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Formerly Utilized Sites Remedial Action Program (FUSRAP)

ADMINISTRATIVE RECORD

for Maywood, New Jersey

U.S. Department of Energy

0489-0613.1

Engineering Evaluation/Cost Analysis for the Cleanup of Residential and Municipal Vicinity Properties at the Maywood Site, Bergen County, New Jersey

Public Draft
July 1995

Prepared by
U.S. Department of Energy
Former Sites Restoration Division
Oak Ridge, Tennessee

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FOREWORD

This engineering evaluation/cost analysis (EE/CA) has been prepared in support of a proposed action to remove radioactively contaminated soils and debris from selected vicinity properties at the Maywood site in Bergen County, New Jersey. The Maywood site consists of properties in the boroughs of Maywood and Lodi and the township of Rochelle Park, New Jersey, that became contaminated with radioactive materials above DOE guidelines as a result of thorium processing operations by the former Maywood Chemical Works. The U.S. Department of Energy (DOE) is responsible for cleanup activities at the Maywood site under its Formerly Utilized Sites Remedial Action Program (FUSRAP), as defined in the Federal Facility Agreement between DOE and the U.S. Environmental Protection Agency (EPA) for the site.

Remedial actions at the Maywood site are being conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA). In addition, DOE has chosen to integrate the values of the National Environmental Policy Act (NEPA), which assure that the socio-economic and potential cumulative impacts of a proposed action are considered as part of the decision-making process for that action. DOE is currently conducting a comprehensive remedial investigation/feasibility study (RI/FS) for remedial action at the Maywood site. The proposed early removal action evaluated in this EE/CA is consistent with the overall cleanup strategy for the site, and will not limit the choice of reasonable alternatives or prejudice the ultimate decision for which the RI/FS is being prepared.

The proposed action is to remove contaminated soil and debris from 37 non-DOE-controlled properties and transport these materials to a permanent disposal facility. These properties include 31 residential vicinity properties (one of which has been partially remediated), the unremediated portion of the Ballod property, three parks, a fire station, and a highway right-of-way. The residual radioactive materials at these properties pose no significant near-term threats to the public or the environment due to the relatively low contaminant concentrations and incomplete exposure pathways; however, DOE has determined that an expedited response action to remove these materials (i.e., prior to remediation of the entire Maywood site) would reduce the potential for release of contaminants from these properties into the environment and minimize the related threats to human health and the environment. The proposed action would complete cleanup actions for all residential vicinity properties associated with the Maywood site and facilitate ultimate remediation of the Maywood site by preventing the inadvertent spread of contaminants from these uncontrolled properties.

This EE/CA is being submitted for public comment in accordance with the requirements of 40 CFR 300.415. DOE is especially interested in input regarding the preferred alternative and any considerations for carrying out the proposed action. DOE will evaluate and respond to comments received during this public comment period, and a summary of comments and responses will be prepared following completion of the comment period. Final selection of an alternative will not be made until comments have been evaluated and concerns have been addressed.

ACRONYMS AND ABBREVIATIONS

AEA	Atomic Energy Act of 1954, as amended
AEC	U. S. Atomic Energy Commission
ALARA	as low as reasonably achievable
ANL	Argonne National Laboratory
ARAR	applicable or relevant and appropriate requirement
BNI	Bechtel National, Inc.
BRA	baseline risk assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended
CFR	Code of Federal Regulations
DCG	Derived Concentration Guide
DOE	U. S. Department of Energy
DOT	U. S. Department of Transportation
EE/CA	engineering evaluation/cost analysis
EPA	U. S. Environmental Protection Agency
FFA	Federal Facilities Agreement
FR	Federal Register
FS	feasibility study
FUSRAP	Formerly Utilized Sites Remedial Action Program
FY	fiscal year
MCW	Maywood Chemical Works
MISS	Maywood Interim Storage Site
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act of 1969
NJDEP	New Jersey Department of Environmental Protection
NPL	National Priorities List
NRC	U. S. Nuclear Regulatory Commission
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
RCRA	Resource Conservation and Recovery Act, as amended
RESRAD	residual radioactivity computer code
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
ROD	record of decision
SAIC	Science Applications International Corporation
SARA	Superfund Amendments and Reauthorization Act
TBC	to-be-considered (guidelines)
11e(2)	Section 11e(2) of the Atomic Energy Act, defining byproduct material

UNITS OF MEASURE

ft	foot (feet)
ft^2	square foot (feet)
ft^3	cubic foot (feet)
g	gram(s)
hr	hour(s)
kg	kilogram(s)
μg	microgram(s)
μR	micro-roentgen(s)
m^2	square meter(s)
m^3	cubic meter(s)
mg	milligram(s)
mi	mile(s)
mR	milli-roentgen(s)
mrem	millirem(s)
pCi	picoCuries
yd^3	cubic yard(s)

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1. INTRODUCTION

The U. S. Department of Energy (DOE) is implementing a cleanup program for properties in the boroughs of Maywood and Lodi and the township of Rochelle Park, New Jersey, collectively referred to as the Maywood site. DOE is responsible for conducting cleanup activities at the Maywood site under its Formerly Utilized Sites Remedial Action Program (FUSRAP). This program, which currently includes 46 sites in 14 states, was established in 1974 by the U. S. Atomic Energy Commission (AEC), a predecessor agency of DOE. The purpose of FUSRAP is to identify and clean up or otherwise control sites with residual radioactive contamination above current guidelines or standards. Residual contamination at the Maywood site resulted from thorium processing operations conducted at the former Maywood Chemical Works (MCW) from 1916 to 1959. Responsibility for the Maywood site was assigned to DOE by Congress under the Energy and Water Development Act of 1984.

Properties within the Maywood site include the DOE-owned Maywood Interim Storage Site (MISS), the adjacent Stepan Company property (formerly Maywood Chemical Works), and other vicinity properties, including numerous residential, commercial, Federal, state, and municipal properties in Maywood, Rochelle Park, and Lodi, New Jersey. These properties are contaminated with the thorium-232, radium-226, and uranium-238 radioactive decay series as a result of thorium processing at MCW. Chemical contaminants are also known to be present on some of the properties.

This engineering evaluation/cost analysis (EE/CA) report has been prepared to evaluate interim cleanup measures for the Maywood site. The scope of the proposed action is to remove contaminated soil and debris from 37 non-DOE-controlled properties and transport these materials to a permanent disposal facility. These properties include 31 residential vicinity properties (one of which has been partially remediated), the unremediated portion of the Ballod property, three parks, a fire station, and a highway right-of-way. The residual radioactive materials at these properties pose no significant near-term threats to the public or the environment due to the relatively low contaminant concentrations and incomplete exposure pathways. However, DOE has determined that an expedited response action to remove these materials (i.e., prior to remediation of the entire Maywood site) would reduce the potential for release of contaminants from these properties into the environment and minimize the related threats to human health and the environment. DOE previously removed contaminated materials from 25 residential vicinity properties at the site during 1984 through 1986, and the proposed action would complete cleanup actions for all residential vicinity properties associated with the Maywood site. Furthermore, the proposed action also would help to alleviate community concerns regarding perceived health risks and potential adverse economic impacts associated with the contamination at these properties.

This proposed action is a component of the comprehensive cleanup program for the Maywood site. Implementation of comprehensive cleanup measures will follow the completion of a remedial investigation/feasibility study (RI/FS) process. The RI/FS process will conclude with the issuance of a record of decision (ROD) that will identify the selected remedy for all

contamination present at the Maywood site. The RI/FS process is being conducted according to the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA). In addition, DOE policy requires the incorporation of the values of the National Environmental Policy Act (NEPA). Details of the RI/FS process are described in the project work plan (ANL/BNI 1992). The proposed removal action is consistent with the comprehensive cleanup strategy for the site.

DOE is the lead agency responsible for cleanup activities at the Maywood site. The limits of DOE's responsibilities for the Maywood site are defined under a negotiated Federal Facility Agreement between DOE and the U. S. Environmental Protection Agency (EPA) Region II which became effective April 22, 1991. DOE is responsible for FUSRAP waste, which is specifically defined as:

- All contamination, both radiological and chemical, whether commingled or not, on MISS;

- All radiological contamination above DOE action levels related to past thorium processing at the MCW site occurring on any vicinity properties; and

- Any chemical contamination on vicinity properties that would satisfy either of the following requirements:

  - the chemical contaminants are mixed or commingled with radiological contamination above DOE action levels; or

  - the chemical contaminants originated on MISS or were associated with the thorium processing activities at the MCW site which resulted in the radiological contamination.

Chemical contamination from MCW that is not on MISS (or that is not shown to be migrating from MISS) and not mixed with FUSRAP waste, is being investigated through a separate RI/FS by the Stepan Company, owner of the former MCW property. This investigation is being conducted through an agreement signed by EPA and the Stepan Company in 1987 and an order signed by EPA in 1991. Although the DOE and Stepan Company RI/FS activities are being conducted independently, EPA has oversight over both actions; in consultation with DOE and the Stepan Company, EPA will ensure that sufficient coordination occurs between the parties to fully address the problems of the Maywood site.

The proposed removal action is expected to be implemented after appropriate regulatory agencies, local government officials, and interested members of the public have had sufficient opportunity to review and comment on the proposal. Preliminary discussion and coordination has taken place between DOE, EPA Region II, and the New Jersey Department of Environmental Protection (NJDEP).

The proposed removal action is consistent with CERCLA, which requires that interim actions contribute to the extent practicable to the efficient performance of any anticipated final remedy. The removal action would also satisfy the conditions for interim actions under NEPA (40 CFR 1506.1). The proposed removal action is consistent with the overall cleanup strategy for the Maywood site, and will not limit the choice of reasonable alternatives or prejudice the ultimate decision for which the RI/FS is being prepared.

The analysis presented in this EE/CA demonstrates that the proposed action can be implemented in a manner that protects human health and the environment. Although portions of several affected vicinity properties are located within the 100-year floodplain of the Saddle River (DOE 1992), mitigative measures can be implemented to control risks associated with flooding; a floodplains assessment is provided in Appendix A. No wetlands would be impacted by the proposed removal action.

The proposed removal action would address the goals of FUSRAP by reducing the potential for further spread of radioactively contaminated soil at the Maywood site. The threats posed by contaminants at the Maywood vicinity properties are considered to be of a non-time-critical nature; that is, no immediate or substantial danger to human health or the environment exists that would necessitate emergency cleanup within six months. However, because contamination exists at properties not owned or controlled by DOE, site activities initiated by property owners (e.g., excavation, renovation) or others (e.g., utility maintenance, road improvements) could result in the generation of contaminated waste or the further release or spread of contaminants into the environment. Removal of these contaminated materials from their current uncontrolled locations for permanent disposal in an appropriately licensed facility would reduce the potential for inadvertent spread of contamination and minimize potential exposure to these materials.

2. SITE CHARACTERIZATION

2.1 SITE DESCRIPTION

The Maywood site consists of properties in the boroughs of Maywood and Lodi and the township of Rochelle Park, New Jersey, that were contaminated by operations for processing thorium, a radioactive element, at the Maywood Chemical Works (MCW). These operations occurred from the early 1900's through 1959. The three municipalities are located in a densely populated area of Bergen County in northeastern New Jersey, approximately 12 miles north-northwest of New York City and 13 miles northeast of Newark, New Jersey (Figure 2-1). The site is listed on the National Priorities List (NPL) as the Maywood Chemical Company.

