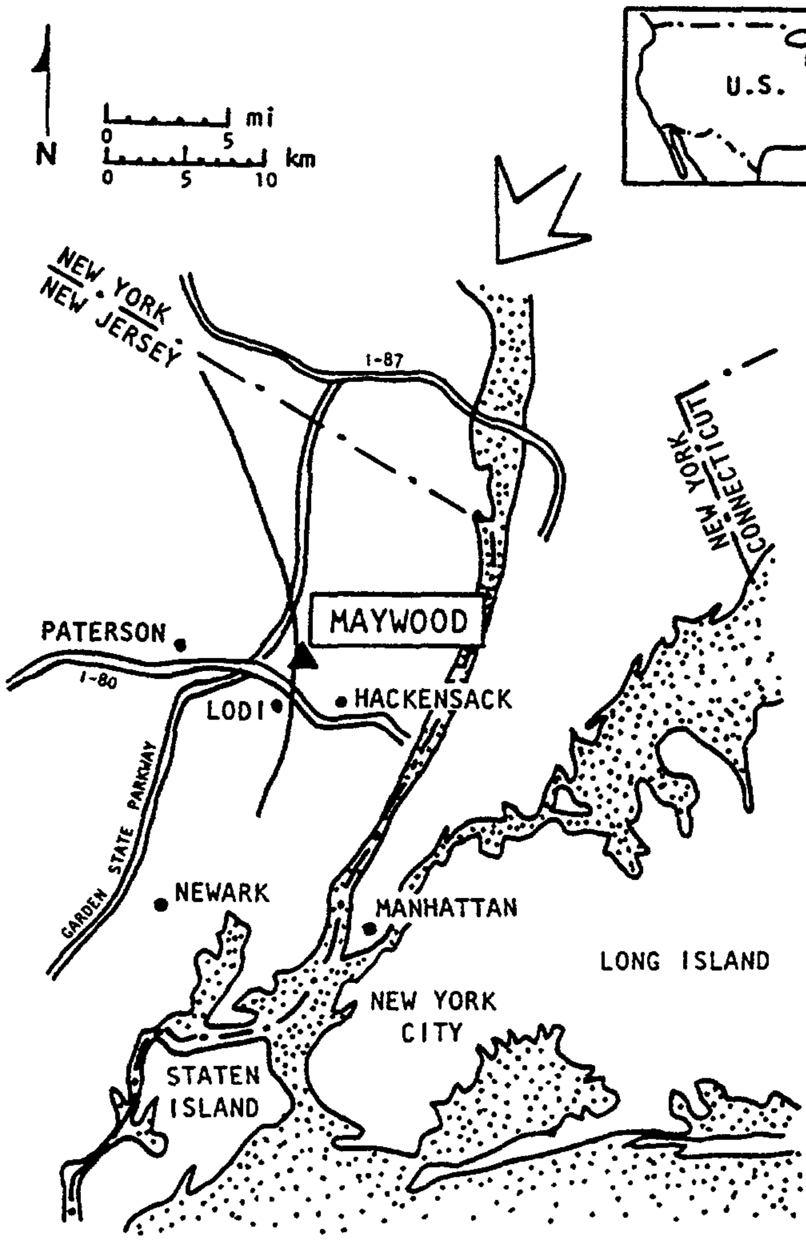

Figure 1.1. Location of Maywood, New Jersey.

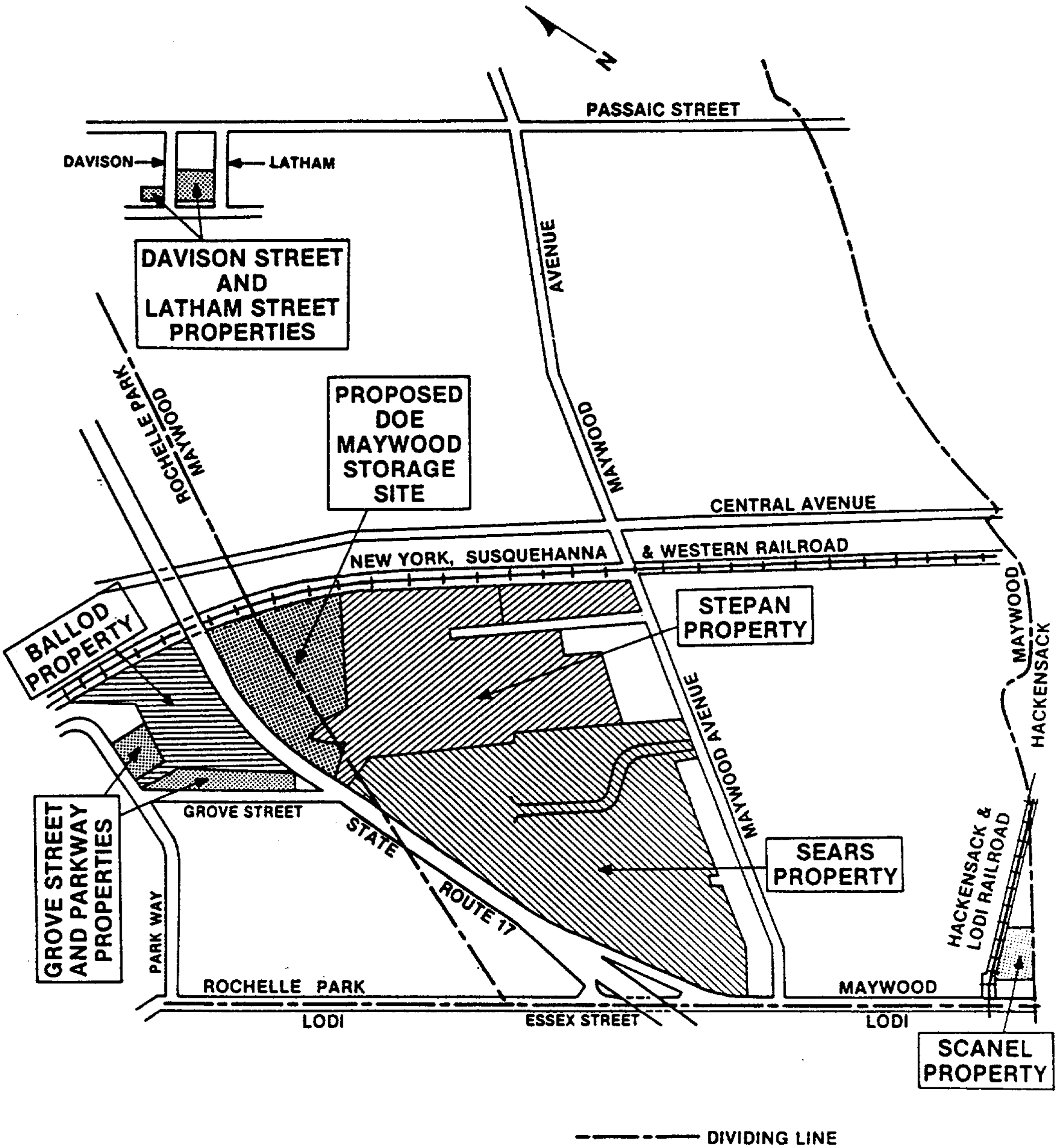

Figure 1.2. Location of Contaminated Properties Near Maywood, New Jersey. Adapted from drawing by Bechtel National, Inc.

Congress has appropriated money for FY 1984 to initiate work. The decision to be made now is how to carry out this initial work. Depending on future funding, there will be separate future decisions on cleanup of additional properties. Because a disposal site is not now available, current plans call for interim storage on the Maywood Storage Site. Another future decision will have to be made relative to permanent disposition of the contaminated materials.

Separate environmental analyses will be prepared to support future decisions on cleanup of other vicinity properties, permanent disposition of the contaminated materials, and release of sites for unrestricted use after cleanup.

2. HISTORY AND NEED FOR ACTION

2.1 GENERAL SETTING

Maywood, New Jersey, is located in a densely populated urban area about 19 km (12 mi) north-northwest of downtown Manhattan (New York City), 21 km (13 mi) northeast of Newark, New Jersey, and 8 km (5 mi) east of Paterson, New Jersey (Figure 1.1). There are several properties in the Borough of Maywood and adjacent Rochelle Park Township (both in Bergen County) that have been identified as being radioactively contaminated as a result of previous processing of thorium ores (monazite sands) at the Maywood Chemical Works (now owned by Stepan Company). These properties (Figure 1.2) and the corresponding radiological survey(s) are:

- Stepan Chemical Plant site (Morton 1981)
- Sears Warehouse property (NUS Corp. 1983)
- Scanel property (including a Chinese restaurant and car wash) (NUS Corp. 1983)
- Maywood Storage Site* (Morton 1981)
- Ballod property (Cole 1981; Morton 1981)
- Seven residential properties on Davison Street and Latham Street (Oak Ridge Natl. Lab. 1981a-g).
- Eight residential properties on Grove Street and Park Way (Bechtel Natl. 1984a).

In addition, a length of the New York, Susquehanna and Western Railroad right-of-way adjacent to the northern boundaries of the Maywood Storage Site and the Stepan and Ballod properties is also contaminated. A radiological survey of this area has recently been completed (Bechtel Natl. 1984b). Soils underneath N.J. Route 17 may also be contaminated.

2.2 HISTORY

The Maywood Chemical Works was founded in 1895. Processing of thorium for use as coatings in the manufacture of gas lamp mantles began in 1916 and ended in 1957. Process wastes were pumped to lower-lying areas west of the

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*Negotiations are currently under way to transfer ownership of this property from Stepan Company to DOE for use as an interim-storage site for the contaminated materials to be excavated from the Maywood/Rochelle Park properties.

processing facilities. Two earthen dikes were constructed on what is now the Ballod property (Figure 2.1) to control distribution of the wastes (Cole 1981). Some of the contaminated wastes were apparently eroded onto adjacent properties on Grove Street and Park Way (Beck 1984).

In 1932, N.J. Route 17 was built through the process waste disposal area. Stepan Chemical Company (now Stepan Company) acquired Maywood Chemical Works in 1959 (Oak Ridge Natl. Lab. 1981a). From 1966-1968, Stepan removed about 15,000 m^3 (19,000 yd^3) of radioactively contaminated wastes from the area west of Route 17 to three burial sites on the main Stepan property. Stepan then requested that the Atomic Energy Commission (AEC--whose regulatory functions are now carried out by the Nuclear Regulatory Commission [NRC]) release the area west of Route 17 for unrestricted use (Anon. 1981). The AEC granted the request and, late in 1968, Stepan sold 3.5 ha (8.7 acres) of property west of Route 17 to Mr. A. Baresi who in turn sold it to Ballod Associates in the late 1970s. Over the past few years the area has been used primarily by local residents for unauthorized trash disposal and by local youths who play in the area (Cole 1981).

About 1928, the Maywood Chemical Works apparently allowed process wastes to be removed from the processing site to nearby properties for use as mulch and fill. Again, between 1944 and 1946, many truckloads of fill were taken from the Stepan site and deposited at 464 Davison Street (then a vacant lot), primarily for fill in a ditch that traversed the back of several lots between Davison Street and Latham Street. The fill material consisted of tea and cocoa leaves mixed with other material resulting from operations at the Stepan plant, and apparently also contained thorium process wastes. Several nearby residents used the material dumped at 464 Davison Street in their lawns and gardens. The lot at 464 Davison was sold, and a house was constructed on it in 1967 (Oak Ridge Natl. Lab. 1981a).

2.3 RADIOLOGICAL CONTAMINATION AND NEED FOR ACTION

The properties that have been identified for cleanup during 1984 (Davison Street/Latham Street properties, Grove Street/Park Way properties, and portions of the Ballod property) have soils that are contaminated to levels exceeding DOE guidelines for residual radionuclide concentrations at FUSRAP sites. These guidelines are summarized for the radionuclides occurring at the Maywood sites in Table 2.1; the complete guidelines are given in Appendix A.

2.3.1 Ballod Property

Two radiological surveys of the Ballod property were conducted at about the same time. Oak Ridge Associated Universities (Cole 1981) identified two major areas of contamination: (1) the northeast section of the property behind the north dike, and (2) the southern part of the property behind the south dike (Figure 2.1). In the north dike area, thorium-232* concentrations are as high as 2500 pCi/g of soil and radium-226* concentrations are as high as 240 pCi/g. Concentrations in the south dike area are as high as 200 pCi/g for thorium-232 and 20 pCi/g for radium-226. In addition, isolated small areas of contamination ("hot spots") are also present (Figure 2.1).

*See the thorium-232 and uranium-238 radioactive decay chains in Section 5. Radium-226 is an intermediate decay product in the uranium-238 decay chain.

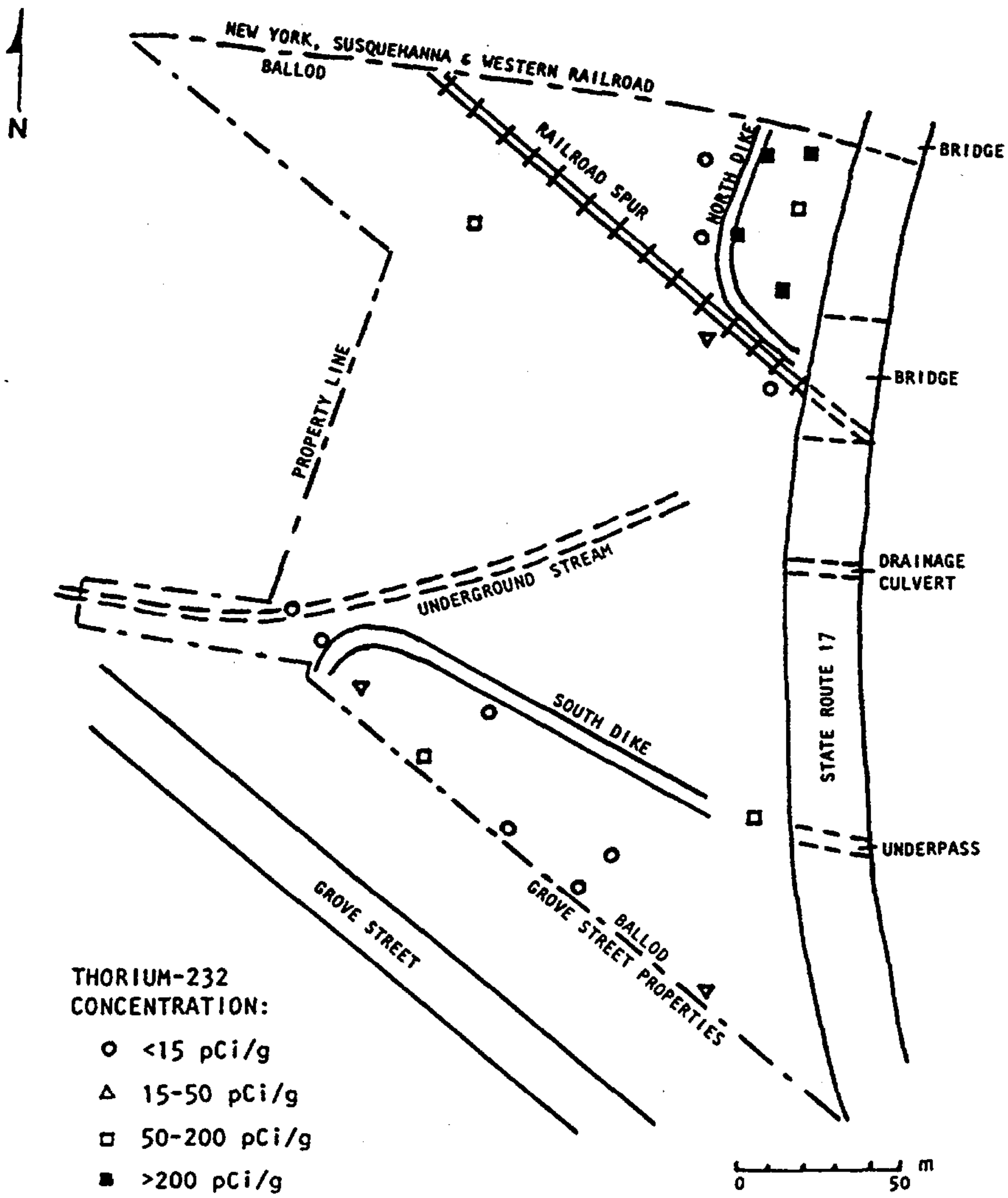

Figure 2.1. Location of Radioactively Contaminated Areas on the Ballod Property. Source: Cole (1981).