To help in developing and evaluating remedial action alternatives, the Maywood site has been divided into several operable units based on land use and the type of contaminated media (e.g., contaminated soils, contaminated buildings) of concern. The location of the properties making up these operable units is shown in Figure 2-2.

The Maywood Interim Storage Site is an 11.7-acre property owned by DOE and located in the borough of Maywood and the township of Rochelle Park. The MISS property was previously part of a 30-acre property owned by the Stepan Company, and it was formerly part of the Maywood Chemical Works. DOE acquired the property from the Stepan Company in 1985. The property contains a waste storage pile, two buildings (Building 76 and a pumphouse), two partially buried structures, temporary office trailers, a reservoir, and two rail spurs. It is bordered on the west by State Route 17, on the north by a New York, Susquehanna, and Western Railroad line, and on the south and east by commercial and industrial properties. Residential properties are located north of the railroad line and within 300 yards to the north of the MISS property boundary. The waste storage pile at MISS previously occupied approximately 2 acres and contained about 35,000 yd^3 of contaminated soils and materials from previous cleanup actions conducted on vicinity properties at the Maywood site. A separate removal action is currently underway to remove the contaminated materials from the pile for permanent disposal at an off-site commercial facility. A building at MISS (Building 76) also houses waste from previous cleanup actions and site investigations. Former waste retention ponds also are located at MISS. The property is enclosed by a chain-link fence and access is restricted within the fenced area. Figure 2-3 indicates principal features of the MISS property.

The Stepan Company, a pharmaceutical manufacturer, is located at 100 West Hunter Avenue in the borough of Maywood, adjacent to MISS. The property covers 18.2 acres, approximately two-thirds of which contains buildings; some of these buildings are located in or near areas where the MCW thorium-processing operations occurred. Burial pits containing thorium-processing and other wastes are located on the site (see Figure 2-3). The property (excluding the main office and parking area) is enclosed by a chain-link fence and access is restricted within the fenced area.

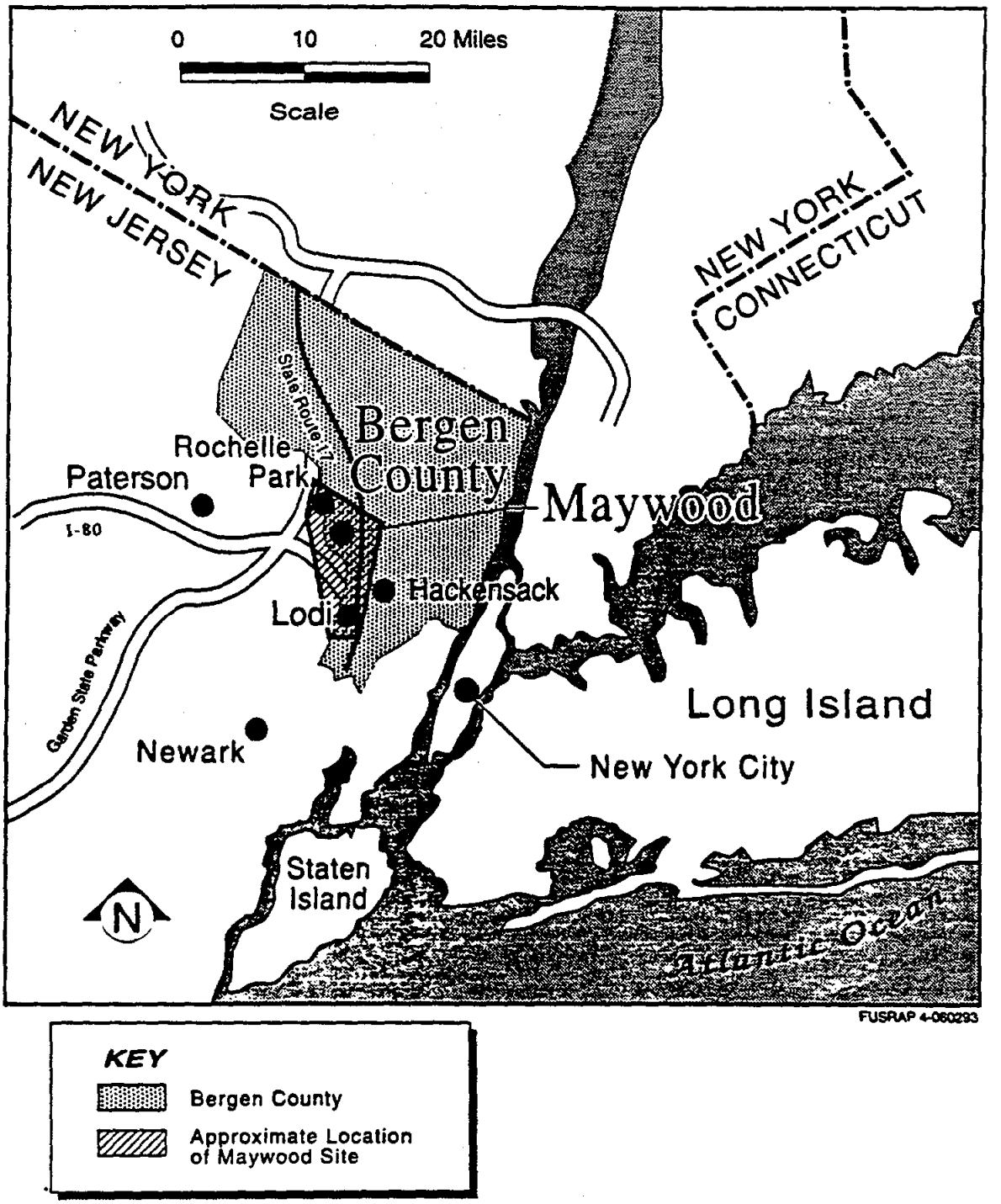

Figure 2-1. Location of the Maywood Site

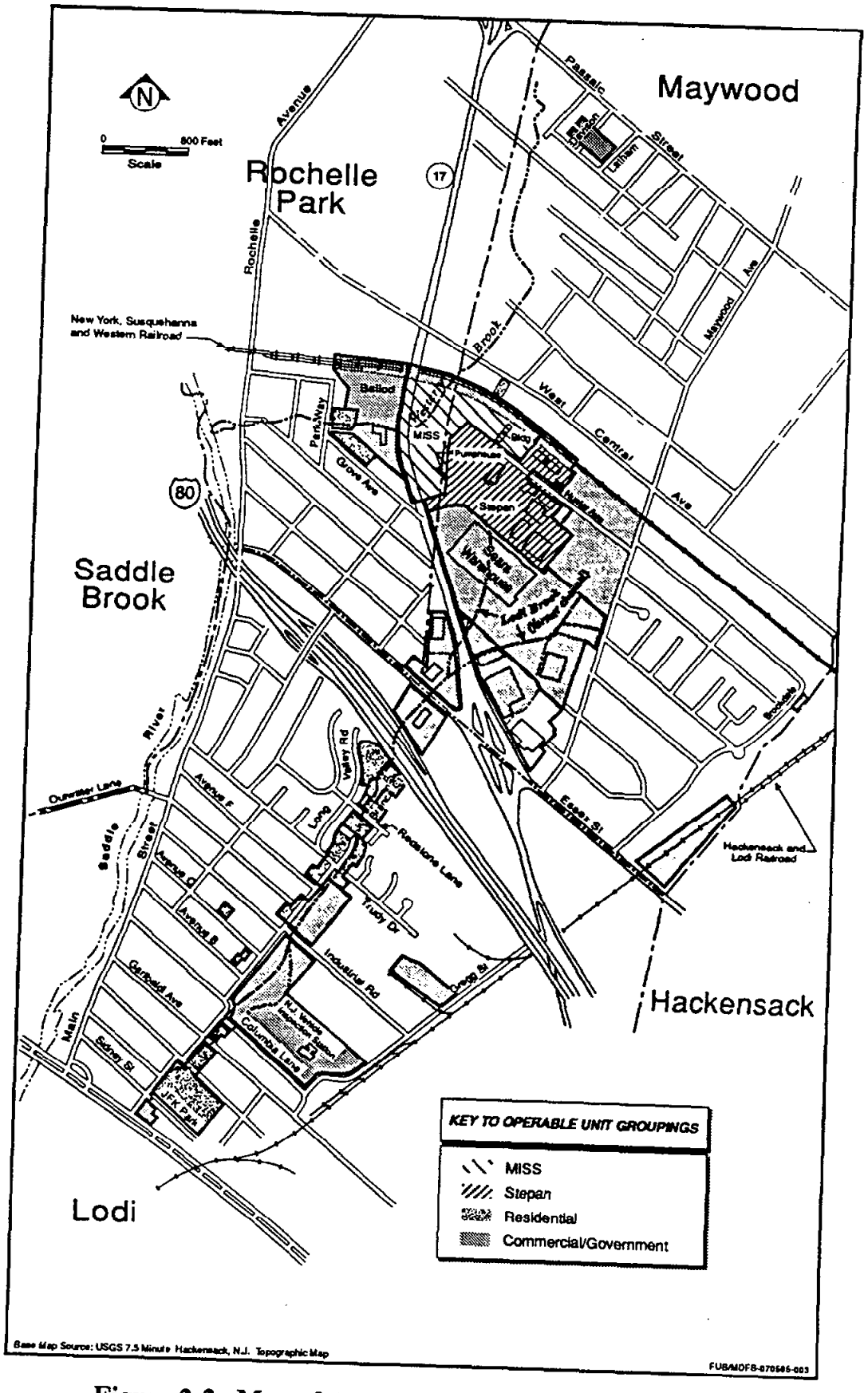

Figure 2-2. Map of the Maywood Site Operable Units

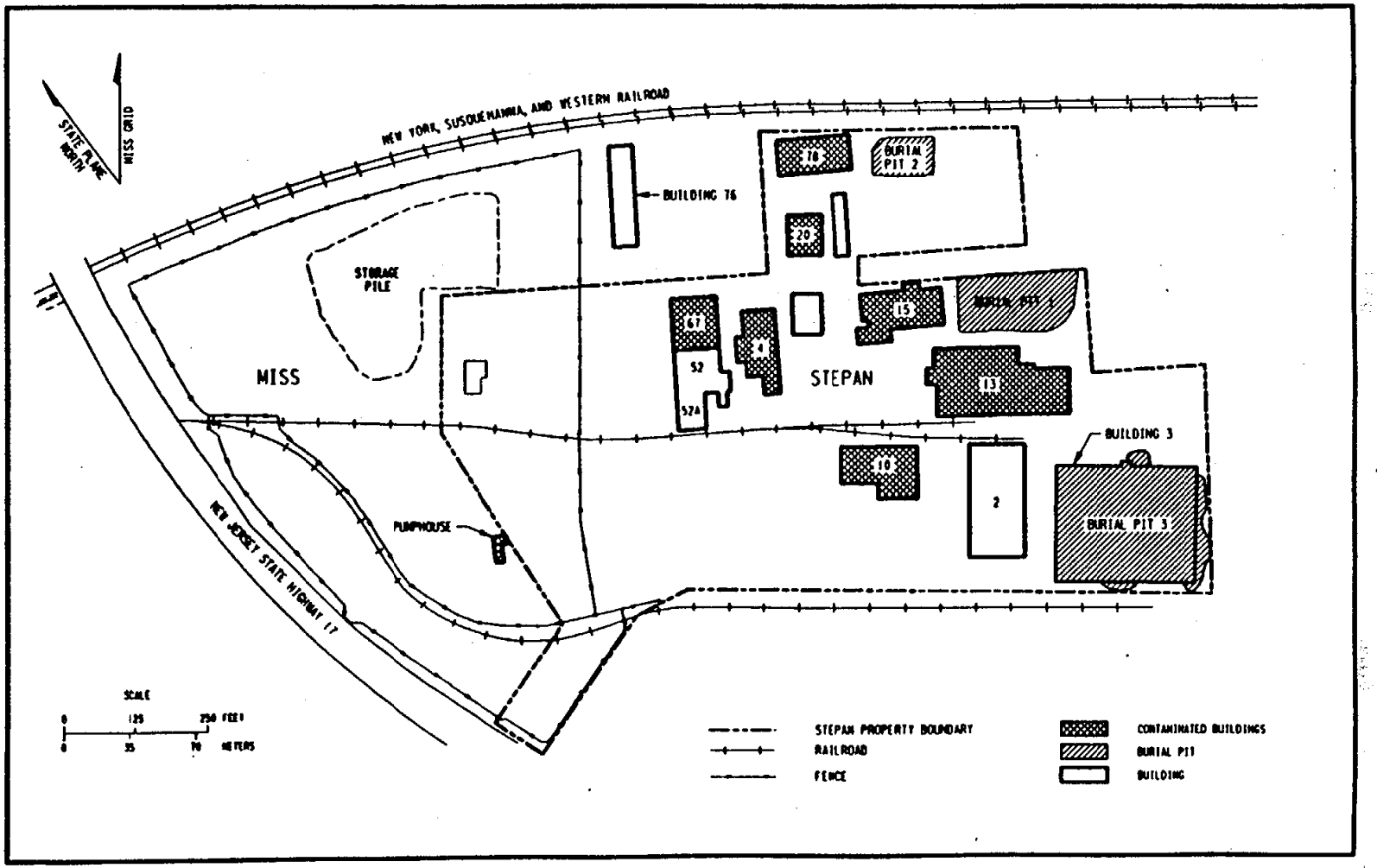

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Figure 2-3
Site Map of the Maywood Interim Storage Site and Adjacent Stepan Company Property

Residential vicinity properties in the boroughs of Maywood and Lodi and the township of Rochelle Park contain radioactive contamination from thorium-processing operations. These properties were identified by DOE through surveys performed by Oak Ridge National Laboratory (ORNL). Nine residential properties in Rochelle Park on Grove Avenue and Rock Way and eight residential properties in Maywood on Davison Avenue and Latham Street were completely decontaminated by DOE between 1984 and 1986. This decontamination was verified by ORNL and the properties were approved for use without radiological restriction. Eight residential properties in Lodi have also been decontaminated and have been independently verified as clean. One additional property in Lodi was partially remediated during previous removal actions. Of the remaining 31 contaminated residential properties designated for potential remediation by DOE, 29 are located in the borough of Lodi (including the one partially remediated property) and two are located in Maywood. Contamination on these properties appears to be due to two primary mechanisms: deposition of contaminated sediments along former stream channels or use of contaminated material as fill and mulch.

Commercial/government vicinity properties include 27 properties located in Maywood, Rochelle Park, and Lodi. Twenty commercial vicinity properties are part of the Maywood site. State and federally owned properties include areas in the right-of-way for Interstate 80, a State Route 17 embankment, and the New Jersey Vehicle Inspection Station. Four contaminated municipal properties in Lodi (three parks and a fire station), residential streets suspected to have contaminated soils below the surface, and contaminated sediments from Lodi Brook are also included in this operable unit. Three of these properties (Ballod, Sears and State Route 17) were once part of the former MCW property and were used, at least in part, for waste disposal. A portion of one property (Ballod) was remediated during a previous removal action. Most of the other properties were contaminated through the same processes as the residential properties — by movement of contaminated sediments along former stream channels or use of contaminated material as fill and mulch.

Contaminated buildings and structures are located on the Stepan property. Radiologically contaminated buildings include Buildings 4, 10, 13, 15, 20, 67, 78, and the guardhouse (see Figure 2-3). The radiological contamination is generally localized in discrete areas within buildings, and is fixed in place on building floors and surfaces and not easily removed by casual contact. The contaminated buildings are all old buildings that existed during the time that MCW was processing thorium. No buildings on vicinity properties were found to be contaminated, other than one residence in Lodi that contained contaminated building materials from MCW. The contaminated portion of this residential building has been removed and reconstructed.

Eighty-five properties, including the Stepan Company property and MISS, have (or had) residual radioactive contamination resulting from MCW thorium-processing activities, and are included as part of the Maywood site. These properties include 56 residential properties (25 of which have been previously remediated), properties owned by the state or Federal government, municipal properties, and commercial properties (one of which has been partially remediated). Of the 60 properties remaining to be remediated, 37 properties are addressed in this EE/CA.

These properties, which are listed in Table 2-1, have been identified for this removal action primarily based on their current land use (e.g., residential properties, municipal parks), potential future development and high contaminant concentrations (Ballod), and potential for recontaminating other remediated vicinity properties (I-80 right-of-way).

2.2 SITE BACKGROUND

The Maywood Chemical Works was constructed in 1895. In 1916, the plant began extracting thorium and rare earths from monazite sands for use in manufacturing industrial products such as mantles for gas lanterns. The plant also produced a variety of other materials, including lithium compounds, detergents, alkaloids, and oils. The plant stopped accepting monazite sands for extraction of thorium in 1956, but it processed stockpiled materials until 1959. Based on available historical information and knowledge of the chemical processes involved, the chemicals identified as having been used in the thorium extraction process include sulfuric acid, nitric acid, ammonium hydroxide, and ammonium oxalate. Oxalic acid was also used at the site in the production of higher-grade thorium.

In the extraction process, waste in a slurry form was produced. Until 1932, the slurry was pumped to two earthen-diked areas west of the plant. At that time, the disposal areas were affected by the construction of State Route 17, which separated the diked areas from the plant and partially buried them. Waste retention ponds also were located throughout the area of MCW that is now MISS.

Some of the process wastes were removed and used as mulch and fill on nearby properties, thereby contaminating those properties with radioactive materials. Although the fill consisted primarily of tea and coca leaves from other MCW processes, these materials were apparently contaminated with the thorium-processing wastes. Other wastes moved off-site from the property through natural drainage of the former Lodi Brook. Most of the open stream channel in Lodi has been replaced by an enclosed storm drain system.

MCW received a radioactive materials license from the AEC in 1954. The property was sold to the Stepan Company in 1959, which received a license from the AEC in 1961. Although the Stepan Company never processed radioactive materials, the company agreed to carry out certain remedial measures in the former disposal area on the west side of State Route 17 (now known as the Ballod property). Stepan began to clean up the thorium processing wastes in 1963. From 1966 through 1968, Stepan removed residues and tailings from the Ballod property and reburied them on the Stepan property in three burial pits. After these actions were completed, AEC certified that the portion of the property west of State Route 17 could be used without radiological restrictions.

Additional radioactive contamination, however, was discovered in the northeast corner of the Ballod property in 1980. The discovery was made after a private citizen reported radioactive contamination near State Route 17 to the New Jersey Department of Environmental Protection (NJDEP). A survey of the area (State Route 17, Ballod property, and Stepan

Table 2-1. Properties to be Addressed in the Proposed Removal Action

Property, Location	Current Land Use
Ballod property, Rochelle Park [a]	Commercial [b]
I-80 Right-of-way	Highway ROW [c]
Lodi (Jet Age) Municipal Park, Lodi	Municipal
Fireman's Memorial Park, Lodi	Municipal
John F. Kennedy Municipal Park, Lodi	Municipal
Fire Station No. 2, Lodi	Municipal
60 Trudy Drive, Lodi	Residential
62 Trudy Drive, Lodi	Residential
4 Hancock Street, Lodi	Residential
5 Hancock Street, Lodi	Residential
6 Hancock Street, Lodi	Residential
7 Hancock Street, Lodi	Residential
8 Hancock Street, Lodi	Residential
10 Hancock Street, Lodi	Residential
2 Branca Court, Lodi	Residential
4 Branca Court, Lodi	Residential
6 Branca Court, Lodi	Residential
7 Branca Court, Lodi	Residential
11 Branca Court, Lodi	Residential
14 Long Valley Road, Lodi	Residential
16 Long Valley Road, Lodi	Residential
18 Long Valley Road, Lodi	Residential
20 Long Valley Road, Lodi	Residential
22 Long Valley Road, Lodi	Residential
24 Long Valley Road, Lodi	Residential
26 Long Valley Road, Lodi	Residential
11 Redstone Lane, Lodi	Residential
17 Redstone Lane, Lodi	Residential
106 Columbia Lane, Lodi	Residential
99 Garibaldi Avenue, Lodi	Residential
90 Avenue C, Lodi [a]	Residential
108 Avenue E, Lodi	Residential
112 Avenue E, Lodi	Residential
113 Avenue E, Lodi	Residential
79 Avenue B, Lodi	Residential
136 West Central Avenue, Maywood	Residential
200 Brookdale SE, Maywood	Residential

[a] Partially remediated.

[b] Included in proposed removal action due to potential for near-term development and relatively high contaminant concentrations.

[c] Included in proposed removal action due to potential for contaminants at this property to re-contaminate adjacent vicinity properties included in the proposed action.

property) conducted by NJDEP identified the contaminants as thorium-232 and radium-226. The U.S. Nuclear Regulatory Commission (NRC) was notified of the results and conducted additional surveys from November 1980 to January 1981. These surveys confirmed that there were high concentrations of thorium-232 in soil samples collected from both the Stepan and Ballod properties. NRC, therefore, requested a thorough survey of the area.

In January 1981, the EG&G Energy Measurements Group conducted an aerial radiological survey of the Stepan property and surrounding properties. The survey, which covered a 3.9-mile^2 area, indicated contamination not only on the Stepan and Ballod properties but also in areas to the north and south of the Ballod property. During February 1981, Oak Ridge National Laboratory (ORNL) performed a separate radiological ground survey of the Ballod property. Those results eventually led to designation of the property for remedial action under FUSRAP. In June 1981, another radiological survey of the Stepan and Ballod properties commissioned by the Stepan Company produced similar findings.

Through a provision of the Energy and Water Development Appropriations Act of 1984, Congress authorized DOE to conduct a decontamination research and development project at the Maywood site. The site was assigned to FUSRAP, and DOE negotiated access to a 11.7-acre portion of the Stepan property for use as an interim storage facility for contaminated materials that were to be removed from vicinity properties. This area is now known as MISS. In September 1985, ownership of MISS was transferred to DOE.

In late 1983, DOE began a program of surveys of properties in the vicinity of the former MCW plant. From 1984 to 1986, DOE completed removal actions at 25 residential properties, and partially remediated one commercial property (Ballod). The waste from these removal actions was placed in storage at MISS. Removal actions at the vicinity properties were halted in 1986 in response to community concerns about additional wastes being brought to MISS.

In July 1991, DOE conducted a time-critical removal action to decontaminate one additional residential property in Lodi. This action was taken in response to radiological surveys which identified gamma exposure rates above DOE guidelines inside a portion of the building. The original owner of the residence was an employee of MCW, who apparently used discarded building and fill materials from MCW in the construction of an addition to the house. Contaminated soil and building materials generated during this removal action were packaged in appropriate containers and placed in Building 76 at MISS for storage.