Table 2.1. DOE Radiological Guidelines for Residual Radionuclide Concentrations in Soil at FUSRAP Sites

Radionuclide	Allowable Concentration Above Background (pCi/g)
Uranium-natural†1	75
Uranium-238†2	150
Uranium-234†2	150
Thorium-230	15
Radium-226	5/15†3
Thorium-232	15

†1 One curie of natural uranium means the sum of 3.7×10^{10} disintegrations/second (dis/s) over any 15-cm-thick layers from U-238 plus 3.7×10^{10} dis/s from U-234 plus 1.7×10^{9} dis/s from U-235.

†2 Assumes no other uranium isotopes are present.

†3 5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over 15-cm-thick soil layers more than 15 cm below the surface and less than 1.5 m below the surface.

A second survey was carried out for Stepan by Nuclear Safety Associates (Morton 1981). Samples taken on the Ballod property in December 1980 revealed a third major contaminated area in the southern part of the property (Figure 2.2).

Based on these radiological surveys, particularly the Morton (1981) report, Bechtel National, Inc., has identified two areas on the Ballod property to be excavated in 1984 (Figure 2.2): Area A to a depth of about 1.8 m (6 ft), and Area B to a depth of about 2.4 m (8 ft). It is anticipated that 8,700 m^3 (11,000 yd^3)* will be removed from these two areas (Table 2.1). Based on the amount of contaminated soil to be removed in 1984 and the Morton (1981) data, it is estimated that 0.4 Ci of thorium-232 will be removed from Area A and 0.5 Ci will be removed from Area B (Robertson 1984). Another 2.6 Ci of thorium-232 is located in the north diked area, but this area is not proposed for excavation in 1984.

*Estimated volumes of material to be excavated are being revised as detailed engineering progresses. As of March 11, 1984, the estimated volume to be excavated on the Ballod property has been revised to 8,000 m^3 (10,000 yd^3).

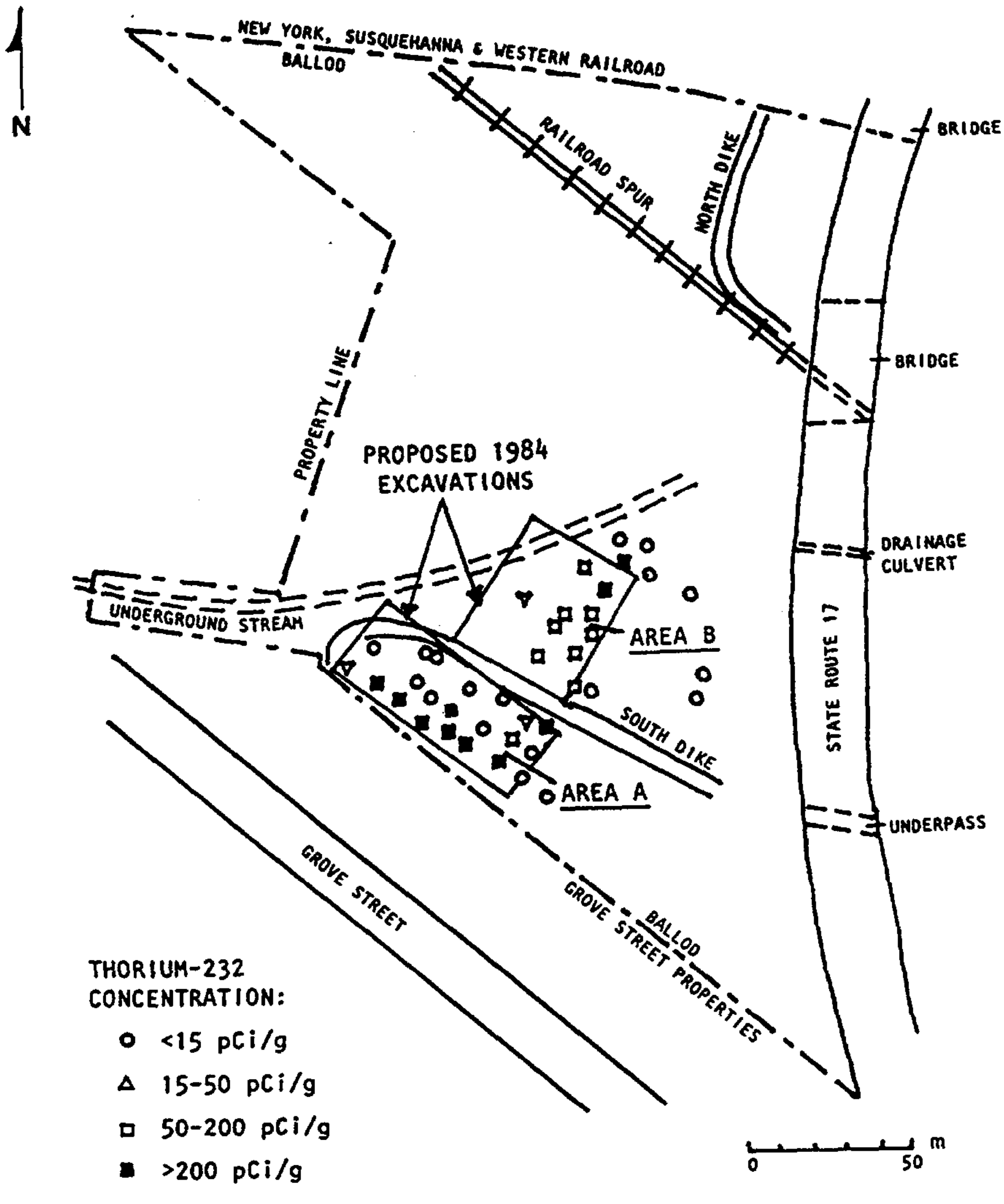

Figure 2.2. Areas on the Ballod Property Proposed for Excavation in 1984. Sources: Morton (1981) and preliminary drawing by Bechtel National, Inc.

2.3.2 Grove Street and Park Way Properties

Along the eastern and southern boundaries of the Ballod property are 15 residential properties fronting on Grove Street and Park Way. Eberline, Inc., recently surveyed these properties for radiological contamination (Bechtel Natl. 1984a). Eight properties are proposed for cleanup (Beck 1984). Contamination is mostly superficial and extends to a depth of approximately 15 cm (6 in.). Contaminated areas are primarily in the backyards near the Ballod property line (Figure 2.3). The estimated total volume needing excavation is 230 m^3 (300 yd^3)* (Table 2.2).

2.3.3 Davison Street and Latham Street Properties

Seven residential properties on Davison Street and Latham Street are contaminated (Figure 2.4). Based on the Oak Ridge National Laboratory (1981a-g) data, it is estimated that approximately 1,000 m^3 (1,300 yd^3) of contaminated soils containing 0.28 Ci of thorium-232 and 0.064 Ci of radium-226 will be removed from these properties during the proposed 1984 actions (Table 2.3). Uranium-238 concentrations are below the criterion limit and radium-226 concentrations are usually below the criterion limit. Thorium-232 accounts for most of the radioactivity. The majority of thorium-232 (80%) and radium-226 (78%) is present on the 464 Davison property.

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*Estimated volumes of material to be excavated are being revised as detailed engineering progresses. As of March 11, 1984, the estimated volumes to be excavated on the Grove Street and Park Way properties have been reduced to 80 m^3 (100 yd^3).

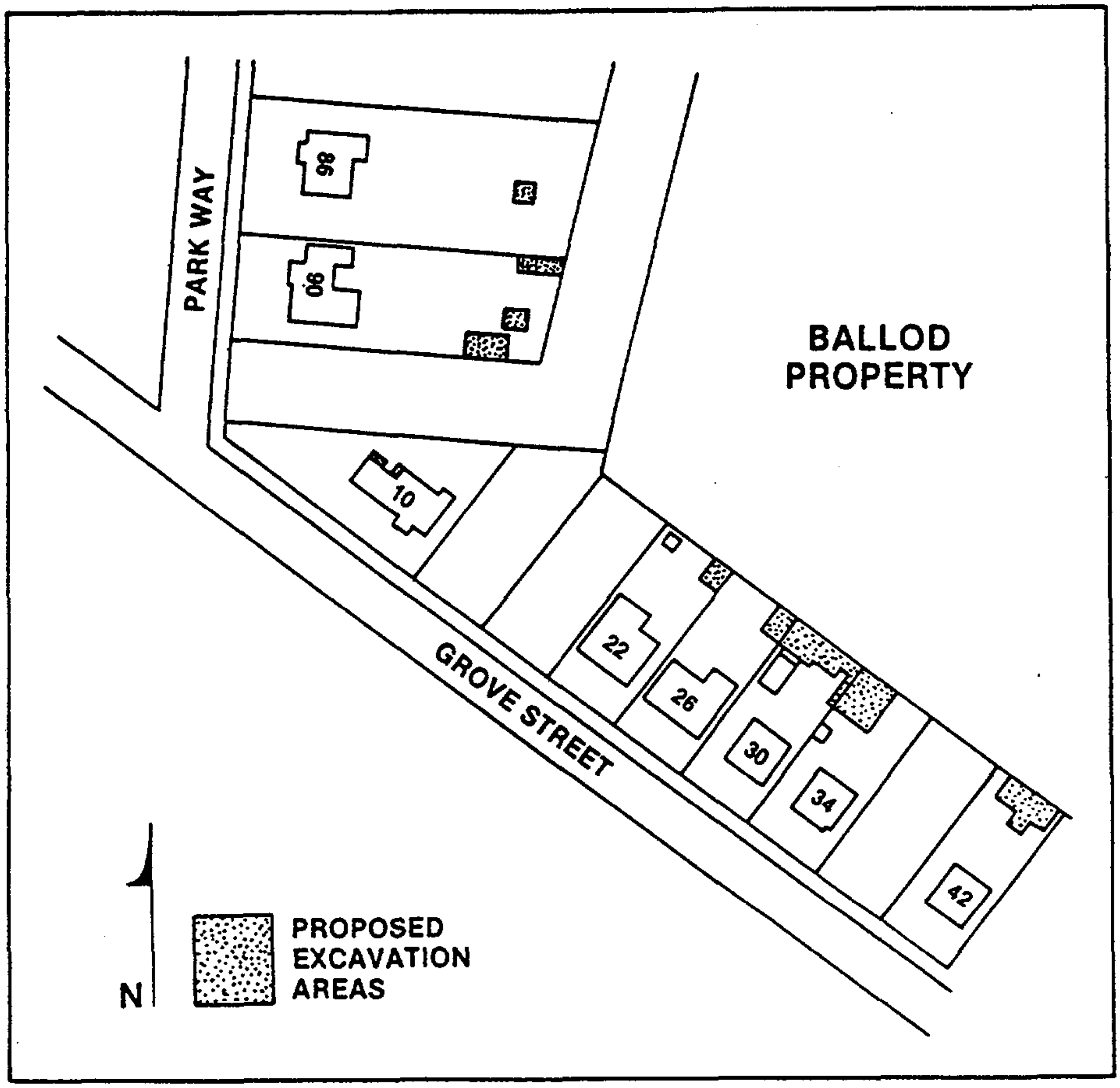

Figure 2.3. Proposed Excavation at the Grove Street and Park Way Properties. Adapted from preliminary drawing by Bechtel National, Inc.

Table 2.2. Estimated Volumes and Radiological Characteristics of Materials Proposed for Excavation in 1984

Property	Volume[†1]		Radionuclide Inventory (Ci)		Radionuclide Concentration (pCi/g)	
	m^3	yd^3	Thorium-232	Radium-226	Thorium-232	Radium-226
Davison Street/Latham Street	1,000	1,300	0.28[†2]	0.064[†2]	190[†2]	43[†2]
Grove Street/Park Way	230	300	Negl.[†3]	Negl.[†3]	Negl.[†3]	Negl.[†3]
Ballod	8,700	11,400	0.9[†4]	0.23[†5]	90[†6]	22[†6]
Total	10,000	13,000	1.2	0.29	100[†7]	23[†7]

[†1] Preliminary estimates by Bechtel National, Inc. Estimates are being revised as detailed engineering progresses. As of March 11, 1984, the volumes at Grove Street/Park Way and Ballod properties have been revised downward to 80 m^3 (100 yd^3) and 8,000 m^3 (10,000 yd^3), respectively.

[†2] Data from Table 2.3.

[†3] Negligible (Beck 1984).

[†4] Data from Robertson (1984).

[†5] No radium-226 data available. It is assumed that the ratio of thorium-232 to radium-226 is the same as at the Davison Street/Latham Street properties.

[†6] Assuming a dry weight density of 1200 kg/m^3.

[†7] Weighted average.