A separate removal action is currently underway to dispose of 35,000 yd^3 of contaminated soil and debris from the waste storage pile at MISS. These materials were generated from the previous removal actions at 25 vicinity properties between 1984 and 1986. The pile covers an area of approximately 2 acres with an average height of 18 ft. The pile was constructed with an impermeable liner and cover, and a leachate collection system. DOE has maintained a comprehensive environmental monitoring program for air, surface water, sediment, and groundwater at MISS since 1984. The removal action was initiated in October 1994, and is expected to be completed by the end of 1997, assuming necessary funding is available. Waste

materials removed from the interim storage pile are being shipped to the Envirocare disposal facility near Clive, Utah.

The Maywood site was placed on the National Priorities List (NPL) by EPA on September 8, 1983. All remedial actions at the site conducted by DOE are being coordinated with EPA Region II under CERCLA. In addition, it is DOE policy to integrate the requirements of CERCLA with the values of NEPA for remedial action at sites for which it has responsibility. The RI/FS conducted under CERCLA is the primary process for ensuring that DOE remedial actions for the site meet environmental regulations. Under the integrated CERCLA/NEPA policy, the CERCLA process is supplemented, as appropriate, to include NEPA values.

During the previous removal actions at the site, the public and local authorities were kept fully informed about the work being planned and conducted by DOE. This was accomplished through coordination with private property owners and local officials regarding logistics of the removal actions, as well as through local media coverage and by issuing public notifications (i.e., press releases). Formal access agreements were obtained with each affected property owner and the borough or township officials before the removal actions were conducted. Any future response activities at the site also will be coordinated with the public and state and local officials according to the community relations plan for the site (BNI 1992).

2.3 ENVIRONMENTAL SETTING

Land Use and Demography. Land use in the vicinity of the Maywood site is a mixture of commercial, light industrial, and residential uses. MISS is zoned for light industrial use. Lands adjacent to MISS are zoned for limited commercial, light industrial, or single-family residential use. Several businesses are located south of MISS. An area north of MISS is used primarily for single-family homes. Along the Maywood/Rochelle Park boundary, north of MISS, is an area zoned for light industrial use. The area east of MISS is predominantly residential. West of MISS is a mixture of commercial, predominantly residential, and light industrial uses. Interstate 80 and State Route 17 separate the commercial properties south of Stepan and MISS from the contaminated residential areas of Lodi. Several municipal parks are within the contaminated residential regions in Lodi. According to the 1990 Census, the population of Maywood was 9,473, Lodi was 22,335, and Rochelle Park was 5,587. The population density in this area is approximately 10,000 people/mile^2.

Topography, Drainage, and Surface Water. The Maywood site is located in the glaciated section of the Piedmont Plateau of north-central New Jersey. The terrain is generally level, with minor highs and lows created by occasional shallow ditches and low mounds. Elevations range from 51 to 67 ft above mean sea level.

The Maywood site lies within the Saddle River drainage basin. MISS is located approximately 0.5 mile east of the Saddle River, which is a tributary of the Passaic River, and approximately 1 mile west of the drainage divide of the Hackensack River basin. Rainwater runoff from most of MISS empties into the Saddle River through Westerly Brook, which flows

under the property, under State Route 17 through a concrete culvert, and eventually empties into the Saddle River. Neither the Saddle River nor Westerly Brook is used as a source of potable water.

Another perennial stream on the Maywood site, Lodi Brook, begins as two branches on the Sears property. Most of the original stream channel has been replaced by an enclosed storm drain system. The former channel matches the distribution of contaminated materials in the borough of Lodi. The western branch of Lodi Brook has been covered by the Sears warehouse and its parking lot. The eastern-most branch drains the surface area outside the Sears fence and then flows underground for most of its route to the Saddle River. Some surface runoff from MISS may flow parallel to State Route 17 and drain into Lodi Brook. Recent surface water flow studies at MISS, however, have observed no measurable surface runoff from the MISS property. Lodi Brook empties into the Saddle River downstream of Westerly Brook's confluence with the Saddle River. Some of the vicinity properties at the south end of Lodi Brook are located within the 100-year floodplain of the Saddle River (See Appendix A).

Geology/Soils. Bedrock underlying the Maywood site consists of igneous-derived sedimentary rock of lower Jurassic and upper Triassic age identified as the Passaic Formation. The Passaic Formation has alternating beds of reddish-brown sandstone, mudstone, and shale. It ranges from 5900 to 8000 ft in thickness. Unconsolidated materials of glacial origin (boulders, gravel, silt, and clay) are layered over the bedrock at the site and in many parts of the region. The composition and characteristics of these deposits vary within the area, including unstratified deposits of unsorted rock fragments ranging from clay-sized particles to boulders laid down directly by glaciers and stratified deposits of bedded, well-sorted materials deposited by glacial meltwater into streams and lakes. Extensive agricultural and urban development has disturbed or destroyed much of the original deciduous soil horizon. Most of the current soil cover in the area may be classified as urban fill.

Hydrogeology/Groundwater. Groundwater in the Maywood area occurs in both the Passaic Formation and the unconsolidated glacial deposits. The Passaic Formation is a productive aquifer with sufficient capacity for public and industrial use. However, there is no known use of this groundwater for drinking water or domestic uses in the area of the Maywood site. Groundwater flows through weathered rock and secondary fracture openings in the Passaic Formation, forming a system of tabular aquifers and aquicludes. The water is moderately mineralized and ranges from moderately hard to very hard. The unconsolidated glacial deposits provide a more variable source of groundwater, with highly variable water quality. It ranges from soft to hard but is generally not mineralized.

Depth-to-groundwater is shallow and ranges from approximately 3 to 15 ft below ground surface. Water levels fluctuate in response to short- and long-term seasonal patterns of precipitation and evapotranspiration. Levels are generally lowest in May through September, with rising water levels beginning in late November through December. Groundwater recharge occurs primarily through percolation from precipitation. At the MISS and Ballod properties, groundwater flow is toward the west in both the bedrock and overburden aquifers. Average

hydraulic gradients vary depending on the season and recent precipitation. Gradients are generally steeper on the MISS property, and decrease rapidly on the Ballod property.

Ecology. The Maywood site is located within the glaciated portion of the Appalachian Oak Forest Section of the Eastern Deciduous Forest Province. However, urban development has destroyed much of the forest habitat in the area. This has resulted in natural landscapes dominated by grasses and forbs, with scattered shrubs and trees. The landscaped commercial and residential properties contain plant species common to landscaped yards, such as grasses, shrubs and trees. No threatened or endangered species have been identified at the Maywood site. Local habitat limits animal life to commonly occurring species adapted to suburban and urban environments.

Aquatic habitats are limited to drainageways, small temporary ponds, Westerly and Lodi Brooks, and the Saddle River. Hydrophytic vegetation is apparent along the upper portions of Lodi Brook on the Sears property. A wetlands delineation, performed as part of the RI/FS that the Stepan Company is conducting, identified wetlands covering approximately 4.1 acres in this area. However, no wetlands are present on the properties considered for the proposed removal action.

Climate and Meteorology. The regional climate is humid, with a normal annual precipitation of about 42 inches and about 120 days of precipitation per year. The area receives approximately 30 inches of snow per year. Average monthly temperatures range from 0.4°C (31.3° F) in January to 24.9°C (76.8°F) in July. The prevailing winds are from the northwest during October to April and from the southwest during the remainder of the year.

Archeological and Historical Sites. None of the buildings at the Maywood site are currently listed in the National Register of Historic Places. A Stage IA survey of the Maywood site has been completed and filed with the New Jersey Historic Preservation Office to confirm that no archeological, cultural, or historic resources would be seriously affected by site activities.

2.4 ANALYTICAL DATA

Detailed descriptions of the site characterization activities and results for the overall Maywood site are presented in the RI report (DOE 1992). Only information pertinent to the vicinity properties considered in this EE/CA is summarized in this section.

Radioactive Contaminants

Radioactive contamination on the residential vicinity properties is present in both surface and subsurface soils. Radionuclide concentrations in surface soils range from <0.5 to 111.6 pCi/g for thorium-232, from 0.4 to 66 pCi/g for radium-226, and from <2 to 37 pCi/g for uranium-238. Contaminated surface soils are primarily covered by grass lawns or asphalt driveways and parking areas. Radionuclide concentrations in subsurface soils range from <0.2 to 240 pCi/g for thorium-232, from <0.2 to 51 pCi/g for radium-226, and from <0.2 to 37.4

pCi/g for uranium-238. Depths of subsurface contamination range from 15 cm (6 in.) to 3 m (9 ft); there is no indication that contamination has migrated below undisturbed soil.

On the Ballod property, surface soil levels range from 0.08 to 2490 pCi/g for thorium-232, from 0.08 to 50 pCi/g for radium-226, and from 0.49 to 250 pCi/g for uranium-238. Subsurface concentrations range up to 3100 pCi/g for thorium-232, up to 240 pCi/g for radium-226, and from 0.85 to 300 pCi/g for uranium-238.

Supplemental sampling was conducted in March 1995 to better delineate the expected boundaries of contaminated soils at the vicinity properties considered in this EE/CA. The results of this investigation (BNI 1995) indicate that the boundaries of contaminated soils at several properties are smaller than previously suspected. Measured radionuclide concentrations ranged from 0.5 to 27.4 pCi/g for thorium-232, 0.4 to 2.7 pCi/g for radium-226, and 0.3 to 11.6 pCi/g for uranium-238.

These concentrations can be compared to DOE guidelines for these radionuclides. DOE has established generic guidelines (DOE 1990) for allowable radionuclide concentrations in soil for radium (radium-226, radium-228) and thorium (thorium-232, thorium-230). These guidelines limit concentrations of these radionuclides in soil to 5 pCi/g above background concentrations averaged over the first 6-inch layer of soil below the ground surface, and 15 pCi/g above background averaged over any 6-inch layer below the surface layer, averaged over any area of 100 m^2. For the properties considered under the proposed removal action, DOE and EPA have established a more restrictive site-specific cleanup criterion of 5 pCi/g above background at all depths for radium-226 and thorium-232 combined.

For radionuclides other than radium and thorium, DOE requires that soil concentration limits must be derived on a site-specific basis, such that the potential radiation dose to any member of the public would not exceed 100 mrem/year above background, and would be reduced as low as reasonably achievable (ALARA) below this dose limit. A site-specific guideline for total uranium of 100 pCi/g above background has been derived for the Maywood site (DOE 1994). However, since uranium contamination at the Maywood properties tends to be co-located with thorium and at similar or lower concentrations, it is anticipated that remediation of thorium and radium to the site-specific criteria will also result in remediation of uranium contamination to levels well below 100 pCi/g.

Chemical Contaminants

Chemical investigation at these vicinity properties was focused on whether excavated soils would be classified as RCRA-regulated hazardous waste and whether chemical constituents associated with thorium processing operations were present. The results indicate that the soil does not exhibit characteristics of a RCRA-regulated waste. Also, no PCBs or pesticides were detected.

Six metals were identified as constituents of FUSRAP waste in soils on residential vicinity properties. These metals were arsenic, barium, chromium, lead, selenium, and zinc. Rare earth elements identified in soils at these properties were cerium, lanthanum, and neodymium. These were the same rare earth elements commonly detected at the MISS and Stepan properties; however, they were found at much lower concentrations on the residential vicinity properties. In general, metals and rare earth elements were found most frequently in areas of radioactive contamination and generally in areas near the location of the original stream channel of Lodi Brook. Their occurrence is most likely attributable to the deposition of thorium process residues.