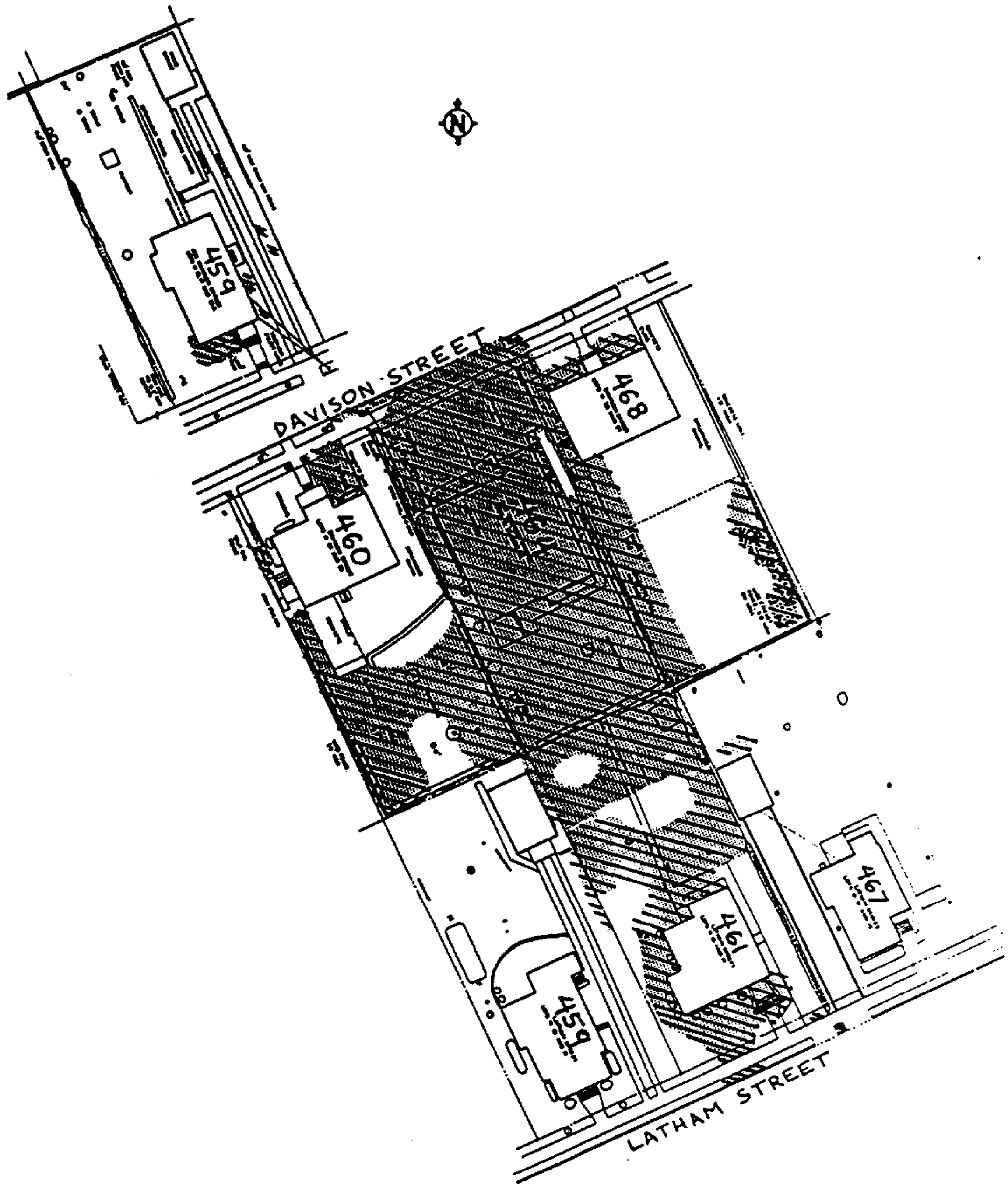

Figure 2.4. Proposed Excavation at the Davison Street and Latham Street Properties. Adapted from preliminary drawing by Bechtel National, Inc.

Table 2.3. Contamination of Davison Street/Latham Street Properties Proposed for Cleanup in 1984†[1]

Property	Location of Contamination	Estimated Volume of Soil Contaminated Above Guideline Levels (m^3)	Level of Soil Contamination: Average Contamination (pCi/g)		Level of Soil Contamination: Total Radionuclide Inventory†[1]	
			Thorium-232	Radium-226	Thorium-232	Radium-226
461 Latham	In extensive flower and shrubbery gardens around house, the vegetable garden, and rear of property	160	47	13	0.009	0.0025
464 Davison	Entire area of lot to depth of 0.9 m (3 ft)	720	255	58	0.22	0.050
468 Davison	Backyard along east border, along all west boundary, and in two shrubbery areas adjacent to house on north side	175	71	23	0.015	0.0048
460 Davison	East half of front yard and most of backyard	195	137	30	0.032	0.0069
467 Latham	Two small areas on property	1	18	3	I†[2]	I
459 Latham	In strip along border of 459 and 461 Latham and spotty amounts along northeast corner	1	5.6	2.3	I	I
459 Davison	Isolated locations in front yard and along east side	5	9.1	3.2	I	I
Total		1260†[3]	190	43†[4]	0.28†[4]	0.064

†[1] Assuming a dry weight density of 1200 kg/m^3.

†[2] I = Insignificant amount compared to other levels.

†[3] This volume is slightly higher than that estimated by Bechtel National as being in need of excavation. However, this volume is used to obtain the estimated radionuclide inventory of the materials to be excavated for the Davison Street and Latham Street properties.

†[4] Weighted average.

Source: Based on data from Oak Ridge National Laboratory (1981a-g).

3. THE EXISTING ENVIRONMENT

3.1 GEOLOGY AND HYDROLOGY

The Maywood Storage Site and vicinity properties are located within the glaciated section of the Piedmont Plateau of north-central New Jersey. The terrain is generally level, with shallow ditches and slight mounds (Cole 1981). The Maywood Storage Site slopes gently toward the Saddle River. It is underlain by the sedimentary mudstone and siltstone of the Brunswick Formation (Morton 1981). The bedrock lies close to the surface and is overlain by 0.9 to 4.6 m (3 to 15 ft) of weathered bedrock and unconsolidated glacial deposits of clay, silt, sand, and gravel. The depth of the glacial deposits varies considerably in the site area. In addition, fill materials have been placed on the site during its many years of industrial use (Morton 1981).

The Maywood Storage Site is located within the Saddle River drainage basin (Figure 3.1) about 0.8 km (0.5 mi) east of the Saddle River (a tributary of the Passaic River) and about 1.6 km (1 mi) west of the drainage divide of the Hackensack River basin (Morton 1981). At the Lodi gauging station, located approximately 1.3 km (0.8 mi) southwest of the site (Figure 3.1), the Saddle River has a drainage area of about 140 km^2 (55 mi^2). Based on 59 years of flow data (1923-1982) at the Lodi station, the minimum daily flow is 0.17 m^3/s (6.0 cfs), the maximum flow is 130 m^3/s (4,500 cfs), and the mean flow is 2.8 m^3/s (100 cfs) (U.S. Geol. Surv. 1983). Local surface drainage at the Maywood Storage Site is into Westerley Brook (Figure 3.1). This brook flows southwestward and enters the Maywood Storage Site near the Maywood-Rochelle Park boundary. It is channelized and encased in concrete, and it is covered with 0.6 to 1.5 m (2 to 5 ft) of fill material within the Maywood Storage Site and the Ballod property. The brook flows west through the underground channel and opens again at the surface about 200 m (655 ft) west of the Ballod property (Cole 1981). It eventually flows into the Saddle River. The Maywood Storage Site is not located in the 100-year floodplain of the Saddle River (Hanabergh 1984). Neither the Saddle River nor Westerley Brook are used for drinking water purposes (Jacobson 1982).

Groundwater in the Maywood area is available primarily from a bedrock aquifer and from unconsolidated surficial deposits. The Brunswick Formation is generally considered to be the more productive and major groundwater resource. Industrial and municipal wells with depths of 92 m (300 ft) or more can produce flows as high as 32 L/s (500 gpm) from the Brunswick aquifer (Morton 1981). Groundwater quality is generally good except that softening is required. Wells drawing from the unconsolidated surficial deposits usually have low yields and are used for domestic purposes. However, some high-yielding wells used for industrial and public supplies have been developed in the thicker surficial deposits of stratified glacial drift.

The groundwater gradient is low at the site and the water table is generally shallow--within about 2.1 to 3.0 m (7 to 10 ft) of the surface

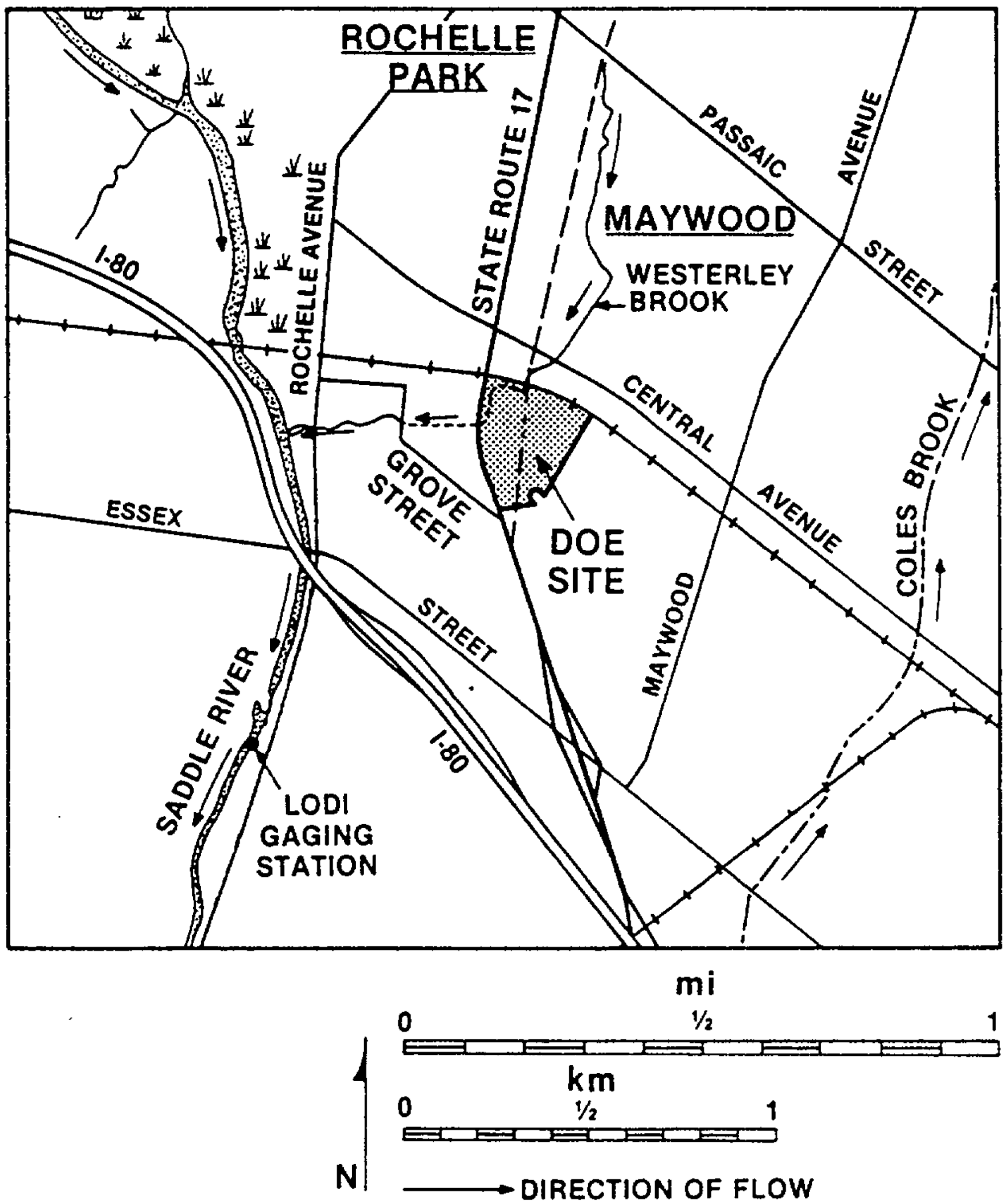

Figure 3.1. Surface Drainage in the Vicinity of the Maywood Storage Site. Adapted from U.S. Geological Survey map (Hackensack Quadrangle, New Jersey, 7.5 minute series).

(Morton 1981). The near-surface aquifer in the unconsolidated glacial materials is interconnected with the lower Brunswick aquifer. The groundwater flows southwest through the bedrock along fractures that tend to be most developed along the northeast-southwest strike of the Brunswick Formation (Spayd 1984). Several Lodi municipal wells are located downgradient southwest of the Maywood Storage Site and the burial grounds on the Stepan property. One of these wells, the "Home Place" well (about 3.2 km [2 mi] southwest of the site), has had elevated levels of radioactivity. Water from this well had a gross alpha concentration of 58.7 and 130.9 pCi/L in September and December 1983, respectively; five other Lodi wells had gross alpha concentrations ranging from 4.76 to 12.4 pCi/L (Spayd 1984). Background gross alpha concentrations in water from the Brunswick Formation in Bergen County range from <1 to 5.86 pCi/L, with a mean value of 1.09 pCi/L. It is not yet known whether the elevated levels of radioactivity in the Lodi wells result from leaching of radioactive contaminants from the buried wastes on the Stepan property or from leaching of existing contaminated soils on the Maywood Storage Site and Ballod property. The New Jersey Department of Environmental Protection is studying this situation.

3.2 METEOROLOGY

New Jersey averages about 120 days of precipitation per year, and the mean annual precipitation is about 120 cm (48 in.). August is the wettest month, with an average of 12 cm (4.8 in.) of precipitation measured at Little Falls, New Jersey, about 14 km [8.4 mi] southwest of Maywood (Gale Res. Co. 1980). The highest amount of precipitation recorded for a single day is 25 cm (9.8 in.), and the highest monthly total is 40 cm (15 in.). Floods frequently accompany heavy rains that are sometimes associated with storms of tropical origin. Short droughts occur during the growing season, but prolonged droughts are rare--generally occurring only once every 15 years (Gale Res. Co. 1980). The prevailing winds are from the northwest from October through April and from the southwest during the summer months.

3.3 ECOLOGY

Maywood is located within the glaciated area of the Appalachian oak forest section of the eastern deciduous forest (Bailey 1978). This forest section is characterized by oak, hickory, maple, basswood, elm, and ash--with alder, willow, ash, elm, and hygrophytic shrubs common in moist (poorly drained) habitats. However, because the sites are located within an urban setting and are developed as industrial and residential properties, little or no forest habitat is present.

The flora of the industrial sites (i.e., the Maywood Storage Site and the Stepan and Ballod properties) is dominated by early successional species (e.g., grasses, aster, goldenrod, clover, dandelion, smartweed, yarrow, thistle, and wild carrot) and shrubs and small trees (e.g., maple, aspen, willow, elm, and oak) (Vinikour 1984). Both the Maywood Storage Site and the Ballod property contain abundant stands of reed (*Phragmites communis*). *Phragmites* is an indicator of poorly drained, moist soils (Galvin 1979). The introduced (non-native) tree-of-heaven (*Ailanthus altissima*) is also common on the Maywood Storage Site, especially near the railroad spur. This species can thrive on poor soils in smoky environments (Schopmeyer 1974). The residential sites contain plant species common to landscaped yards such as grasses (fescue and blue grass), garden vegetables and/or flowers, evergreen shrubs, and trees.

The fauna is limited due to a lack of suitable habitat. Commonly encountered species are those that have adapted to suburban/urban encroachment. Birds found in the vicinity include house sparrow, cardinal, red-winged blackbird, common crow, robin, red-eyed vireo, mourning dove, and wood thrush. In Westerley Brook and the Saddle River, common surface-feeding ducks occur, such as mallards and black ducks. Mammal species occurring in the site vicinity probably include the Norway rat, racoon, opossum, muskrat, house mouse, meadow vole, white-footed mouse, deer mouse, eastern mole, eastern cottontail rabbit, striped skunk, eastern gray squirrel, and shorttail shrew. There are several woodchuck burrows on the Maywood Storage Site (Vinikour 1984). Generally, reptiles and amphibians are adversely affected by urbanization due to factors such as falling prey to humans and/or vehicles, habitat loss, and chemical wastes (Stearns and Ross 1978). However, a few species such as the eastern garter snake and American toad have partially adapted to urban habitats and can be expected to occur in the area.