2.5 SITE CONDITIONS THAT JUSTIFY A REMOVAL ACTION

The threats posed by radioactive contamination at the Maywood vicinity properties are of a non-time-critical nature; that is, no immediate risk to human health or the environment currently exists at these properties that would require emergency cleanup within six months. However, the conditions do meet criteria listed in Section 300.415(b)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) for conducting removal actions. The proposed removal action meets the requirement of CERCLA Section 104 in providing an efficient long-term response to the release or threatened release of site contaminants.

While the contamination present on these properties does not represent a near-term health threat, the presence of radioactive contamination at properties not owned or controlled by DOE could result in the inadvertent spread of contamination. For example, excavation and construction activities or utility construction and maintenance activities in contaminated areas could result in the disturbance and spread of contamination. The early removal of the contaminated materials from these vicinity properties would help to prevent the inadvertent spread of contamination that could result from various non-DOE-related land development activities; this would facilitate remediation of the overall Maywood site by potentially reducing the ultimate volume of materials requiring excavation. Furthermore, removal of these contaminated materials from their current uncontrolled locations for permanent disposal in an appropriately licensed facility would reduce the potential for increased exposures to these materials. This action also would complete cleanup efforts for all residential vicinity properties associated with the Maywood site, and help to alleviate community concerns regarding potential exposures at these properties.

The results of sampling at these vicinity properties indicate that the primary contaminants of concern are thorium-232 and its decay products. The available data, as summarized in Section 2.4, indicate that the contaminated materials at these properties exceed the cleanup guidelines for the Maywood site. Potential radiological hazards from the contaminated soils are discussed in Section 5.1.1 of this report. To date, site investigations have not identified evidence of other contaminated media (for example, groundwater, surface water, or building surfaces) that warrant early removal actions.

3. REMOVAL ACTION OBJECTIVES

The potential exists for disturbance and spread of soil contamination at the vicinity properties considered in this EE/CA. Examples of near-term activities that could result in such disturbance include road improvements, private construction activities, and utility construction and maintenance. The intent of the proposed removal action is to relocate the contaminated materials to an appropriately licensed permanent disposal facility, where appropriate environmental precautions are employed. Specifically, implementation of the proposed removal action would allow DOE to remove, transport, and safely dispose of contaminated soils and debris from properties where other activities (not involving DOE) are likely to result in spreading contamination and/or otherwise complicating ultimate cleanup measures. The specific objectives are defined in Sections 3.1 through 3.4 in terms of statutory limits, scope and purpose of the proposed action, schedule, and compliance with regulatory requirements.

3.1 STATUTORY LIMITS

Authority for responding to releases or threats of releases from a contaminated site is addressed in Section 104 of CERCLA. Executive Order 12580 delegates to DOE the response authority for DOE sites. Under CERCLA Section 104(b), DOE is authorized to undertake such investigations, surveys, testing, or other data gathering deemed necessary to identify the existence, extent, and nature of the contaminants present at the Maywood site, including the extent of threats to human health and the environment. In addition, DOE is authorized to undertake planning, engineering, and other studies and investigations appropriate to directing response actions to prevent, limit, or mitigate potential risks associated with the site. Removal actions which are appropriate prior to implementation of the final remedial action for the site may be authorized by DOE, as necessary, in accordance with the FFA.

3.2 SCOPE AND PURPOSE

The scope of the proposed removal action includes the removal, transportation, and permanent disposal of radioactively contaminated materials from 37 vicinity properties associated with the Maywood site. The specific objectives of this removal action include:

- Removal of radioactively contaminated materials from selected vicinity properties;
- Transportation of excavated materials to an appropriately licensed facility for permanent disposal;
- Minimization of potential health hazards to personnel performing the removal action;
- Restoration of the affected properties according to agreements established with each property owner; and

- Certification of the properties for unrestricted use - i.e., a property may be released without radiological restrictions if residual radioactive material does not exceed authorized concentration limits.

The primary purpose of the proposed action is to limit the potential for contaminant releases into the environment from these properties, and ensure the protection of human health and the environment. All activities would be conducted in a way to minimize the potential risks to on-site personnel performing the removal action. The timely and complete removal of contaminated materials from these vicinity properties would contribute to the efficient performance of comprehensive remedial actions being planned for the overall Maywood site.

3.3 SCHEDULE

The proposed removal action for the contaminated materials at the Maywood vicinity properties is scheduled to begin in FY1996. This removal action is estimated to require approximately three to four years for completion, depending on the availability of funding. If sufficient budgetary resources are not allocated to DOE during this period, the period for completion of the action could be extended; this schedule could also be delayed due to such other factors as unanticipated difficulties in waste transportation or the availability of disposal capacity. Site preparation, survey, and mobilization activities in support of the proposed removal action may begin prior to FY1996.

The schedule includes development of detailed work plans and health and safety plans, development of appropriate decontamination facilities, removal of the contaminated materials from each affected property, transportation of the contaminated materials for off-site disposal, backfilling excavated areas with clean soil, and restoration of the disturbed areas. Temporary relocation of residents at some affected properties also may be required. It is anticipated that activity will be suspended during the winter months due to inclement weather conditions.

3.4 COMPLIANCE WITH REGULATORY REQUIREMENTS

The proposed removal action will be carried out according to all environmental laws and requirements that are determined to be applicable or relevant and appropriate requirements (ARARs) to the maximum extent practicable. This includes federal laws as well as more stringent state standards. In addition to ARARs, "to-be-considered" guidelines (TBCs) may play a role in the selection and implementation of a preferred alternative; TBCs include standards identified in specific departmental orders, etc., which are not promulgated by law but may be significant for the proposed action. A compilation of potential ARARs and TBCs for the proposed removal action is presented in Appendix B. The final compilation of ARARs for the overall Maywood site will be published in the RI/FS for the site. The identification of potential ARARs and TBCs for the proposed removal action is based on the nature of the contamination (primarily soil contaminated with thorium-232), the nature of the proposed removal action, and the location of the site.

In accordance with CERCLA and the NCP, an alternative that does not meet an ARAR may be selected if one of several waiver conditions is met. One of these conditions is that the action is an interim measure and will become part of a total remedial action that will attain the requirement. This condition applies directly to the proposed removal action because this action is only part of the overall remedial action for the Maywood site. Moreover, compliance with ARARs may not be required for removal actions even when none of the specific waiver conditions is satisfied, based on consideration of factors such as the urgency of the situation and the scope of the removal action to be conducted.

Nevertheless, the proposed removal action will be conducted to comply with the substantive requirements of all ARARs to the maximum extent practicable. DOE will comply with all pertinent environmental requirements to ensure the protection of human health and the environment during implementation of the proposed action. Appropriate standards from the Occupational Safety and Health Act (OSHA) and other employee protection laws and guidelines also will be followed to protect workers during implementation.

4. REMOVAL ACTION TECHNOLOGIES AND ALTERNATIVES

This section summarizes the procedures and rationale used to identify alternatives for conducting the proposed removal action. It considers relevant technologies that could be implemented to achieve the removal action objectives specified previously. This process is consistent with the NCP and EPA guidance regarding removal actions. Because of the nature of the contaminated materials at the Maywood vicinity properties, the number of practical and suitable technologies that can be applied is limited. The technologies considered in selecting removal action alternatives include those identified in the NCP [40 CFR 300.415(d)], along with experience and information gained as a result of planning and implementing previous removal actions at the Maywood site and similar sites.

4.1 TECHNOLOGY IDENTIFICATION AND SCREENING

Technologies potentially applicable to the proposed removal action have been screened and evaluated on the basis of site-specific conditions at the Maywood site. The objective of the proposed removal action is to limit the potential for inadvertent spread of contamination and to ensure protection of human health and the environment. While the contaminated soils at the Maywood vicinity properties are not considered to present an immediate risk to human health or the environment, the proposed removal action would further reduce the potential for exposure to humans or the environment.

General response actions that may apply to the remediation and management of radiologically contaminated sites include institutional controls, containment, removal, treatment, interim storage, and disposal. Several of these technologies, however, are not applicable to the proposed removal action considered in this EE/CA. Alternatives for the proposed removal action were identified by considering applicable technologies within each general response action category, according to the guidelines of the NCP [40 CFR 300.430(e)]. The potential technologies were screened with regard to effectiveness, implementability, and cost. The identification and screening of the technologies that may apply to the proposed action are discussed below and key considerations are summarized in Table 4-1.

Institutional Controls

Institutional controls are measures that prevent or minimize public exposure by limiting access or use of contaminated areas. They may include physical barriers (such as fences), use or deed restrictions, and environmental monitoring. Such controls are not effective in reducing the toxicity, mobility, or volume of contaminants, but they may reduce the potential for exposures to contaminated materials. The NCP specifies that institutional controls may not be used as a substitute for active response measures as the sole remedy unless active measures are determined not to be practicable. Costs associated with institutional controls are generally low, but may increase significantly if it becomes necessary to purchase property. Public concerns and potential inconvenience to property owners could also result in difficulties in implementation;

TABLE 4-1. Summary of General Response Technology Screening

Technology	Evaluation Result	Comments
Institutional Controls		
Use or deed restrictions	Rejected	Limits on-site exposure to contaminants, but not effective in controlling the source or migration of contaminants; may be effective when used in conjunction with other technologies. Difficult to implement at privately owned properties.
Access restrictions	Rejected	Limits on-site exposure to contaminants, but not effective in controlling the source or migration of contaminants; may be effective when used in conjunction with other technologies. Difficult to implement at privately owned properties.
Monitoring	Retained	Provides data for assessing control measures; may be effective when used in conjunction with other technologies. An extensive environmental monitoring program is in place at MISS. Comprehensive environmental and personnel monitoring would be implemented throughout the proposed removal action.
Containment		
In-situ (capping)	Rejected	Can reduce contaminant mobility and mitigate potential exposures; contaminant toxicity and volume would not be reduced. Nature of contamination in noncontiguous areas on multiple properties would make this option ineffective at these properties. Institutional issues would present difficulties in implementation at privately owned properties.
Removal		
Excavation	Retained	Easy to implement, using conventional earth-moving equipment. Would allow use of remediated area without restrictions. Requires storage or disposal facility for excavated wastes and access restrictions during excavation.
Decontamination/ Demolition	Retained	While no contaminated structures are associated with these vicinity properties, it is possible that some below-ground building surfaces (e.g., foundations, basement walls) may require decontamination.

TABLE 4-1 (Continued)

Technology	Evaluation Result	Comments
Treatment		
Chemical/Physical Treatment	Rejected	Treatment alternatives for the Maywood site will be fully evaluated in the RI/FS process. Not applicable for the proposed removal action due to administrative feasibility issues and potential delays in implementation.
Interim Storage		
Existing on-site facility	Rejected	Can effectively protect human health and the environment in the short term by reducing contaminant mobility and limiting exposures while a permanent remedy is developed. The MISS waste pile, which provides interim storage for contaminated materials from previous removal actions, is currently undergoing a separate removal action.
Off-site	Rejected	No suitable off-site interim storage facility is currently available and development of a new facility would be prohibitively expensive and time-consuming.
Disposal		
On-site	Rejected	Permanent disposal of the Maywood site wastes will be fully evaluated in the RI/FS process. No on-site disposal alternative is available for the proposed removal action and would be inappropriate due to the potential for biasing waste management evaluations in the RI/FS.
Off-site	Retained	Off-site commercial disposal facilities are currently licensed to accept 11e(2) byproduct material such as the wastes from these Maywood vicinity properties. Off-site disposal at an existing DOE disposal facility is also plausible, but no such facility is currently in agreement to accept the Maywood site wastes. Siting of new disposal facilities is not considered to be a viable option within the time frame of the proposed removal action.

since none of the vicinity properties considered here are owned by DOE, the implementability of institutional controls would be severely limited. Therefore, institutional controls are eliminated from further consideration.