Aquatic habitat is limited to drainageways, temporary ponds and other bodies of standing water, and Westerley Brook. Plant communities of Westerley Brook and permanently moist areas are dominated by cattails and marsh grasses. Mosquito and midge larvae, aquatic beetles and bugs, and other aquatic invertebrates capable of rapid colonization and/or short life cycles are typical inhabitants of temporary water bodies found in the vicinity. Species typical of small, generally degraded streams are found in Westerley Brook (e.g., aquatic worms, midges, snails, blackflies, beetles, bugs, minnows, and suckers).

No threatened or endangered species occur in the site vicinity (Fairbrothers and Hough 1973; N.J. Dep. Environ. Prot. 1975).

3.4 LAND USE

The Maywood Storage Site is a fenced vacant lot to be acquired by DOE from the Stepan Company for use as an interim-storage site for the radioactively contaminated materials to be excavated from nearby contaminated properties. The rest of the Stepan property is also enclosed by a fence and is currently used for chemical processing activities. Local residents use the Ballod property for unauthorized trash disposal, and local youths also play on the property (Cole 1981). SWS Industries had considered constructing an office/warehouse facility on the Ballod property (Mueller and Gunn 1981) but has located elsewhere (Dertsh 1984). This property has also been considered for residential development (Dertsh 1984). The Ballod property is zoned commercial and the Maywood Storage Site is zoned commercial and industrial.

A combination of industrial and residential land use exists within the immediate vicinity. With the exception of one house located along the east border of the Stepan property, the area to the east and south of the Maywood Storage Site is used for industrial and commercial purposes. Several residences are located along the south and west borders of the Ballod property. The New York, Susquehanna and Western Railroad property is located along the northern border of the Maywood Storage Site. Route 17 divides the Ballod property and the storage site.

Much of the land within several miles of the Maywood Storage Site is zoned for residential housing (one-family) and limited light industrial use. A few nearby lots are zoned for restricted commercial business. Zoning districts for garden apartments and residential two-family housing are also found within several miles of the site. Similar commercial and residential zoning districts are found in the vicinity of the contaminated residences located on Latham and Davison streets.

3.5 SOCIOECONOMICS

The Maywood Storage Site and the Stepan and Ballod properties were part of a site that was initially developed in the late 19th Century as a chemical plant (Mueller and Gunn 1981). The Latham Street residences were all built in the mid-1920s, and the Davison Street homes were built in the 1950s and 1960s (Oak Ridge Natl. Lab. 1981a-g).

The contaminated sites are interconnected by a number of primary and secondary highways and are accessible to railroad and interstate transportation systems. New Jersey Route 17 divides the Ballod property from the Maywood Storage Site; the New York, Susquehanna and Western Railroad borders the north side of the site, and a railroad spur crosses the corner of the Ballod property and continues across the storage site into the Stepan plant. Reconstruction work on Route 17, including the railroad overpass, is scheduled for the spring of 1984 (Campbell 1984). Although the noise level within the residential areas tends to be low, highway and rail traffic cause higher noise levels.

The 1980 housing characteristics in the communities of Maywood and Rochelle Park were similar. Median home values were $67,200 for Maywood and $68,900 for Rochelle Park (U.S. Bur. Census 1982a). Vacancy rates for home owner and rental properties were very low compared to the patterns in many other New Jersey communities (Table 3.1).

Table 3.1. Housing Characteristics of Selected Areas in New Jersey†[1]

Select Locations	Vacancy Rate	
	Home Owner	Rental
Trenton SMSA	1.4	6.1
Newark City	1.6	6.5
Atlantic City	9.3	9.1
Maywood	0.3	1.0
Rochelle Park	0.1	0.7

†[1] Data from U.S. Bureau of the Census (1982a).

There are no churches, schools, hospitals, municipal buildings, or other institutional facilities immediately adjacent to the contaminated properties. However, these types of facilities are found within 1.6 km (1 mi) of the contaminated areas (U.S. Nucl. Reg. Comm. 1981) and along the routes that might be used for transport of contaminated materials to the Maywood Storage Site from vicinity properties (see Section 4.1.1).

The 1980 populations for Maywood and Rochelle Park were about 9,900 and 5,600 respectively, a decline from the 1970 populations of 11,000 and 6,400. Within Bergen County, the 1970 and 1980 populations were about 898,000 and 845,000 (U.S. Bur. Census 1973, 1982b). The population in this county is expected to increase over the next 20 years (Ryle 1980).

The socioeconomic makeup of Maywood and Rochelle Park is similar (U.S. Bur. Census 1982b). Both communities are comprised predominately of white, married-couple families who were born in New Jersey. In these communities, the median family income in 1979 was about $23,000 to $24,000. The main occupations in Maywood for employed persons 16 years and over include managerial and professional specialty occupations and technical, sales, and administrative support occupations, followed by service occupations. The occupational pattern in Rochelle Park is slightly different. The main occupations are technical sales and administrative support occupations, followed by managerial and specialty occupations and a variety of production-related occupations. Commuting by private vehicle appears to be the preferred mode of transportation to work in both communities, and the mean community travel times range from 19.7 to 21.4 minutes.

There is strong community concern that cleanup of the vicinity properties, particularly the residential properties, should proceed as quickly as possible (Feinstein 1982a, 1982b; Lang 1983; Stepan Chem. Co. 1983). Local residents and owners of contaminated residential properties have expressed concern about potential adverse health effects associated with radiation exposures (Mitchell 1984) and about reduced property values and difficulties in financing and selling properties (Anon. 1982). Officials from both Maywood and Rochelle Park have expressed three major concerns: (1) whether contaminated materials originating from only the Stepan site will be relocated on the Maywood Storage Site, (2) whether the site will become a "permanent" or "long-term" storage site, and (3) whether the consolidation of contaminated materials into one large pile will cause increased harmful effects from radiation (Curtis 1984; Rupp 1984).

4. PROPOSED REMEDIAL ACTIONS AND ALTERNATIVES

4.1 PROPOSED 1984 ACTIONS

4.1.1 Property Cleanup

The proposed actions for 1984 involve cleanup of three groups of properties: the Davison Street/Latham Street properties, the Grove Street/Park Way properties, and portions of the Ballod property. All contaminated materials will be removed from the two residential areas and placed in a temporary storage pile on the Maywood Storage Site.* The material from the Ballod property will be excavated beginning at the boundary with the Grove Street properties and working back north. The estimated volumes of material to be removed in 1984 are given in Table 2.2.

Except for the property at 464 Davison, removal of contaminated soil from the yards of the Davison Street/Latham Street properties (Figure 2.4) will be accomplished using a backhoe. A 0.5-yd^3 backhoe can load 150 m^3 (200 yd^3) of material onto trucks in one day (Means Co. 1981). Assuming that the close quarters of these residential lots will make excavation and loading slightly more difficult, it is estimated that most of the contaminated soil can be removed in about nine working days. Removal of the contaminated soils underneath the basement of the residence at 464 Davison will take longer (about three weeks). The slab will be removed and the basement will be excavated with shovels in 1.2-m (4-ft) sections as deeply as necessary. Each section will be backfilled when completed, and a new basement floor will be poured when all sections have been excavated/backfilled.

There are no weight restrictions on the public roads, but the trucks will be limited to a size of 10 yd^3. Using 10-yd^3 capacity trucks, approximately 15 truckloads per day will be required to move the contaminated soils about 2.4 to 3.8 km (1.5 to 2 mi) from the Davison Street/Latham Street properties to the interim-storage pile on the Maywood Storage Site. The contaminated materials in the trucks will be covered with tarps.

Two options are being considered for routing of the trucks. In Option 1, the trucks will travel east to Maywood Avenue, south to Central Avenue, west under Route 17 (Figure 4.1), south on a new gravel access road to the railroad, east on the south side of the railroad back under Route 17, and then south onto the storage site (Figures 4.1 and 4.2). In Option 2, the trucks will continue south on Maywood Avenue to either (a) the entrance to the Sears property (Figure 4.3) and then across the Sears property to a new access road to be constructed from the south end of the Maywood Storage Site (Figure 4.4),

*Negotiations for transfer of the proposed storage site from Stepan, Inc., to DOE are nearing completion. The proposed actions are planned to commence after transfer of ownership has been completed.

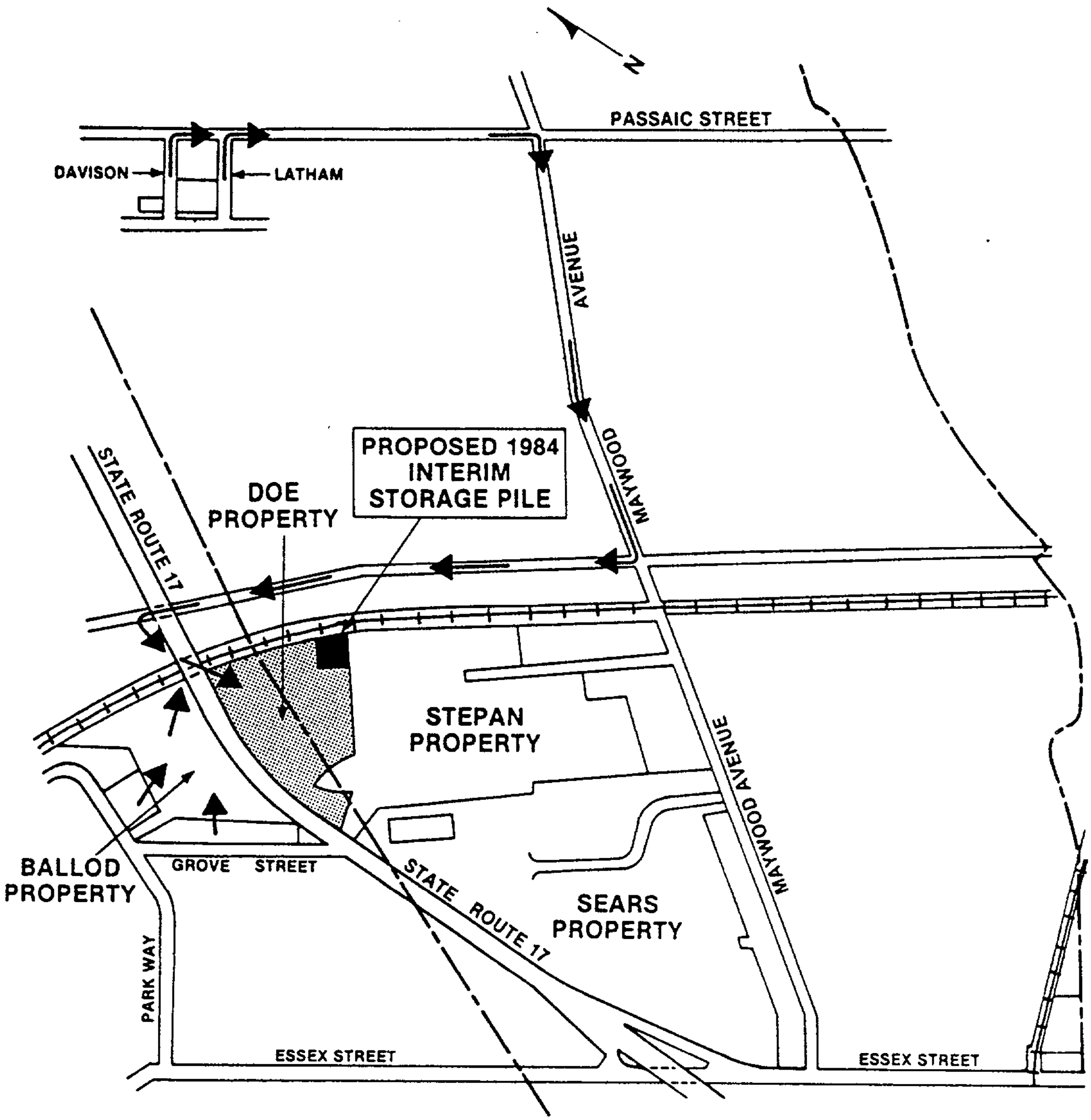

Figure 4.1. Option 1: Proposed Routing for Trucks Transporting Contaminated Soils. Adapted from preliminary drawing by Bechtel National, Inc.

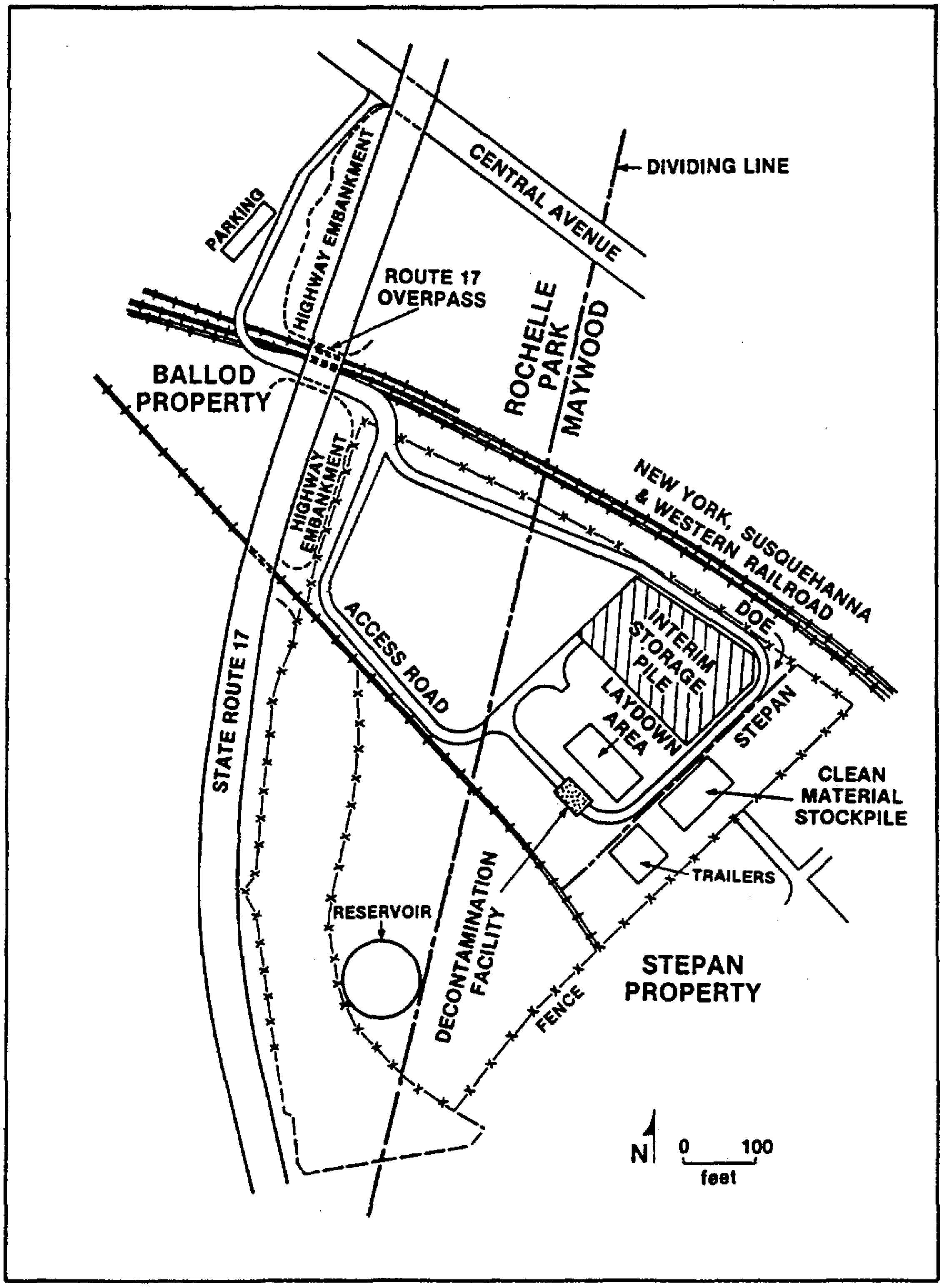

Figure 4.2. Option 1: Proposed 1984 Storage Pile, Access Road, and Support Facilities. Adapted from preliminary drawing by Bechtel National, Inc.

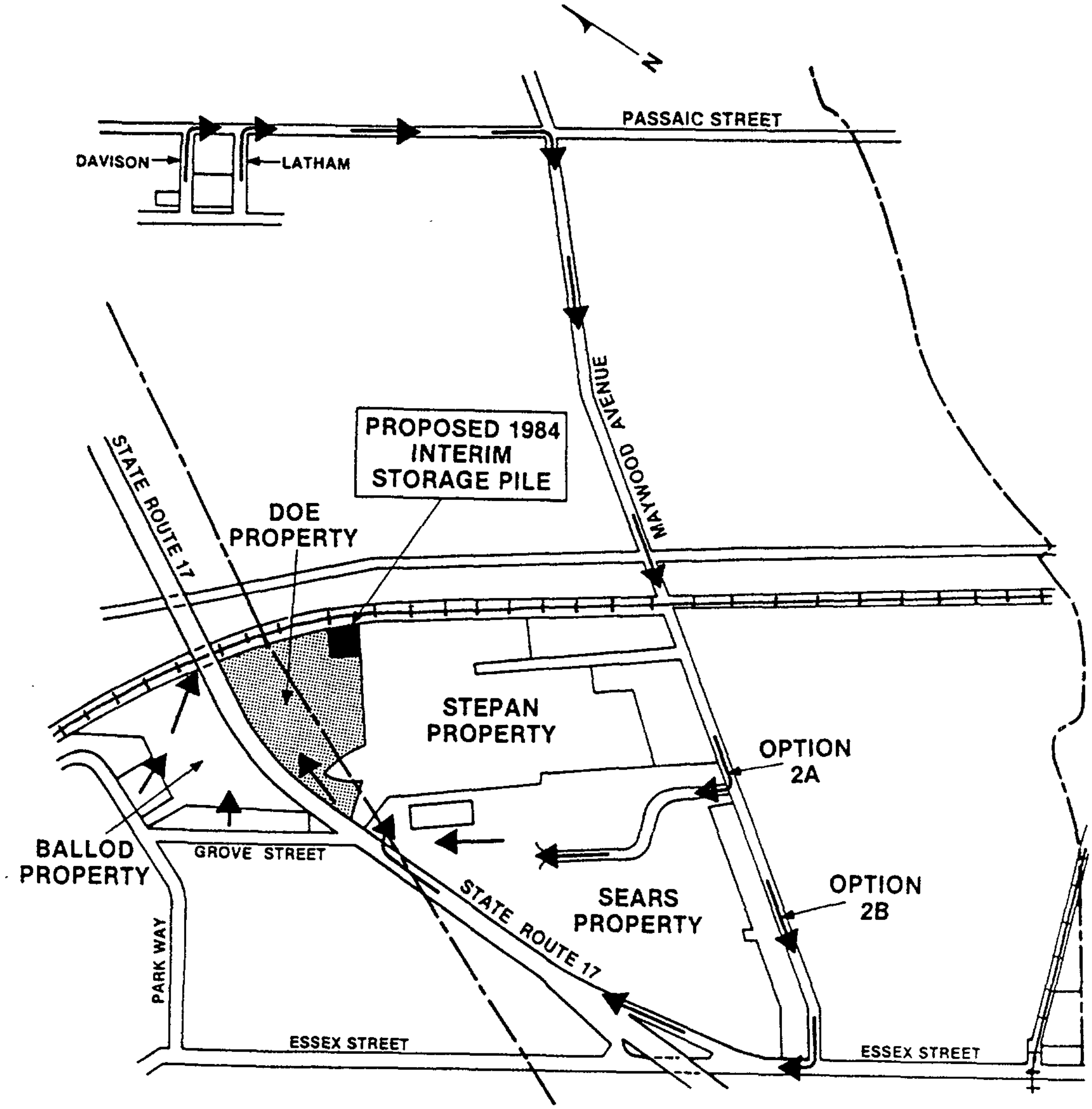

Figure 4.3. Option 2: Proposed Routing for Trucks Transporting Contaminated Soils. Adapted from preliminary drawing by Bechtel National, Inc.

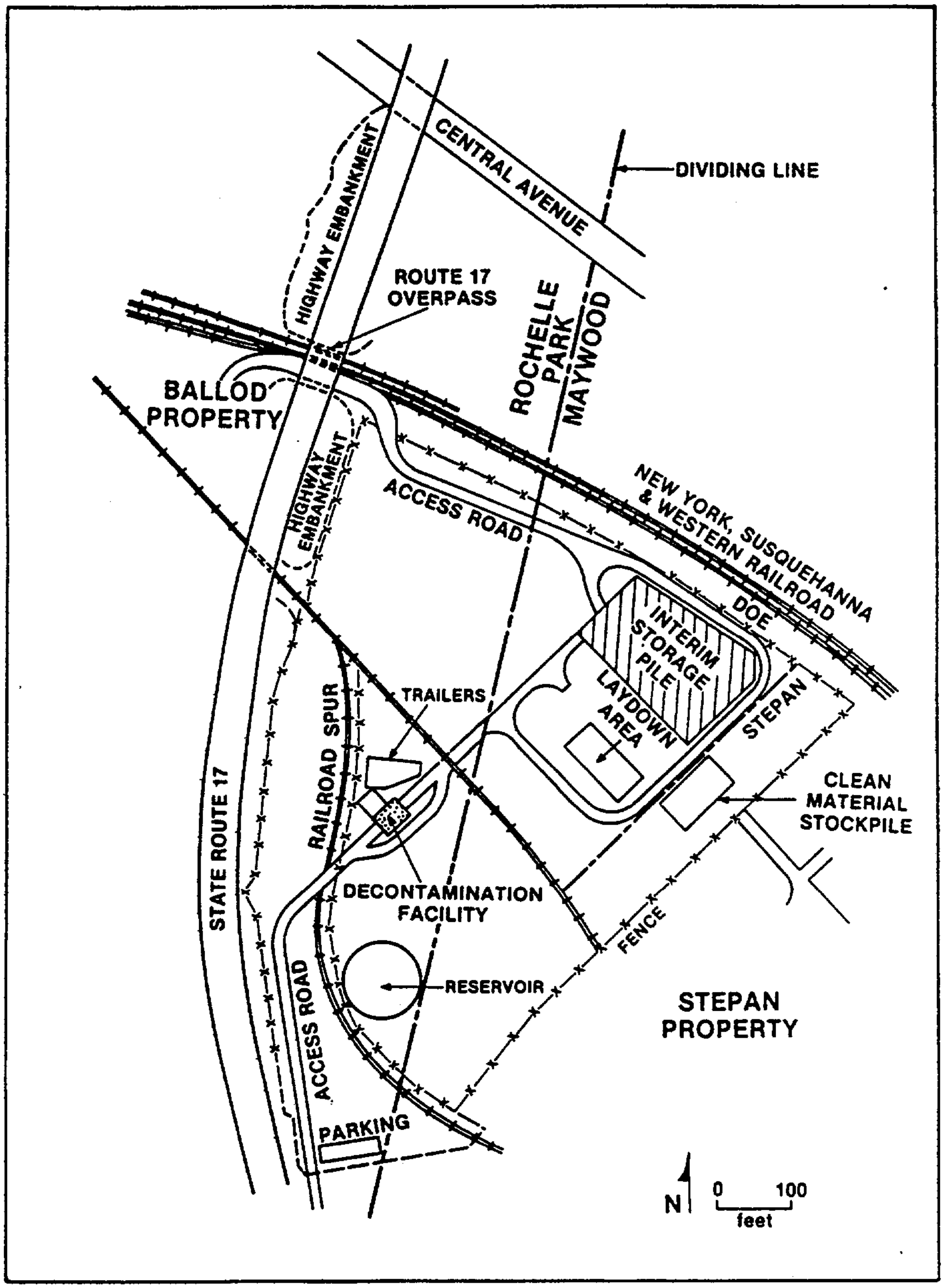

Figure 4.4. Option 2: Proposed 1984 Storage Pile, Access Road, and Support Facilities. Adapted from preliminary drawing by Bechtel National, Inc.

or (b) Essex Street, west to Route 17, north on Route 17 to an existing entrance to the Sears property, and then onto a new access road on the storage site (Figures 4.3 and 4.4). Negotiations are under way to determine which of these options can be implemented.

Removal of the small amount of contaminated soils on the Grove Street/Park Way properties and the Ballod property will be accomplished with standard earth-moving equipment and procedures because no buildings are involved. Public streets will not be traversed (Figure 4.1 and 4.3).

It is expected that the backfill requirements will be about equal to the amount excavated. After backfilling is complete, the area will be landscaped and reseeded. It is estimated that the total time from site preparation to backfill and landscaping at the Davison Street/Latham Street properties will be about two months and the total time at the Grove Street/Park Way properties will be about one month. The properties will be restored to an equal or better condition than existed before the remedial actions.

4.1.2 Interim Storage

For the proposed 1984 actions, a small storage pile containing 10,000 m^3 (13,000 yd^3)* of contaminated soils will be constructed on the northeast corner of the DOE Maywood Storage Site (Figure 4.2). The contaminated soils will be placed directly on the ground to form a pile covering 3,300 m^2 (35,000 ft^2) with a height of 4.6 m (15 ft).** The pile will have 2:1 side slopes and will be compacted by a bulldozer. Part of the area to be covered by the pile is already contaminated (Morton 1981). It will take 3-4 months to complete the pile, at which point it will be covered with a synthetic cover (Hypalon).

After depositing each load at the storage pile, the trucks used to haul the excavated material from the Davison Street/Latham Street properties will be surveyed for radioactivity and decontaminated as necessary. A decontamination facility, consisting of a gravel-filled pit with a wooden ramp over the pit, will be constructed on the storage site (Figures 4.2 and 4.4). Steam and high-pressure water will be used to clean the trucks. After collecting in the pit, the water will flow to a standpipe and will be recirculated through a sand filter to remove particulates. It is expected that the sand filters will have to be replaced about every two days; used filters will be disposed on the interim-storage pile. When the water becomes too contaminated and can no longer be recirculated, it will be transferred to a 19-m^3 (5000-gal) stationary bladder tank and will be used for dust control at the storage pile.

A summary of the measures to mitigate and monitor potential impacts that will be a part of the proposed action is given in Table 4.1.

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*As noted previously, the estimated volumes of materials to be excavated in 1984 are being revised as detailed engineering progresses. As of March 11, 1984, the estimated total volume has been reduced fo 9,000 m^3 (12,000 yd^3).

**Although not currently proposed, it is estimated that there will be room for two large storage piles on the Maywood Storage Site, having a total volume of about 84,000 m^3 (110,000 yd^3).

Table 4.1. Summary of Measures to Mitigate and Monitor Potential Adverse Impacts of the Proposed 1984 Actions

- Controls over possible spread of contamination, including: worker and environmental monitoring; decontamination of vehicles; and erosion- and dust-control measures.

- Erosion and dust controls, including: staged, prompt restoration/revegetation of disturbed areas and completion of work before end of growing season; temporary cover over storage pile, as necessary; watering of disturbed areas and unpaved truck routes; covering truckloads of contaminated material with tarps.

- Water quality monitoring, including: installation of monitoring wells around the storage area.

- Air monitoring for radioactive gases and contaminated dust.

- Noise mitigation, including: periodic checks of mufflers, compressors, etc.; work between 8:00 a.m. and 8:00 p.m. to minimize nuisance to nearby residents.

- Use of temporary snow fences around excavation areas; prompt restoration of fences, driveways, landscaping, etc.

- Scheduling of truck movements and provision of traffic directors, as necessary, to minimize traffic congestion.

- Consultation, cooperation, and coordination with local authorities and concerned citizens throughout the entire period of the action, including: regular information/coordination/planning meetings during both the cleanup and storage phases and designation of an onsite public liaison person for the cleanup phase.

- Periodic monitoring and surveillance of the interim-storage pile, with maintenance of the Hypalon cover and a pest (rodent and plant) control program, as necessary, to ensure the integrity of the pile and minimize potential offsite movement of contaminants.

A major advantage of the proposed action is the consolidation of the contaminated material into a single controlled area, thus reducing the potential risks of prolonged exposure of people to radiation as a result of either uncontrolled changes in land use or further dispersion by human activities or natural processes. Another advantage is the alleviation of public concerns about the contaminated properties.

4.2 ALTERNATIVES TO THE PROPOSED ACTIONS

One alternative to the proposed action is to take no action. This would result in continued exposure of people living on the contaminated properties to elevated levels of radioactivity and continued adverse social impacts such as concerns about health effects and property values (Section 3.5).

Another alternative to the proposed actions involves the method used to decontaminate the property at 464 Davison Street where it is necessary to remove and excavate under the basement slab. Because of the close quarters in the building, use of large mechanical equipment will be limited. In addition, it will be necessary to minimize the spread of dust and radioactivity throughout the house. An alternative might be to demolish this building and remove both the contaminated soils and any contaminated rubble to the interim-storage pile. Without the inhibitions imposed by retaining the house, larger equipment could be used and the cleanup completed more expeditiously. After removal of all the contaminated material, clean fill could be placed on the site. The current occupants could either be relocated in an equivalent home in the area or a new home could be built on the site, depending on negotiations with the home owner. Although this alternative may be technically feasible, it may be more costly and there may be legal impediments to its implementation.

Another alternative might be to move the contaminated soils from all properties directly to another site for permanent disposal. This alternative offers the advantage of having to move the contaminated materials only once. However, a permanent disposal site has not yet been identified and Congress has directed DOE to give priority to cleaning up the residential properties and has made funds available for this purpose. Any delay in cleaning up properties until a permanent disposal site is available would result in continued adverse social impacts associated with concerns about health effects and property values.

One additional alternative might be to remove the contaminated soils to permanent disposal on the Maywood Storage Site. Additional site characterization would be required and some additional land might have to be acquired for a buffer zone. Funds are currently not available for consideration of a permanent site. In addition, local authorities have taken the position that they do not want the Maywood Storage Site to be used for permanent disposal of radioactive materials.

5. ENVIRONMENTAL CONSEQUENCES AND MITIGATION

5.1 RADIOLOGICAL

A major potential issue is the radiological impacts associated with the proposed remedial actions. The predominant pathways by which radionuclides could reach nearby workers and members of the general public during the proposed actions are: (1) internal dose from inhalation of radioactive products such as those from decay of thoron gas (radon-220) and radon gas (radon-222)--radionuclides in the decay chains of thorium-232 and uranium-238, which are found at the Maywood site (Figures 5.1 and 5.2), (2) internal dose from inhalation of contaminated dust particles, (3) external dose from submersion in a cloud of contaminated dust, and (4) external dose from radioactive particles deposited on the ground. Based on analysis of similar activities (Argonne Natl. Lab. 1982), it is expected that the internal dose from ingesting contaminated food or water will be relatively insignificant.