Containment

Containment technologies are designed to keep contaminated materials at their current locations. The purpose of containment is to reduce contaminant mobility and the potential for contaminants to move off-site. Containment technologies, in and of themselves, do not typically reduce the toxicity or volume of contaminants, but they may be effective in reducing contaminant mobility. Costs associated with containment technologies are considered moderate.

Containment technologies, particularly capping, are considered impractical for the vicinity properties considered here, due to the nature of the contamination in small noncontiguous deposits in many cases. Also, the non-DOE ownership of these properties may limit the ability to ensure the long-term integrity of the containment system, and public concerns (e.g., inconvenience to property owners) could result in difficulties in implementation. Therefore, containment is eliminated from further consideration.

Removal

Removal of contaminated materials from a site can effectively reduce contaminant mobility and potential exposure. Contaminated soil and debris may be removed from the Maywood vicinity properties considered here using conventional equipment such as backhoes, bulldozers, scrapers, and front-end loaders; manual excavation techniques may be required in areas with limited access for conventional equipment or where the contaminated area may be very limited. These technologies are reliable, can be easily and economically implemented with standard construction procedures and conventional equipment, and have been used extensively to control radioactive contamination similar to that associated with these properties. Because the scope of the proposed removal action primarily involves the cleanup of contaminated soils, excavation is identified as an applicable removal technology, and is retained as a possible component of the action alternatives.

Treatment

Treatment includes a wide range of technologies, only a limited number of which are applicable to radioactively contaminated materials. Radioactive waste treatment technologies can be categorized as those that remove the radioactive material from the waste matrix, and those that change the form of the waste, thereby reducing the toxicity, mobility, or volume of the contaminants. Treatment technologies identified as potentially applicable for the Maywood site are being fully evaluated in the RI/FS process for the site, including treatability studies for technologies that appear particularly promising. However, these studies are not expected to be completed by the desired initiation date for the proposed removal action, and the poor administrative feasibility of treatment for the soils from these vicinity properties could delay the

implementation schedule. Therefore, treatment of contaminated materials from the vicinity properties is eliminated from further consideration.

Interim Storage

Interim storage involves the temporary placement of contaminated materials in a manner that effectively protects human health and the environment until the final treatment or disposal of the materials can be determined. Interim storage can be achieved by placing the contaminated materials in an existing engineered facility or in a newly constructed facility. Costs range from low, if existing storage capacity is available, to moderately high, if construction of a new facility is required.

Contaminated materials from previous removal actions at the Maywood site are currently in interim storage at MISS. A separate removal action is currently underway to transfer these waste materials to a permanent disposal facility. Interim storage of the contaminated materials excavated from the vicinity properties considered in this EE/CA at the MISS waste pile would be inconsistent with this ongoing removal action for the waste pile. Interim storage in a newly constructed facility would be impractical on the basis of cost and implementation time. Therefore, interim storage is eliminated from further consideration.

Disposal

Disposal involves the permanent placement of contaminated materials in a manner that reduces contaminant mobility and protects human health and the environment for the long term. This technology can effectively reduce contaminant mobility and the potential for human exposure.

Alternatives for ultimate disposal of wastes from the overall Maywood site are being fully evaluated in the RI/FS process for the site. The disposal considerations for the proposed removal action are independent of the remedial action decisions regarding disposal for the overall Maywood site, and will not bias that process. Some potential disposal alternatives with lengthy time requirements (such as siting and developing a new facility, either on-site or off-site) may be appropriate for the site-wide disposal evaluation but would not be appropriate for the proposed removal action. The only disposal option considered available within the desired time frame, and which is therefore retained for further consideration in this analysis, is a licensed commercial disposal facility. Commercial disposal is currently available for the wastes from the Maywood vicinity properties, which are classified as 11e(2) byproduct material, at the Envirocare facility at Clive, Utah, and additional facilities may be available prior to implementation of the proposed removal action. Disposal costs, including transportation to the disposal facility, are considered moderate to high.

4.2 IDENTIFICATION OF PRELIMINARY ALTERNATIVES

The preliminary screening of potentially applicable technologies resulted in identification of the following technologies as potential components of removal action alternatives: removal of contaminated materials from the affected vicinity properties and disposal at a licensed commercial facility. The screened technologies have been grouped into the following preliminary alternatives for the proposed action:

- Alternative 1: No action. Remedial action for the vicinity properties would be delayed until the record of decision (ROD) for the Maywood site is issued.

- Alternative 2: Expedited removal of the contaminated materials from the affected vicinity properties, followed by transport of the wastes for off-site commercial disposal. This alternative includes access restrictions and increased environmental and personnel monitoring during construction and restoration activities.

5. EVALUATION OF ALTERNATIVES

The proposed removal action is an early action with regard to the overall remedial action planned for the Maywood site. The primary purpose of this removal action is to limit the potential for inadvertent spread of contamination and to ensure protection of human health and the environment. The alternatives identified in Section 4.2 are evaluated below with respect to effectiveness, implementability, and cost.

5.1 EFFECTIVENESS

The effectiveness of an alternative is defined by its ability to protect human health and the environment from risks associated with the contamination in both the short term and the long term. Measures of effectiveness include (1) reduction of potential risks to human health and the environment; (2) compliance with regulatory requirements; (3) timeliness; and (4) reduction of contaminant toxicity, mobility, and volume through treatment.

5.1.1 Potential Health Impacts

Under Alternative 1, no action would be taken until a final decision is made regarding remediation of the overall Maywood site. This alternative involves no immediate change in current exposures to radioactive materials at the site. An analysis of the potential risks to human health and the environment under current conditions at the Maywood site is provided in the Baseline Risk Assessment (BRA) for the site (DOE 1993). The BRA analysis predicts a potential radiation dose of <1 to 246 mrem/year to current receptors at the vicinity properties considered in this EE/CA. Under a future use scenario where a residence is established on the unremediated portion of the Ballod property, potential doses could be up to 2800 mrem/yr. These estimates are based upon conservative (health protective) assumptions and are considered to represent reasonable worst case conditions.

Under Alternative 2, contaminated soil and debris would be removed and transported off-site for disposal. Under this alternative, potential risks to human health and the environment at these properties would be reduced because the contaminated materials would be removed from their present uncontrolled locations and placed in an engineered facility designed for permanent disposal. The potential for human exposure to contaminants would be reduced in both the short and the long term under Alternative 2 because the source of contamination would be removed.

Worker Radiation Dose and Health Risk. Potential worker exposures would increase in the short term during the removal action period for Alternative 2. The primary exposure pathways would include inhalation of contaminated dust and external gamma radiation. All activities associated with the implementation of Alternative 2 would be conducted according to the site-specific health and safety plan to protect workers and the public. The potential radiation doses to workers conducting the removal action would be kept as low as reasonably achievable (ALARA) by strict compliance with environmental, safety, and health protection guidelines and appropriate engineering practices for radiation protection.

The potential radiation dose to workers implementing the proposed removal action was estimated using the RESRAD computer code (Yu et al., 1993). For the purpose of this evaluation, radionuclide concentrations in contaminated soils were considered separately for the Ballod property and all other residential and municipal properties considered in this EE/CA due to the much higher contaminant concentrations at Ballod. Average soil concentrations for the residential vicinity properties are 11.3 pCi/g for thorium-232, 10.6 pCi/g for uranium-238, 1.25 pCi/g for radium-226, whereas concentrations at the Ballod property averaged 185 pCi/g for thorium-232, 228 pCi/g for uranium-238, and 0.86 pCi/g for radium-226 (DOE 1993). In each case, short-lived decay products are assumed to be in equilibrium with the parent radionuclide, and uranium-235 and its decay products are assumed to be present at 5% of uranium-238 concentration, based on typical isotopic distributions for natural uranium. Potential exposure pathways considered in this evaluation included external gamma exposure, inhalation of contaminated dust and radon gas, and incidental ingestion of contaminated soil. It was assumed that the hypothetical worker receiving the maximum exposure would spend a maximum of 1500 hours per year (8 hours/day x 5 days/week x 9 months/year) in the contaminated area at the residential and municipal vicinity properties. For the remediation of the Ballod property, a total exposure duration of 500 hours was assumed. It was assumed that the remedial action worker would have a breathing rate of 1.2 m^3/hour, and would be exposed to an average concentration of contaminated particulates in air of 100 $\mu g/m^3$. The worker was also assumed to ingest contaminated soil at a rate of 100 mg/day as a result of incidental hand-to-mouth contact.

The maximum radiation dose to the hypothetical worker from exposure to site contaminants during removal activities at the residential and municipal vicinity properties was estimated at 38 mrem/year (32 mrem/year from external gamma exposure and 5 mrem/year from inhalation of contaminated dust). This estimate is well below the DOE limit of 5,000 mrem/year for occupational exposure (10 CFR 835) and also below the DOE primary dose limit for the public of 100 mrem/yr (DOE 1990). This radiation dose would result in an incremental lifetime cancer risk of approximately 1 x 10^{-5} (i.e., the risk of getting cancer resulting from this radiation exposure over the remainder of the worker's lifetime would be approximately 1 in 100,000).

The maximum dose to a hypothetical remedial action worker at the Ballod property was estimated at 198 mrem/year (165 mrem/year from external gamma exposure, 30 mrem/year from inhalation of contaminated dust, and 3 mrem/year from incidental ingestion of contaminated soil). This estimate is still well below the DOE limit of 5,000 mrem/year for occupational exposure but above the 100 mrem/year limit for the public. This radiation dose would result in an incremental lifetime cancer risk of approximately 5 x 10^{-5} (i.e., the risk of getting cancer resulting from this radiation exposure over the remainder of the worker's lifetime would be approximately 5 in 100,000). Exposure assumptions are summarized in Appendix C.

These dose estimates to the hypothetical worker experiencing the maximum exposure are based on very conservative (health protective) exposure assumptions. They do not take into

Table 5-1. Estimated Radiation Dose and Health Risk to Hypothetical Receptors (Alternative 2).

Receptor	Radiation Dose (mrem/yr)				Incremental Cancer Risk
	External Gamma	Particulate Inhalation	Soil Ingestion	Total	
Removal Action Worker					
Residential/Municipal VPs	32	5	< 1	38	1×10^{-5}
Ballod Property	165	30	3	198	5×10^{-5}
Member of the Public					
During Removal Action	NA	< 5	NA	< 5	4×10^{-7}
Following Removal Action	< 1 - 4	< 1	< 1	< 1 - 6	$< 4 \times 10^{-6}$

NA = Not Applicable - no significant exposure via this pathway for the public.

account mitigative measures (such as dust suppression, respiratory protection, protective clothing) which would be used during the proposed removal action. The potential radiation doses to workers performing the removal action would be kept as low as reasonably achievable (ALARA) by appropriate health physics practices and by strict compliance with DOE environmental, safety, and health protection guidelines. Mitigative measures would be implemented to minimize the amount of airborne contamination. Workers also would wear respiratory protection equipment, if necessary, to reduce the likelihood of inhaling contaminated particulates, and lapel air monitors would be worn to verify the safety of the working environment. A comprehensive personnel dosimetry program would be implemented to monitor all radiation exposures and doses to workers throughout the removal action. Therefore, actual exposures and risks would be significantly lower than the estimates presented above.