The analysis of potential doses to nearby individuals and to the general public within an 80-km (50-mi) radius of Maywood is based on the following:

- Radionuclides in each of the two separate decay chains (Figures 5.1 and 5.2) are assumed to be present in equilibrium with the parents thorium-232 and uranium-238.

- The average concentrations of nuclides in the contaminated materials to be excavated and stored are 100 pCi/g for the thorium-232 decay chain and 23 pCi/g for the uranium-238 decay chain (Table 2.2).

- The duration of the activities involving cleanup and construction of the storage pile will be 4 months.

- There will be both gaseous and particulate releases while the material is being excavated and placed on the storage pile, but only gaseous releases will occur thereafter because the storage pile will be covered and maintained.

- Particulate releases from excavation activities are assumed to be 0.001% of the material to be moved (U.S. Environ. Prot. Agency 1977), and particulate releases from the exposed storage pile during the 4 months of pile construction are assumed to be 0.27 $kg/m^2/mo$ (1.2 tons/acre/mo) (U.S. Environ. Prot. Agency 1977; Argonne Natl. Lab. 1982). Estimated particulate releases are therefore 0.00037 Ci of thorium-232 and 0.000086 Ci of uranium-238.

- Thoron and radon gas releases will include both "puff" releases when the contaminated soils are disturbed during excavation and "steady" releases from the storage pile. Puff releases are assumed to be 20% of the radon and thoron gas inventories (the other 80% remains trapped within the

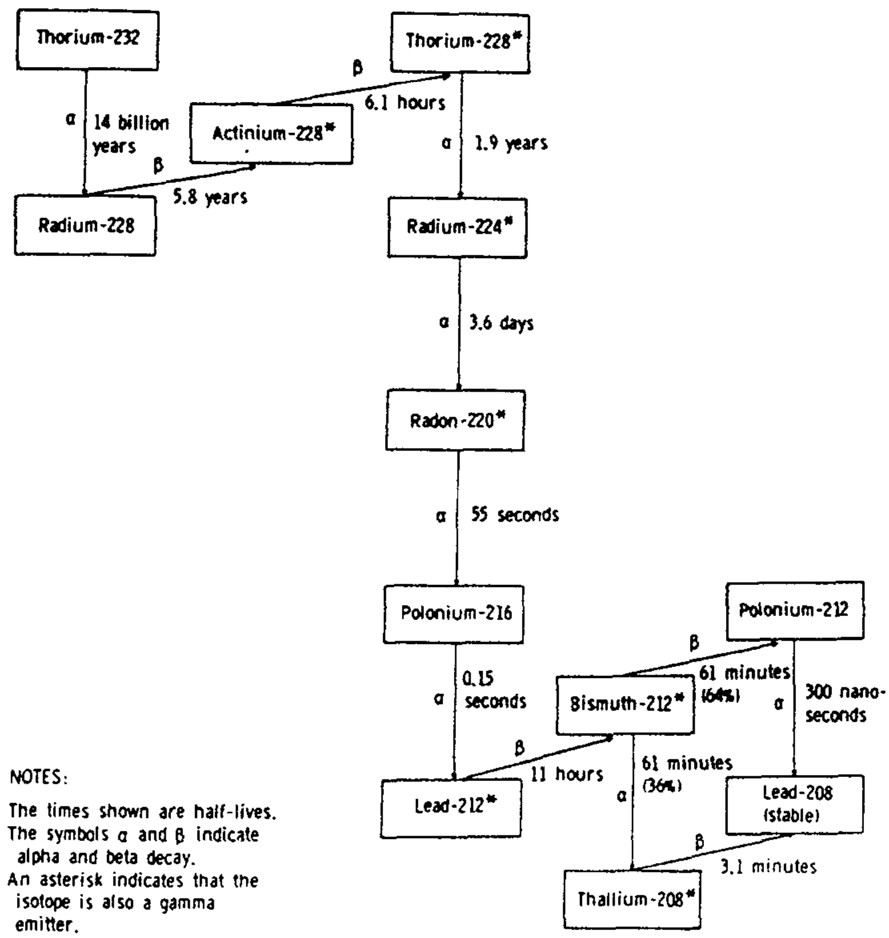
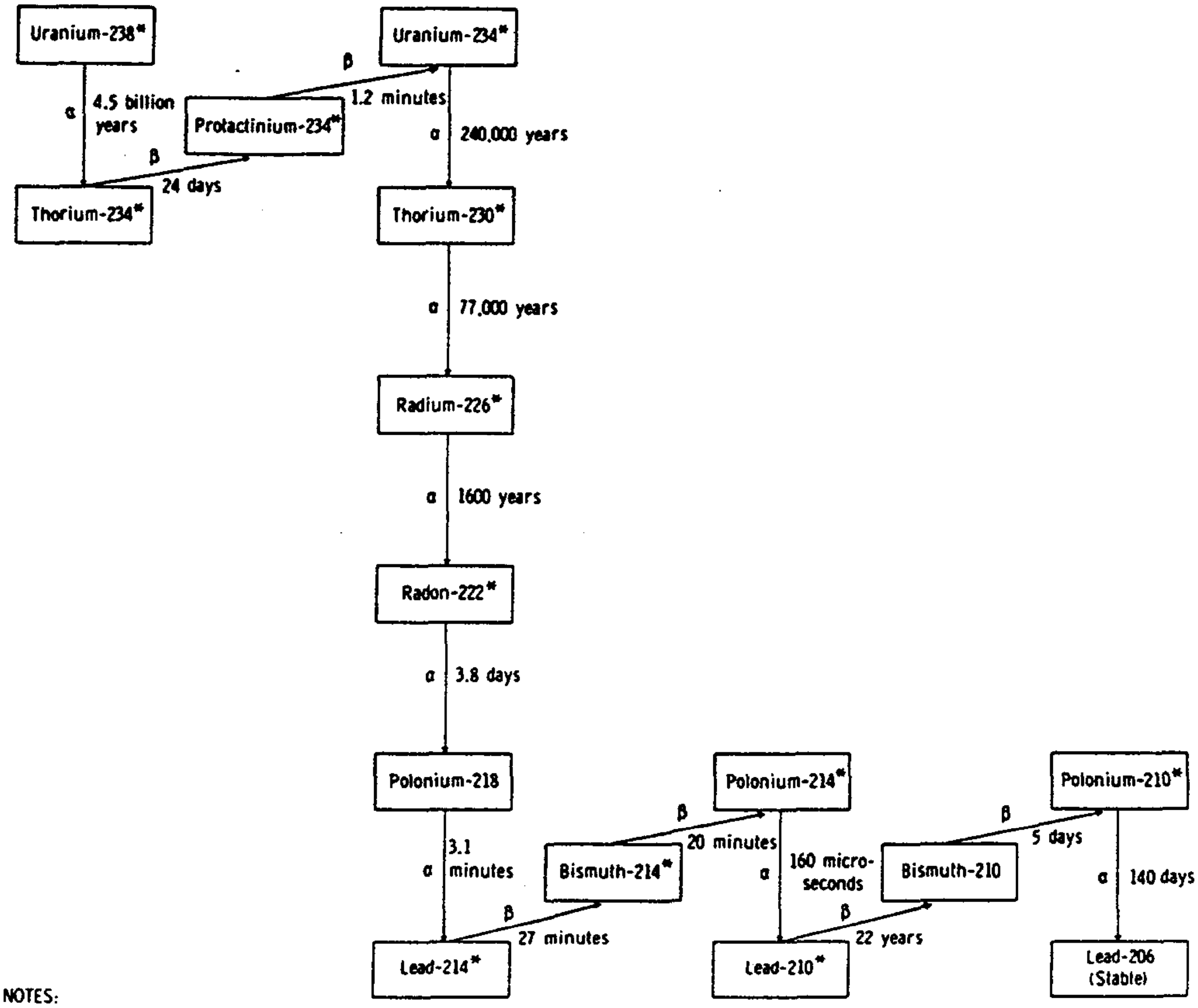


Figure 5.1. Thorium-232 Radioactive Decay Chain.



NOTES:

Only the dominant decay mode is shown.
The times shown are half-lives.
The symbols α and β indicate alpha and beta decay.
An asterisk indicates that the isotope is also a gamma emitter.

Figure 5.2. Uranium-238 Radioactive Decay Chain.

contaminated particles). Steady releases account for most of the releases and are calculated based on the following assumptions: (a) the stored material will be 4.5-m (15-ft) deep, (b) it will cover 3300 m^2 (35,000 ft^2), (c) it will have about a 13% moisture content, and (d) it will have a gaseous diffusion coefficient of 0.0036 cm^2/s. For continued releases during interim storage, no credit is taken for retardation of radioactive gases by the cover. Thoron fluxes are estimated to be 920 $pCi/m^2/s$, and radon fluxes are estimated to be 6.4 $pCi/m^2/s$. These fluxes are calculated according to the method of analysis given in a report of the U.S. Nuclear Regulatory Commission (1983). The thoron fluxes are higher because thoron has a shorter half-life and the activity is consequently higher. It is estimated that 33 Ci of thoron will be released during the actions and 95 Ci/yr thereafter from the storage pile. Radon releases are estimated to be 0.28 Ci during the action and 0.67 Ci/yr thereafter.

- The population distribution for the 15 million people within 80 km (50 mi) of the Maywood Storage Site is estimated based on 1980 county census data.

- Meteorological conditions at Maywood are assumed to be similar to those at Newark, New Jersey, for which meteorological data are available.

- Doses are evaluated in terms of the 100-year environmental dose commitment (EDC). The 100-year EDC is the integrated dose over 100 years resulting from continued exposure to the radionuclides released either during the 4 months of remedial actions or during each subsequent year from the storage pile.

Assuming that the mitigative measures discussed in Table 4.1 are implemented, potential doses to nearby individuals are predicted to be small (Table 5.1). The predicted whole-body doses are similar in magnitude to doses received while spending one hour on a jet plane at high altitudes or spending

Table 5.1. Estimated Radiological Doses to Nearby Individuals As a Result of Releases During the Proposed 1984 Remedial Actions†[1]

Individual/ Location	Distance and Direction from Center of Storage Pile	Dose (mrem) Whole Body	Bone	Average Lung	Bronchial Epithelium
Resident on Central Avenue	0.15 km NE	0.37	9.3	9.0	0.016
Worker at Stepan Company	0.1 km SE	0.33	6.9	8.0	0.0089
Resident on Grove Street	0.3 km W	0.30	7.4	0.89	0.0025

†[1] Bases for radiological analysis are given in the text.

4 months (the time required to complete the remedial actions) at an altitude that is 60 m (200 ft) higher (Table 5.2). Specific organ doses (e.g., bone and lung) are lower than doses received from natural sources (Table 5.2).

The estimated doses to several organs and the whole body for the general public are presented in Table 5.3. The general public is considered to be the population of about 15 million people (1980 census) residing within 80 km (50 mi) of the site. The general public will receive doses resulting from releases during the remedial actions. After the remedial actions have been completed, the population near Maywood will continue to be exposed to radioactive releases from the storage pile (e.g., radon and thoron gas). These doses will all be negligible compared to doses the same population will receive from natural background sources of radiation (Table 5.3).

Doses to workers will be controlled and limited to less than those specified by DOE regulations for occupational doses (e.g., whole-body doses of 3000 mrem/quarter or 5000 mrem/year). Workers will be trained with regard to radiation risks and proper health-physics procedures.

Another radiological issue may be whether the decontamination criteria for the contaminated areas will be considered sufficient (see Appendix A). The criteria to be used are based on recent detailed studies (U.S. Dep. Energy 1983; Gilbert et al. 1983). DOE believes that these criteria are conservatively low for considering potential adverse health effects that might occur in the future from any residual contamination. Release of the cleaned-up areas for unrestricted use is not part of the proposed remedial actions. Such release will be subject to a separate DOE decision in the future.

5.2 PHYSICAL AND BIOLOGICAL

The proposed action will result in some short-term impacts on surface water and groundwater. Disturbed areas will be subject to wind and water erosion, with subsequent increases in turbidity, sedimentation, and dissolved solids of nearby receiving rivers (e.g., Westerley Brook and Saddle River). The greatest potential for such impact will be in August during the thunderstorm season, and the magnitude of this impact will depend primarily on the timing of construction and the amount of material exposed. However, because Westerley Brook and the Saddle River are located in an urbanized area and are thus recipients for a number of point and nonpoint discharges, no noticeable change in the quality or biota of these water bodies is expected. Mitigative measures--such as placement of a temporary cover over the storage pile, minimizing the time that the contaminated areas are exposed, and use of straw bales downslope from the excavation areas and storage pile--should minimize this impact.

Contaminated runoff from the storage pile and continued runoff from the existing contaminated areas on the Maywood Storage Site may be an issue. For the 1984 remedial actions, the existing drainage patterns will not be changed. The addition of access roads and the small storage pile is not expected to markedly affect the overall infiltration and runoff patterns. If large additional amounts of contaminated materials are to be brought to the storage site in future years, a site runoff control system will be provided. Such future actions will be subject to separate environmental analysis at the time a decision is to be made regarding future remedial actions (see Section 1).

Table 5.2. Comparison of Doses to Maximally Exposed Individual to Doses from Natural Background Sources

Dose from Remedial Action (values from Table 5.1)	Comparable Dose
0.37 mrem (whole body)†[1]	Equal to dose from riding about 1 hour in a jet plane at 10,000 m (33,000 ft) because of increase in cosmic radiation with altitude, or Equal to dose from staying for the same amount of time as the remedial action (4 months) at 60-m (200-ft) higher altitude
9.3 mrem (bone)†[1]	40 mrem received from natural radiation sources (background) over the same period of time
9.0 mrem (average lung)†[1]	60 mrem received from natural background radiation over the same period of time
0.016 mrem (bronchial epithelium)†[2]	110 to 200 mrem received from radon from natural background radiation over the same period of time

†[1] Conversion factors are given in reports of Argonne National Laboratory (1982) and National Council on Radiation Protection and Measurements (1975).

†[2] Based on 320 to 600 mrem/yr, assuming an outdoor radon-222 concentration of 0.3 pCi/L (Moses et al. 1963), an indoor concentration of 1 pCi/L (U.N. Sci. Comm. At. Radiat. 1977), and dose conversion factors for radon-222 of 1000 mrem/yr per pCi/L for outdoor background conditions (infinite source) and 625 mrem/yr per pCi/L for indoor conditions (50% equilibrium of radon daughters) (U.S. Nucl. Reg. Comm. 1980).

Contamination of groundwater may also be an issue. Elevated radiation levels have recently been discovered in water from Lodi municipal wells located downgradient from the Maywood Storage Site. It is not known whether the cause of the well contamination is leachate from materials in the Stepan burial grounds or the Maywood Storage site. The consolidation of contaminated materials from the vicinity properties onto the Maywood Storage Site could potentially increase groundwater contamination. However, it is planned that the 1984 storage pile will be very small and will be only temporary until a permanent disposal site can be found. The storage pile will be compacted and covered with a synthetic membrane (Hypalon) that is widely used in the construction industry. Infiltration of precipitation into the pile, and consequent leaching out of the pile, will be minimal if the cover and the pile remain intact.

Table 5.3. Estimated Doses to the General Public As a Result of the Proposed 1984 Remedial Actions

Tissue or Organ	Dose†[1] (person- or organ-rem): From Releases During the 4 Months of Remedial Actions	Dose†[1] (person- or organ-rem): From Natural Background Radiation During the 4 Months of Remedial Actions
Whole body	0.60	500,000
Bone	24	600,000
Average lung	38	900,000
Bronchial epithelium	4.2	530,000-3,000,000
Tissue or Organ	**Dose†[1] (person- or organ-rem/yr): From Continuing Gaseous Releases from the Storage Pile**	**Dose†[1] (person- or organ-rem/yr): From Continuing Natural Background Radiation**
Whole body	0.067	1,500,000
Bone	0.16	1,800,000
Average lung	2.7	2,700,000
Bronchial epithelium	2.7	4,800,000-9,000,000

†[1] Reported as the 100-year environmental dose commitment to the population within 80 km (50 mi) of the Maywood Storage Site.

Another issue may be the durability of the interim-storage pile. Frost penetrates to a depth of about 38 to 50 cm (15 to 20 in.) in the Maywood area. Frost heave could cause the Hypalon cover to rupture--resulting in infiltration of snowmelt and rainwater, saturation of the pile, and leaching to groundwater. This may be exacerbated by the relatively steep side slopes (2:1) that may lead to slumping of the stored material. However, measures will be taken to minimize this potential impact, including: use of a cover material that has a 20-year guaranteed life, compaction of the stored materials, periodic surveillance to check on the integrity of the pile and its cover, repairs (as necessary), and routine monitoring of groundwater in new wells to be drilled around the storage area.

Water from the Stepan plant will be used for equipment decontamination. A steam/high-pressure water system will be used to minimize water use, and water will be recirculated through filters as much as possible. The amount of water to be used is small relative to the available resources and local demands in Maywood. Contaminated water will be stored in a bladder tank and used for dust control on the storage pile.

Construction of the access roads will require consumption of timber, sand, and gravel resources. These resources are generally available locally, and supplies will not be unduly strained by the demands of the proposed project.

Implementation of the proposed action will have only a minimal effect on the terrestrial biota in the project area. Mammals and birds currently inhabiting the properties will be dispossessed (larger and/or mobile species) or destroyed (smaller, less mobile species). The vegetation on the sites will be destroyed temporarily on the Ballod property and for the period of interim storage on the Maywood Storage Site. The adverse effects of dust, noise, and traffic during the period of excavation and storage will be minimal due to (1) the paucity of wildlife, (2) the fact that the sites are located in an urban area where such impacts currently exist, and (3) implementation of mitigative measures (i.e., dust suppression). Vegetation destroyed on the residential properties due to excavation will be replaced through landscaping agreements. No impacts to endangered or threatened biota are anticipated from the proposed actions because their habitats do not correspond to those found on the affected sites.

Animals and plants could adversely affect the durability of the interim-storage pile. Burrowing animals that are on the site, such as the woodchucks (Section 3.3), may invade the pile--resulting in excavation of the contaminated soils, increased water infiltration, and decreased stability of the pile (Arthur and Markham 1983). Plant roots may also intrude into the storage pile (Cline and Uresk 1979; Yamamoto 1982)--especially species that produce suckers, such as the tree-of-heaven (Section 3.3). However, during the interim-storage period, the cover will be maintained and a pest-control program will be implemented, if necessary (Table 4.1).

5.3 SOCIOECONOMIC

The following assessment is based on the census information presented in Section 3.5 and a review of available secondary information about the local communities and the project plan presented in the report of Bechtel National (1983). Additional information was obtained during a visit to the area and meetings with local officials on February 22-23, 1984.

At the county and community levels, the settlement pattern should not be permanently impacted by the proposed action. Following cleanup of contaminated soils, current residential and industrial land uses could continue (subject to local zoning ordinances). Cleanup may affect the future use of the currently contaminated properties. For example, the Ballod property is the only undeveloped property in Rochelle Park and has been considered for residential and commercial development in recent years (Dertsh 1984). Excavations or building on the site will not be appropriate until the thorium contamination has been cleaned up, the residual contamination characterized, and a decision made regarding release of the site for unrestricted use. Use of the Maywood Storage Site will be restricted for as long as contaminated materials are stored there.

Cleanup activities involving movement and storage of the contaminated material could cause some localized impacts. Depending on which main access option is negotiated (Section 4.1.1), increased truck and commuter traffic will occur on the following streets: Davison Street, Latham Street, Grove

Street, Park Way, Passaic Street, Central Avenue, Maywood Avenue, Essex Street, and N.J. Route 17 (Figures 4.1 and 4.3). Also, if construction work on Route 17 is not completed by the time remedial actions commence, traffic conjestion could increase. Truck movements will be scheduled and traffic directors will be provided, as necessary, to minimize traffic congestion. Trucks hauling contaminated materials from the Grove Street/Park Way properties and the Ballod property will not traverse public streets (Figures 4.1 and 4.3).

Excavation and construction activities, as well as increased traffic, are expected to increase local noise levels, and some residents in the immediate vicinity of the proposed actions may be annoyed. In order to minimize this nuisance, there will be periodic checks of mufflers, compressors, etc., and work will be carried out only between 8:00 a.m. and 8:00 p.m.

Activities on and near the New York, Susquehanna and Western Railroad could disrupt train service. Earth-moving activities, truck traffic, and surveying will be coordinated with train schedules in order to minimize conflicts.

Demographic changes from the influx of workers or outmigration of local residents is expected to be insignificant. Local subcontractors will be hired, and the personnel associated with the small, short-term work force are expected to follow the commuting trends that are well established for this area (see Section 3.5). Impacts, such as demands on local goods and services or effects on the local economy, are expected to be minimal for a project of this size (Argonne Natl. Lab. 1982).

A positive socioeconomic impact that is expected to occur is the alleviation of problems that have occurred since the contamination was discovered a few years ago (e.g., concerns about health effects, negative publicity about the area, and difficulties with property sales--see Section 3.5). After cleanup of the residential properties, concerns of the owners and their neighbors should be reduced. However, some degree of public concern may continue until decisions are made regarding: (1) permanent disposition of the contaminated materials to be stored on the Maywood Storage Site, and (2) release of the decontaminated sites for unrestricted use.

Some short-term socioeconomic impacts may occur for those residents who are experiencing cleanup activities in their yards and, in one case, under their house. Yards, fences, and the basement floor of the house at 464 Davison Street are expected to be temporarily disturbed by excavation and restoration activities. While these actions are taking place, the lifestyle of the residents will be temporarily interrupted. The property access agreements will contain provisions for the residents to vacate the property, if they so desire, during the remedial actions. Security will be provided for all properties during the proposed actions. Properties will be restored to an equal or better condition than before the remedial actions.

SECTION 6. REFERENCES

Anonymous. 1981. Thorium Contamination in Maywood, New Jersey. Stepan Chemical Company Vicinity Summary of Survey Data, May 4-5, 1981.

Anonymous. 1982. It just shouldn't happen. The Record. Wednesday, December 8, 1982.

Argonne National Laboratory. 1982. Methods for Assessing Environmental Impacts of a Property-Cleanup/Interim-Storage Remedial Action. ANL/EIS-16. Prepared for Formerly Utilized Sites Remedial Action Program, U.S. Department of Energy, by Division of Environmental Impact Studies, Argonne National Laboratory.

Arthur, W.J., III, and O.D. Markham. 1983. Small mammal soil burrowing at a radionuclide transport vector at a radioactive waste disposal area in southeastern Idaho. J. Environ. Qual. 12(1):117-122.

Bailey, R.G. 1978. Descriptions of the Ecoregions of the United States. U.S. Forest Service, Intermountain Region, Ogden UT. 77 pp.

Bechtel National, Inc. 1983. Survey Plan for the Radiological Characterization of the Vicinity Properties of the Stepan Chemical Plant, Maywood, New Jersey. Bechtel Job 14501. November 1983.

Bechtel National, Inc. 1984a. Radiological Survey of the Grove Street and Park Way Properties, Rochelle Park, New Jersey (in preparation).

Bechtel National, Inc. 1984b. Radiological Survey of the New York, Susquehanna and Western Railroad Property in Rochelle Park and Maywood, New Jersey (in preparation).

Beck, J. 1984. Personal communication (Bechtel National, Inc.) to P. Merry-Libby (Argonne National Laboratory). January 25, 1984.

Campbell, L. 1984. Technical Services Division, Weekly Status Report to AMC&E, January 5, 1984. U.S. Department of Energy, Oak Ridge Operations.

Cline, J.F., and D.W. Uresk. 1979. Revegetation of disturbed grounds in the semi-arid climate of southcentral Washington. Health Phys. 36:289-294.

Cole, L.W. 1981. Radiological Assessment of Ballod and Associates Property (Stepan Chemical Company), Maywood, New Jersey. Final Report. Prepared for U.S. Nuclear Regulatory Commission by Oak Ridge Associated Universities. July 30, 1981.

Curtis, S.A. 1984. Trip Report: Site Visit to Maywood (Stepan) Site and Local Area in Bergan County, New Jersey. Intra-Laboratory Memorandum (Argonne National Laboratory) to P. Merry-Libby, March 2, 1984.

Dertsh, E. 1984. Personal communication (Mayor of Rochelle Park) to P. Merry-Libby (Argonne National Laboratory). February 22, 1984.

Fairbrothers, D., and M. Hough. 1973. Rare or Endangered Vascular Plants of New Jersey. [As cited by Ford, Bacon & Davis Utah Inc. (1979).]

Feinstein, L. 1982a. Council hit for thorium cleanup delay. The Record. Wednesday, October 20, 1982.

Feinstein, L. 1982b. Cleanup of radioactivity could be a long way off. The Record. Friday, October 22, 1982.

Ford, Bacon & Davis Utah Inc. 1979. Environmental Analysis of the Middlesex Municipal Landfill Site, Middlesex, New Jersey. FBDU 230-008. Prepared for U.S. Department of Energy, Division of Environmental Control Technology. July, 1979.

Gale Research Company. 1980. Climates of the States. National Oceanic and Atmospheric Administration Narrative Summaries, Tables, and Maps for Each State With Overview of State Climatologist Programs. 2nd ed. Volume 1, Alabama - North Dakota. Detroit, MI.

Galvin, M. 1979. Management of Transmission Line Rights-of-Way for Fish and Wildlife. Volume 2, Eastern United States. FWS/OBS-79/22. U.S. Fish and Wildlife Service.

Gilbert, T.L., P.C. Chee, M.J. Knight, J.M. Peterson, C.J. Roberts, J.E. Robinson, S.Y.H. Tsai, and Y.C. Yuan. 1983. Pathways Analysis and Radiation Dose Estimates for Radioactive Residues at Formerly Utilized MED/AEC Sites. ORO-832 (Rev.). Prepared for the Formerly Utilized Sites Remedial Action Program, U.S. Department of Energy, Oak Ridge, TN, by the Division of Environmental Impact Studies, Argonne National Laboratory, Argonne, IL. March 1983 (Reprinted with corrections: January 1984).

Hanabergh, E.W. 1984. Personal communication (Supervisor, Municipal Public Works, Borough of Maywood, New Jersey) to J. Yang (Argonne National Laboratory), February 23, 1984.

Jacobson, R. 1982. Letter (Attorney for Stepan Chemical Company) to R. Page (U.S. Nuclear Regulatory Commission), dated April 7, 1982.

Lang, K. 1983. Congressman Toricelli tours area thorium sites. The Shopper. January 19, 1983.

Means (Robert Snow) Company, Inc. 1981. Building Construction Cost Data, 40th annual edition.

Mitchell, K.R. 1984. Testimony to the Subcommittee on National Resources, Agriculture Research and Environment, Karin R. Mitchell, 477 Latham St., Maywood, NJ.

Morton, H.W. 1981. Radiation Survey of the Stepan Chemical Company, Radioactive Material on Ballod Associates Property. Results of a Survey Conducted by Nuclear Safety Associates Inc. in 1980, 1981.

Moses, H., et al. 1963. The effect of meteorological variables upon radon concentrations three feet above the ground. J. Air Pollut. Control Assoc. 13(1):12.

Mueller, J.R., and S.A. Gunn. 1981. An Aerial Radiologic Survey of the Stepan Chemical Company and Surrounding Area, Maywood, New Jersey. EG&G Survey Report, NRC-8109. Performed by EG&G Energy Measurements Group for the U.S. Nuclear Regulatory Commission. April 1981.

National Council on Radiation Protection and Measurements. 1975. Review of the Current State of Radiation Protection Philosophy. NCRP Report No. 43. Washington, DC.

New Jersey Department of Environmental Protection. 1975. Endangered, Threatened, Peripheral and Undetermined Wildlife Species in New Jersey. Official List. Division of Fish, Game and Shell Fisheries, Endangered and Non-Game Species Project, April 10, 1975. [As cited by Ford, Bacon & Davis Utah Inc. (1979).]

NUS Corporation. 1983. Radiological Study of Maywood Chemical, Maywood, New Jersey. Prepared for the U.S. Environmental Protection Agency by the NUS Corporation.

Oak Ridge National Laboratory. 1981a. Results of the Radiological Survey at 459 Davison Avenue, Maywood, New Jersey. Health and Safety Research Division, Oak Ridge, TN. September 1981.

Oak Ridge National Laboratory. 1981b. Results of the Radiological Survey at 460 Davison Avenue, Maywood, New Jersey. Health and Safety Research Division, Oak Ridge, TN. September 1981.

Oak Ridge National Laboratory. 1981c. Results of the Radiological Survey at 464 Davison Avenue, Maywood, New Jersey. Health and Safety Research Division, Oak Ridge, TN. September 1981.

Oak Ridge National Laboratory. 1981d. Results of the Radiological Survey at 468 Davison Avenue, Maywood, New Jersey. Health and Safety Research Division, Oak Ridge, TN. September 1981.

Oak Ridge National Laboratory. 1981e. Results of the Radiological Survey at 459 Latham Street, Maywood, New Jersey. Health and Safety Research Division, Oak Ridge, TN. September 1981.

Oak Ridge National Laboratory. 1981f. Results of the Radiological Survey at 461 Latham Street, Maywood, New Jersey. Health and Safety Research Division, Oak Ridge, TN. September 1981.

Oak Ridge National Laboratory. 1981g. Results of the Radiological Survey at 467 Latham Street, Maywood, New Jersey. Health and Safety Research Division, Oak Ridge, TN. September 1981.

Robertson, R. 1984. Personal communication (Bechtel National, Inc.) to S. Vogler (Argonne National Laboratory), February 14, 1984.

Rupp, W.F. 1984. Agreement with Stepan Chemical Company, Maywood, New Jersey. Letter to Steven Miller, Esq. (U.S. Department of Energy, Office of General Council) from Rupp & Ten Hoeve, Attorneys at Law, Hackensack, NJ.

Ryle, P.M. 1980. An Economic Profile of Bergen County, New Jersey. N.J. Department of Labor and Industry, Office of Economic Research. March 1980.

Schopmeyer, C.S. 1974. Seeds of Woody Plants in the United States. Agriculture Handbook No. 450. U.S. Forest Service, Washington, DC. 883 pp.

Spayd, S.E. 1984. Personal communication (New Jersey Department of Environmental Protection) to J. Yang (Argonne National Laboratory), February 24, 1984.