General Public Radiation Dose and Health Risk. During construction and transportation activities associated with Alternative 2, a resident or employee at a nearby property could receive a radiation dose above normal background exposure. The primary exposure pathway for the off-site public would be inhalation of contaminated dust. The dose to the off-site receptor from external gamma radiation would be negligible because the external gamma exposure rate decreases rapidly with distance from the source.

The radiation dose to the maximally exposed member of the public during the removal action, therefore, would be bounded by the inhalation dose to the removal action worker discussed previously. The maximum incremental radiation dose to the general public from implementation of the proposed removal action is estimated to be less than 5 mrem/year for Alternative 2. This dose is very small relative to the dose received from background sources of radiation. It is also well below the dose limit of 100 mrem/year for the public and the pathway-specific limit of 10 mrem/year for airborne releases (40 CFR 61). The lifetime incremental cancer risk resulting from this radiation exposure is estimated to be approximately 4×10^{-7} (4 in 10,000,000). Appropriate health physics practices and engineering measures (e.g., wetting the soil) would be employed during all excavation, transportation, and disposal activities to minimize airborne releases of radioactivity and protect the public from unnecessary exposure.

Under Alternative 2, the residual radiation exposure to the public would be reduced from current conditions following completion of the removal action. Under typical residential conditions, the radiation dose to a resident at the remediated properties is estimated in the range <1 to 6 mrem/yr (see Appendix C). The lifetime incremental cancer risk from this exposure would be approximately 4×10^{-6} (4 in 1,000,000).

Under Alternative 2, wastes would be transported from the vicinity properties to the MISS property by truck, and loaded onto rail cars for transport to the off-site disposal facility using the on-site rail spur. This transport of contaminated materials from the vicinity properties to the MISS rail spur could result in an increase in local traffic during the implementation period. However, due to the limited volume of contaminated materials expected to be excavated at most of these vicinity properties and logistics of the removal activities, the increase in local truck traffic is expected to be relatively minor. The potential impact of any increased traffic would be mitigated by implementing traffic control measures, as necessary, including establishment of designated transportation routes and stationing of flagmen at appropriate locations. The occurrence of any spillage during transport is expected to be minimal, and, because of the nature of the cargo (soil), any spillage could easily be cleaned up and retrieved for disposal; the potential for radiation exposure of the general public resulting from spillage would be minimal.

While Alternative 2 would not directly reduce the volume or toxicity of contaminants, it would reduce contaminant mobility through improved containment in a permanent disposal facility. It would reduce the potential for release of contaminants from these properties into the environment and minimize the potential for exposure of the public.

The commercial disposal facility which would receive the contaminated materials removed from the Maywood vicinity properties operates under license to the Nuclear Regulatory Commission and state authorities. License conditions provide for the protection of public and worker health and the environment.

5.1.2 Potential Environmental Impacts

Soils and Water Resources. Under Alternative 1, no direct impacts to soils would occur. Alternative 2 also would be expected to have no long-term impacts on soil or water resources. However, some minor impacts could occur during the excavation of contaminated soils from the vicinity properties, as disturbed areas would be more likely to experience wind and water erosion. These temporary effects could be minimized by decreasing the area disturbed at any time during excavation operations, and by employing good engineering practices (such as sediment barriers to minimize the amount of sediment leaving the work area, and containment of surface runoff during storms).

Air Quality. Alternative 1 would result in no incremental impacts on air quality. Environmental monitoring activities at the site indicate no significant adverse air impacts from normal site operations (BNI 1993). Resuspension and dispersion of contaminated particulates

during excavation and transportation activities under Alternative 2 could impact local air quality during the short term. These impacts, however, would be eliminated after the removal action was completed. The potential for dust generation while implementing the removal action would be minimized by implementing good engineering practices (such as wetting and/or covering exposed surfaces, as appropriate, during the action period). Monitoring of ambient concentrations of airborne particulates and radon would be conducted throughout the removal action to ensure compliance with requirements to protect workers and the public.

Ecological Resources. Implementation of Alternative 1 would result in no physical changes to existing habitats and associated biota. However, the potential for spread of contamination into a larger area of the local environment due to mechanisms such as resuspension, runoff, and leaching, would continue, and the potential for exposure of local biota would remain. Alternative 2 could impact local biota as a result of disturbance of habitats during excavation and restoration activities. Animals inhabiting the vicinity properties and adjacent areas within sight or range of hearing of the construction or waste transportation operations might be temporarily disturbed or displaced. However, the Maywood site does not provide substantial wildlife habitats because of its urban nature. As a result, few animal species inhabit the property.

Vegetation in the contaminated areas of the vicinity properties would be disturbed during the excavation activities. However, the existing plant species are neither unique nor restricted in distribution, and disturbed habitats could be readily revegetated. Because the Maywood site supports only a few common species, the proposed removal action would have no significant harmful effect on plants or wildlife.

Threatened or endangered species would be unaffected by implementing any of the alternatives. Critical habitats for listed species are not present at the Maywood site, and no threatened or endangered species are known to inhabit the site.

Wetlands and Floodplains. It is DOE's policy to avoid adverse impacts on floodplains and wetlands to the extent possible (10 CFR 1022). Any remedial actions at the Maywood site will be carried out in compliance with Executive Order 11988, Floodplain Management, and Executive Order 11990, Protection of Wetlands, where applicable. Portions of four of the vicinity properties at the south end of Lodi Brook are located within the 100-year floodplain of the Saddle River (DOE 1992); a floodplain assessment consistent with the requirements of Executive Order 11988 and 10 CFR 1022 is provided in Appendix A. No wetlands would be impacted by the proposed removal action.

Cultural Resources. No archaeological sites or historic structures listed in the National Register of Historic Places would be affected by implementing any of the alternatives. A Stage IA Survey of the Maywood site has been completed and filed with the State Historic Preservation Office.

5.1.3 Compliance with Regulatory Requirements

The proposed removal action is an interim measure which would become part of the comprehensive remedial action for the Maywood site that will attain all applicable or relevant and appropriate requirements. Under Alternative 1, concentrations of radioactive contaminants in surface and subsurface soils at these properties would continue to exceed applicable criteria, awaiting final remediation of the property. Alternative 2, however, would include excavation of all contaminated soils exceeding these guidelines at these properties, and therefore would satisfy contaminant-specific ARARs. Alternative 2 would be conducted in a manner that would follow pertinent environmental requirements and protect human health and the environment during implementation of the removal action. Appropriate OSHA standards and other employee protection laws and guidelines also would be followed to ensure worker protection during implementation, and compliance with all action-specific and location-specific ARARs.

5.1.4 Timeliness

Alternative 2 would result in expedited remediation of the Maywood vicinity properties. The only practical constraint on the speed with which Alternative 2 could be implemented is the availability of funding resources. Under Alternative 1, no action would be taken to remediate these vicinity properties before the comprehensive remediation of the overall Maywood site. Alternative 2, therefore, is more timely than Alternative 1.

5.1.5 Reduction of Contaminant Toxicity, Mobility, and Volume Through Treatment

Section 121 of CERCLA specifies a statutory preference for remedial actions that use treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume of the hazardous substances as a principal element. Because of the nature of the primary contaminant of concern in the contaminated soils (thorium-232 and its associated decay products), treatment for reduction of toxicity is not feasible. Therefore, only treatment to reduce contaminant mobility and/or volume may be considered. None of the alternatives considered here include treatment as a principal element.

5.2 IMPLEMENTABILITY

The implementability of an alternative is defined by its technical feasibility, availability, and administrative feasibility. Technical feasibility refers to the ability to construct, operate, maintain, replace, and monitor an alternative's technical components. The demonstrated performance of technical components is also considered, as are potential constraints associated with the site environment. Availability of services and materials refers to the resources required to implement specific components of an alternative and the ability to obtain them. Administrative feasibility addresses the acceptability of an alternative by other agencies, and how well it satisfies specific project requirements (such as budget, schedule, and efficient performance of the overall remedial action planned for the site).

5.2.1 Technical Feasibility

Technical feasibility does not apply to Alternative 1, the no-action alternative. The components of Alternative 2 are technically feasible and have been implemented for similar actions. Excavation of the contaminated materials from the Maywood vicinity properties is technically feasible using readily available equipment. Its performance has been demonstrated during past removal actions at the Maywood site and other sites.

Commercial disposal of the waste materials excavated from the vicinity properties is technically feasible and would reduce potential contaminant mobility. Commercial disposal of 11e(2) wastes is currently available at the Envirocare facility in Clive, Utah, and additional facilities may be available prior to implementation of the proposed removal action. All commercial radioactive waste disposal facilities are required to maintain comprehensive environmental monitoring and occupational health physics programs as a license condition.

5.2.2 Availability of Services and Materials

Availability does not apply to Alternative 1, the no-action alternative. The services and materials required to implement Alternative 2 are readily available.

5.2.3 Administrative Feasibility

Administrative feasibility considerations include the potential of a proposed action to achieve response objectives and to satisfy state and local concerns. These concerns include permitting and interagency cooperation, public and occupational safety, transportation factors, impacts on land use and values, compliance with policies and requirements, and public acceptance. The NCP specifies that a formal community relations plan be developed to provide information to the public and to obtain public comment. A site-specific community relations plan has been developed for the Maywood site (BNI 1992).

State and local authorities and citizens have indicated a strong preference for removal and off-site disposal of contaminated materials from the Maywood site. Since Alternative 2 achieves this objective, it is expected to have favorable administrative feasibility. Alternative 1 would not address community concerns in any manner. Short-term negative impacts on the community during implementation of Alternative 2 would include traffic and noise associated with removal and transportation of the contaminated materials; these impacts would be mitigated by conducting all activities according to pertinent regulatory requirements, by using good engineering practices, and through an active community relations program.

No administrative feasibility issues are anticipated with respect to commercial disposal of the waste. The waste volume associated with this proposed removal action would be a small fraction of the total waste capacity of the commercial disposal facility.

Removal activities conducted under Alternative 2 would be conducted with the approval of the affected local authorities. All response activities at the Maywood site are coordinated with EPA Region II and state and local government authorities. Active communications would be maintained with the public, local media, EPA, and state and local officials, as specified in the community relations plan for the site.

5.3 COST

The costs of alternatives are considered only in a comparative manner to determine if the cost of one alternative is much greater than that of another alternative of similar effectiveness. General estimates of potential costs for each alternative can be compared to permit a screening according to relative costs. Funds from DOE, not from EPA's Superfund, would be used to implement the proposed removal action. Because the proposed action would be completed within a few years, present value considerations would not appreciably affect cost estimates; cost estimates for this analysis assume no discount or escalation.

For Alternative 1 (No Action), no direct incremental costs would be incurred. This alternative would only defer the costs associated with remediation of the vicinity properties until the ultimate remediation of the overall Maywood site.

The total cost of implementing Alternative 2 is estimated at approximately $ 45,000,000. This estimate includes all direct and indirect costs, including subcontracts, engineering, environmental health and safety support, procurement, overhead, and contingencies. The cost estimates for waste transportation ($135/yd^3) and disposal ($206/yd^3) are specific to the Envirocare facility in Clive, Utah, based on current estimates. A volume of contaminated soil and debris to be excavated from the affected vicinity properties is estimated to be 28,613 yd^3. Assuming an expansion factor of 30%, approximately 37,197 yd^3 of contaminated materials would be transported for off-site disposal. Costs for excavation, loading, transportation and disposal of the contaminated materials from the vicinity properties are the primary cost elements for Alternative 2. Additional cost elements include site preparation activities, mobilization and demobilization expenses, medical monitoring, training, engineering, health and safety support, restoration of the disturbed areas, subcontract costs (such as analytical laboratory and civil survey costs), contingencies, and program management costs. Additional cost detail is provided in Appendix D.