Stearns, F., and J.E. Ross. 1978. The pressure of urbanization and technology, pp. 199-217. In H.P. Brokaw (ed.), Wildlife in America. Council of Environmental Quality, Washington, DC.

Stepan Chemical Company. 1983. Radiation Briefing Paper, Stepan Chemical Co., Maywood, NJ, 1/10/83. In Scope of Work, Maywood Chemical, Maywood, New Jersey.

United Nations Scientific Committee on the Effects of Atomic Radiation. 1977. Sources and Effects of Ionizing Radiation. Report to the General Assembly, United Nations, New York. p. 76.

U.S. Bureau of the Census. 1973. 1973 Census of Population. Characteristics of the Population. New Jersey Section 1. Vol. 1, Part 32. March 1973.

U.S. Bureau of the Census. 1982a. Characteristics of Housing Units. General Housing Characteristics, New Jersey. HC80-1-A32 N.J. 1980 Census of Housing.

U.S. Bureau of the Census. 1982b. Characteristics of the Population. General Social and Economic Characteristics, New Jersey. PC80-1-C32 N.J. 1980 Census of Population.

U.S. Congress. 1983. FY 1984 Energy and Water Appropriations Act. Congressional Record--House. June 28, 1983.

U.S. Department of Energy. 1983. Radiological Guidelines for Application to DOE's Formerly Utilized Sites Remedial Action Program. ORO-831 (Rev.). Oak Ridge Operations, Oak Ridge, TN. March 1983 (Reprinted with corrections: January 1984).

U.S. Environmental Protection Agency. 1977. Technical Guidance for Control of Industrial Process Fugitive Particulate Emissions. PB-272-288. Office of Air Quality Planning and Standards, Research Triangle Park, NC. March 1977.

U.S. Geological Survey. 1983. Water Resources Data for New Jersey, Water Year 1982, Volume 1. Atlantic Slope Basins, Hudson River to Cape May. Report No. USGS-WDR-NJ-82-1. June 1983.

U.S. Nuclear Regulatory Commission. 1980. Final Generic Environmental Impact Statement on Uranium Milling. NUREG-0706. September 1980.

U.S. Nuclear Regulatory Commission. 1981. Maywood, New Jersey Surveys Uncontrolled Locations in Radioactive Material. Report No. 99990001/81-05. Office of Inspection and Enforcement, Region I.

U.S. Nuclear Regulatory Commission. 1983. Final Environmental Statement Related to the Decommissioning of the Rare Earths Facility, West Chicago, Illinois, Docket No. 40-2061. NUREG-0904. Office of Nuclear Material Safety and Safeguards. May 1983.

Vinikour, W. 1984. New Jersey Site Visit Comments. Intra-Laboratory Memorandum (Argonne National Laboratory) to P. Merry-Libby, February 27, 1984.

Yamamoto, T. 1982. A Review of Uranium Spoil and Mill Tailings Revegetation in the Western United States. U.S. For. Serv. Gen. Tech. Rep. RM-92. 20 pp.

APPENDIX A. U.S. DEPARTMENT OF ENERGY INTERIM RESIDUAL CONTAMINATION AND WASTE-CONTROL GUIDELINES FOR FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM (FUSRAP) AND REMOTE SURPLUS FACILITIES MANAGEMENT PROGRAM (SFMP) SITES

(April 1984)

Presented here are the residual contamination cleanup and waste-control guidelines of general applicability to the FUSRAP project and remote SFMP sites.* A site-specific analysis will be prepared for each FUSRAP and remote SFMP site prior to determining residual contamination guidelines for a specific site. In addition, it is policy of the DOE to decontaminate sites in a manner consistent with DOE's as-low-as-reasonably-achievable (ALARA) policy. ALARA will be considered in reducing levels of residual contamination below applicable dose limits. ALARA will be implemented using cost/benefit considerations, and applied on a site-specific basis.

The soil residual contamination guidelines were developed on the basis of limiting maximum individual radiation exposure to DOE limits specified in DOE Order 5480.1A, exclusive of exposure from natural background radiation or medical procedures. The radium-226 and thorium-230 guidelines include an additional limitation for builup of radon-222 decay products in buildings. The aggregate of the contribution from all major pathways was assumed, based on scenarios for permanent intrusion--e.g., establishing residences on the site. In most circumstances, the probability is low that such an intrusion will occur. Also, conservative assumptions were used in deriving these criteria to ensure that a particular dose limit would not be exceeded. Use of these guidelines is additionally conservative because the pathways considered in the derivation of the guidelines assume all water intake and most food intake is from the site. Also, the FUSRAP and remote SFMP sites often have limited agricultural capability and the contamination is generally not homogeneous. The combined effect of these factors is such that the probable radiation exposure to the average population on, or in the vicinity of, FUSRAP or remote SFMP sites decontaminated to these guidelines will not be appreciably different from that normally received from natural background radiation.

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*A remote SFMP site is one that is excess to DOE programmatic needs and is located outside a major operating DOE Research and Development (R&D) or production area. Remote sites are more likely to be released to the public or excessed to other government agencies after decontamination than are sites located with major R&D or production areas.

The residual contamination guidelines for surface contamination of structures were adapted from guidelines developed by the U.S. Nuclear Regulatory Commission (1982) for decontamination of facilities and equipment prior to release for unrestricted use or termination of licenses for byproduct, source, or special nuclear material. The waste-control guidelines are consistent with DOE Orders and EPA regulations for inactive uranium milling sites, 40 CFR Part 192.

A. RESIDUAL CONTAMINATION GUIDELINES FOR FORMERLY UTILIZED SITES AND REMOTE SURPLUS FACILITIES MANAGEMENT PROGRAM SITES

The following guidelines represent the maximum residual contamination limits for unrestricted use of land and structures contaminated with radionuclides related to the nuclear fuel cycle at FUSRAP and remote SFMP sites. A site-specific analysis will be prepared for each site prior to determining residual contamination guidelines for a specific site. It is the policy of DOE to decontaminate sites to contamination levels at or below the limits and in a manner consistent with DOE's as-low-as-is-reasonably-achievable (ALARA) policy on a site-specific basis. Site-specific guidelines and ALARA policy will be determined by DOE on a site-specific basis and an ALARA report filed on completion of remedial action at a site. Existing state and federal standards will be applied for water protection. Residual contamination limits for other nuclides will be developed when required using the same methodology as was used for those represented here [described in ORO-831 (U.S. Dep. Energy 1983) and ORO-832 (Gilbert et al. 1983)].

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

Radionuclide	Soil Criteria†[1],†[2],†[3] (pCi/g above background)
U-Natural†[4]	75
U-238†[5]	150
U-234†[5]	150
Th-230†[6]	15
Ra-226	5 pCi/g, averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over 15-cm-thick soil layers more than 15 cm below the surface and less than 1.5 m below the surface.
U-235†[5]	140
Pa-231	40
Ac-227	190
Th-232	15

Am-241	60
Pu-241†[7]	2400
Pu-238, -239, -240	300
Cs-137	80
Sr-90	300
H-3 (pCi/mL soil moisture)	5,200

†[1] In the event of occurrence of mixtures of radionuclides, the fraction contributed by each radionuclide to its guideline shall be determined, and the sum of these fractions shall not exceed 1. There are two special cases for which this rule must be modified:

(a) If Ra-226 is present, then the fraction for Ra-226 should not be included in the sum if the Ra-226 concentration is less than or equal to the Th-230 concentration. If the Ra-226 concentration exceeds the Th-230 concentration, then the sum shall be evaluated by replacing the Ra-226 concentration by the difference between the Ra-226 and Th-230 concentrations.

(b) If Ac-227 is present, then the same rule given in (a) for Ra-226 relative to Th-230 applies for Ac-227 relative to Pa-231.

†[2] Except for Ra-226, 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. The same conditions prevail for Ra-226 except for soil layers beneath 1.5 m; beneath 1.5 m, the allowable Ra-226 concentration may be affected by site-specific conditions and must be evaluated accordingly.

†[3] Localized concentrations in excess of these guidelines are allowable provided that the average over 100 m^2 is not exceeded. However, DOE ALARA policy will be considered on a site-specific basis when dealing with elevated localized concentrations.

†[4] One curie of natural uranium means the sum of 3.7×10^{10} disintegrations per second (dis/s) over any 15-cm-thick layers from U-238 plus 3.7×10^{10} dis/s from U-234 plus 1.7×10^{9} dis/s from U-235. One curie of natural uranium is equivalent to 3,000 kilograms or 6,600 pounds of natural uranium.

†[5] Assumes no other uranium isotopes are present.

†[6] The Th-230 guideline is 15 pCi/g to account for ingrowth of Ra-226 as Th-230 decays. Ra-226 is a limiting radionuclide because its decay product is Rn-222 gas.

†[7] The Pu-241 guideline was derived from the Am-241 concentration.

2. Structure Guidelines (Maximum Limits for Unrestricted Use

a. Indoor Radon Decay Products

A structure located on private property and intended for unrestricted use shall be subject to remedial action as necessary to ensure the annual average concentration of radon decay products is less than 0.03 WL within the structure.

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.

c. Indoor/Outdoor Structure Surface Contamination

	Allowable Surface Residual Contamination ($dpm/100\ cm^2$)†[1]		
Radionuclides†[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	5,000α	15,000α	1,000α
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above	5,000β-λ	15,000β-λ	1,000β-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.

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

†[6] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels shall be reduced proportionately and the entire surface shall be wiped.

B. CONTROL OF RADIOACTIVE WASTES AND RESIDUES FROM FUSRAP AND REMOTE SFMP SITES

Specified here are the control requirements for radioactive wastes and residues related to the nuclear fuel cycle at FUSRAP and remote SFMP sites. It is the policy of DOE to store radioactive wastes in a manner representing sound engineering practices consistent with DOE's ALARA policy.

1. Interim Storage

All operational and control requirements specified in the following DOE Orders and other items shall apply:

a. 5480.1A, Environmental Protection, Safety, and Health Protection Program for DOE Operations.

b. 5480.2, Hazardous and Radioactive Mixed Waste Management.

c. 5483.1, Occupational Safety and Health Program for Government-Owned Contractor-Operated Facilities.

d. 5484.1, Environmental Protection, Safety, and Health Protection Information Reporting Requirements.

e. 5484.2, Unusual Occurrence Reporting System.

f. 5820, Radioactive Waste Management.

g. Control and stabilization features will be designed to ensure, to the extent reasonably achievable, an effective life of 50 years and, in any case, at least 25 years.

h. Rn-222 concentrations in the atmosphere above facility surfaces or openings shall not (1) exceed 100 pCi/L at any given point, or an average concentration of 30 pCi/L for the facility site, or (2) exceed an average Rn-222 concentration at or above any location outside the facility site of 3.0 pCi/L (above background).

i. For water protection, use existing state and federal standards; apply site-specific measures where needed.

2. Long-Term Management

   a. All operational requirements specified for Interim Storage Facilities (B.1) will apply.

   b. Control and stabilization features will be designed to ensure, to the extent reasonably achievable, an effective life of 1,000 years and, in any case, at least 200 years. Other disposal site design features shall conform with 40 CFR Part 192 performance guidelines/ requirements.

   c. Rn-222 emanation to the atmosphere from facility surfaces or openings shall not (1) exceed an average release rate of 20 $pCi/m^2/s$, or (2) increase the annual average Rn-222 concentration at or above any location outside the facility site by more than 0.5 pCi/L.

   d. For water protection, use existing state and federal standards; apply site-specific measures where needed.

   e. Prior to placement of any potentially biodegradable contaminated wastes in a Long-Term Management Facility, such wastes will be properly conditioned to (1) ensure that the generation and escape of biogenic gases will not cause the requirement in paragraph 2.c. to be exceeded, and (2) ensure that biodegradation within the facility will not result in premature structural failure not in accordance with the requirements in paragraph 2.b. If biodegradable wastes are conditioned by incineration, incineration operations will be carried out in compliance with all applicable federal, state, and local air emission standards and requirements, including any standards for radionuclides established pursuant to 40 CFR Part 61, National Emission Standards for Hazardous Air Pollutants (NESHAPS).

C. Exceptions

Exceptions may be made to the guidelines presented herein following analysis of the site-specific aspects of a candidate site. Specific situations that warrant consideration for modifying these guidelines are:

1. Where remedial actions would pose a clear and present risk of injury to workers or members of the public, notwithstanding reasonable measures to avoid or reduce risk.

2. Where remedial actions would produce environmental harm that is clearly excessive compared to the health benefits to persons living on or near affected sites, now or in the future, notwithstanding reasonable measures to limit damage to the environment. A clear excess of environmental harm is harm that is long-term, manifest, and grossly disproportionate to health benefits that may reasonably be anticipated.

3. Where the cost of remedial actions for contaminated soil is unreasonably high relative to long-term benefits and the residual radioactive materials do not pose a clear present or future hazard. The likelihood that buildings will be erected or that people will spend long periods

of time at such a site should be considered in evaluating this hazard. Remedial actions will generally not be necessary where residual radioactive materials have been placed semipermanently in a location where site-specific factors limit their hazard and from which they are costly or difficult to remove, or where only minor quantities of residual radioactive materials are involved. Examples are residual radioactive materials under hard-surface public roads and sidewalks, around public sewer lines, or in fence-post foundations. Supplemental standards shall not be applied at such sites, however, if individuals are likely to be exposed for long periods of time to radiation from such materials at levels above those that would prevail in Subpart A.

4. Where the cost of cleanup of a contaminated building is clearly unreasonably high relative to the benefits. Factors that shall be included in this judgment are the anticipated period of occupancy, the incremental radiation level that would be affected by remedial actions, the residual useful lifetime of the building, the potential for future construction at the site, and the applicability of less costly remedial methods than removal of residual radioactive materials.

5. Where there is no known remedial action.

D. Guideline Sources

Guideline	Source
Residual Contamination Guidelines†[1]	
Soil Guideline	DOE Order 5480.1A, 40 CFR Part 192†[2]
Structure Guideline	40 CFR Part 192, U.S. Nuclear Regulatory Commission (1982)
Control of Radioactive Wastes and Residues	
Interim Storage	DOE Order 5480.1A
Long-Term Management	40 CFR Part 192

†[1] The bases of the residual contamination guidelines are developed in ORO-831 (U.S. Dep. Energy 1983) and ORO-832 (Gilbert et al. 1983).

†[2] Based on limiting the concentration of Rn-222 decay products to 0.03 WL within structures.

REFERENCES (Appendix A)

Gilbert, T.L., P.C. Chee, M.J. Knight, J.M. Peterson, C.J. Roberts, J.E. Robinson, S.Y.H. Tsai, and Y.C. Yuan. 1983. Pathways Analysis and Radiation Dose Estimates for Radioactive Residues at Formerly Utilized MED/AEC Sites. ORO-832. Prepared for the Formerly Utilized Sites Remedial Action Program, U.S. Department of Energy, Oak Ridge, TN, by the Division of Environmental Impact Studies, Argonne National Laboratory, Argonne, IL. March 1983.

U.S. Department of Energy. 1983. Radiological Guidelines for Application to DOE's Formerly Utilized Sites Remedial Action Program. ORO-831. Oak Ridge Operations, Oak Ridge, TN. March 1983.

U.S. Nuclear Regulatory Commission. 1982. Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material. Division of Fuel Cycle and Material Safety, Washington, DC. July 1982.

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