5.4 COMPARATIVE SUMMARY

The two alternatives for managing contaminated materials at the Maywood vicinity properties were compared on the basis of effectiveness, implementability, and cost. This comparison is summarized in Table 5-2.

TABLE 5-2. Comparative Analysis of Removal Action Alternatives

Alternative	Effectiveness	Implementability	Cost
Alternative 1: No action	No immediate change in impacts on human health and the environment. Contaminant concentrations in soil at the vicinity properties would remain above site-specific criteria.	Technical Feasibility and Availability not applicable. Administrative Feasibility is unfavorable, since this alternative does not achieve response objectives or satisfy state and local concerns.	No direct cost
Alternative 2: Expedited removal of contaminated material from the Maywood vicinity properties and off-site commercial disposal	Eliminates long-term impacts to human health and the environment due to contaminants above site-specific criteria at these vicinity properties; minor short-term impacts during the removal action can be effectively mitigated.	Technical Feasibility would be straightforward, using readily available equipment and standard engineering practices. Administrative Feasibility is expected to be very favorable, as this alternative achieves response objectives and satisfies state and local concerns.	$ 45 Million

Alternative 1 would provide for no cleanup action to be taken. This Alternative is technically implementable; however, it is not effective, since it would provide no improvement in the control of contaminated materials. While it has no direct incremental cost, costs for site maintenance, surveillance, and monitoring would continue to accumulate indefinitely.

Alternative 2 would include expedited removal of contaminated materials from the vicinity properties and permanent disposal at an appropriately licensed commercial facility. This Alternative would be more effective in providing permanent control of contaminated materials from the vicinity properties. Alternative 2 would use technically feasible methods for the removal of contaminated materials from the affected properties, using readily available equipment. Commercial disposal of the waste generated from this removal action is technically feasible and currently available. Alternative 2 would have higher near-term costs for excavation, transportation, and disposal of the contaminated materials; however, the overall costs for remediation of the Maywood site could be reduced by preventing the inadvertent spread of contaminants from these vicinity properties.

Because the excavation and disposal activities under Alternative 2 would be implemented according to all regulatory requirements and good engineering practices, these activities are not expected to meet serious institutional obstacles. The potential short-term environmental consequences associated with Alternative 2 from the temporary disturbance of the site soils can be minimized by using good engineering practices during the action period. The long-term environmental consequences associated with this alternative would be beneficial, because the relocation of the radioactive materials from the current uncontrolled locations to a permanent disposal facility would reduce the potential for release of contaminants to the environment and minimize potential exposure to these materials.

5.5 IDENTIFICATION OF THE PROPOSED ALTERNATIVE

Based on an evaluation of the alternatives for the proposed removal action, DOE proposes to select Alternative 2 as the most technically feasible, effective and timely alternative, which best addresses community concerns. Under Alternative 2, the contaminated materials at the specified vicinity properties would be excavated and transported to an off-site commercial disposal facility. This alternative would present no unacceptable risk to public health and the environment, and can be implemented in a timely, straightforward, and effective manner.

The proposed removal action is consistent with CERCLA, which requires that interim actions contribute to the extent practicable to the efficient performance of any anticipated final remedy. The analysis presented in this EE/CA demonstrates that the proposed action can be implemented in a manner that protects human health and the environment. The proposed removal action is consistent with the overall cleanup strategy for the Maywood site, and will not limit the choice of reasonable alternatives or prejudice the ultimate decision for which the RI/FS is being prepared.

6. PROPOSED ACTION

Under the proposed removal action, contaminated soils and debris at Maywood vicinity properties contaminated with radioactive materials exceeding DOE cleanup criteria will be removed and transported to an off-site commercial disposal facility. The approximate boundaries of excavation on each property will be established based on existing radiological data, supplemented by additional radiological survey activities conducted prior to and during excavation. Each property owner's consent to remove the contaminated soil from the property will be secured through an access agreement defining DOE's responsibilities and liabilities with regard to the cleanup. The environment at each vicinity property will be monitored throughout the removal action to ensure that all pertinent requirements are met. Appropriate measures will be employed to reduce potential adverse impacts on the environment and minimize health risks (see Table 6-1).

Conventional excavation equipment will be used to remove the contaminated soil and debris from each affected property. Excavation will be performed with the hand tools or machinery appropriate to the quantity of soil to be removed and the depth at which contaminated soil is found. As excavation proceeds, field personnel will monitor the levels of radioactive contamination in the excavation area, to estimate when soils contain levels of contamination below the site-specific cleanup criteria. Soil samples will be collected from the excavated areas to confirm that the residual radioactivity is at acceptably low levels. All samples will be analyzed to determine that the site-specific cleanup criteria for thorium-232 and radium-226 (the primary radioactive contaminants) have been achieved - i.e., residual concentrations may not exceed 5 pCi/g above background for thorium-232 and radium-226 combined, averaged over any area of 100 m^2 and any 15-cm depth interval. Selected samples will also be analyzed for a broader spectrum of potential contaminants of concern.

Upon determination that contaminated soil above criteria has been removed, the excavated areas will be backfilled with clean soil. Local backfill sources will be reviewed and sampled, as required, to ensure that the fill material does not pose a health threat. The affected areas will be restored according to the agreement established with each property owner (e.g., establishment of grass, repair of asphalt or concrete surfaces, fence repair or replacement, etc.). Samples also will be collected from the excavated wastes for analysis to assure compliance with the waste acceptance criteria of the disposal facility.

Wastes will be packaged and shipped according to the waste acceptance criteria of the disposal facility, as well as applicable requirements of DOE, U.S. Department of Transportation (DOT), and New Jersey transportation regulations. Excavated materials from the vicinity properties will be placed in trucks for transport to the on-site rail spur at MISS, where they will be loaded into rail cars for transport to the disposal facility by rail in bulk form. Appropriate precautions will be used to prevent the spread of contamination.

Table 6-1. Major Mitigative Measures for the Proposed Action

Mitigative Measure	Features
Dust Control	Dust suppressants (e.g., water sprays, foam application) will be used during all activities having the potential for generating significant quantities of airborne particulates.
Worker Protection	An operational environmental safety and health plan will be developed for the proposed removal action. Respiratory protection equipment and other appropriate personnel protective equipment will be used, as necessary. All workers will wear protective clothing and will pass through an access control point for radiological scanning prior to leaving the site. A comprehensive radiation monitoring and personnel dosimetry program will be implemented.
Environmental Monitoring	Gamma radiation levels and airborne contaminant concentrations (particulates and radon) will be monitored in the general work area and at the site perimeter to protect both workers and the general public. Appropriate responses, such as increasing engineering controls, will be taken if measured contaminant levels approach project administrative control limits. Contaminant releases to air and surface water off-site will be minimized by implementing appropriate engineering controls.
Equipment Inspection	Equipment used for excavation, processing, and transportation of contaminated materials will be routinely inspected during operations. Equipment will be decontaminated, as necessary, to prevent inadvertent spreading of contamination into uncontrolled areas.
Run-on/run-off Controls	Surface water run-on will be controlled by temporary berms or other diversion structures. Migration of contaminants through run-off will be mitigated by sediment filters or siltation fences.
Access Restrictions	Access to work areas will be restricted, and current access controls at MISS will be maintained. All workers will pass through an access control point for radiation scans to prevent radioactive materials from leaving the site.
Traffic Control	Transportation routes will be established for truck traffic transporting contaminated materials from the affected vicinity properties to the MISS rail spur. Flagmen will be stationed at appropriate locations as necessary to assure trucks enter and leave the site safely.

The exteriors of all vehicles will be surveyed for radioactive contamination, and any vehicles exceeding applicable contamination guidelines will be decontaminated before going onto public roads. Transportation routes will be established, and an emergency response plan will be developed and coordinated with appropriate local fire and police departments. During all truck travel on public roads, truck beds will be covered by tarpaulins to contain contaminated materials and avoid dust generation and release. The excavated materials are not expected to be classified as radioactive under DOT guidelines, because the activity concentrations are expected to be well below 2,000 pCi/g, the lower limit established by the DOT for defining radioactive materials.

The removal action will be conducted in a phased approach to remediate logical groupings of properties (e.g., groups of adjacent properties) in a sequential manner. This approach will be designed to minimize disturbance to property owners and maximize the efficiency and safety of construction activities. To the extent practicable, excavation and construction activities will be carried out to minimize the disturbance of important site features, such as mature trees, buildings and structures, and to accommodate specific concerns of the property owners. Temporary relocation of residents will be provided, where appropriate, during the excavation and construction period.

In situations where limited areas of soil contaminated above criteria are present only as subsurface lenses beneath a much larger layer of clean soil or beneath building foundations, detailed property-specific analyses will be developed to evaluate the potential for leaving these materials in place; such supplemental criteria would be recommended on a case-by-case basis only where they would present no unacceptable risks to human health or the environment, as documented in property-specific hazard assessments, and would be coordinated with EPA and state regulatory authorities. Similarly, residual concentrations of thorium and radium could exceed 5 pCi/g in small localized areas, so long as the average concentrations remain below this limit (DOE 1990). For example, such criteria might be applied in the case of a localized area of subsurface soil contamination beneath a large tree.

In summary, the proposed removal action will include the following activities:

(1) Preparation of detailed work plans/instructions and health and safety plan.

(2) Preparation of appropriate decontamination facilities to clean equipment and tools used in excavation and transport activities.

(3) Delineation of approximate boundaries of contamination to be excavated at each property. Activities may include additional radiological surveys to supplement existing data, as needed, and establishment of control areas surrounding excavation sites to meet health and safety requirements.

(4) Excavation of contaminated materials exceeding site-specific cleanup criteria from the affected vicinity properties.

(5) Analysis of samples of the excavated materials to confirm compliance with regulatory requirements and waste acceptance criteria of the disposal facility.

(6) Loading of excavated materials into trucks for local transport to the on-site rail spur at MISS.

(7) Transfer of excavated materials into railcars at the MISS rail spur. Staging operations will be conducted to limit the volume of wastes awaiting shipment to 1000 yd^3 at any time, and to ship all staged wastes prior to the end of any construction season.

(8) Rail transport to the off-site commercial disposal facility for permanent disposal.

(9) Survey and sampling of excavated areas to verify that site-specific cleanup criteria have been achieved.

(10) Restoration of excavated areas with clean soil, revegetation, etc., in accordance with the agreement established with each property owner.

(11) Environmental monitoring will be implemented throughout the removal action to ensure compliance with all pertinent requirements. Appropriate mitigative measures will be used to reduce potential adverse environmental impacts and health risks (Table 6-1).

7. PUBLIC PARTICIPATION: HOW TO PARTICIPATE IN THE DECISION-MAKING PROCESS

The public, U.S. Environmental Protection Agency, New Jersey Department of Environmental Protection, and other state and local government officials are invited to review this document. Written comments on the document and DOE's preferred alternative may be submitted during a 30-day public comment period which begins July 17, 1995, and ends August 16, 1995.

Information repositories and administrative record files for the Maywood site have been established at the following locations:

- Maywood Public Library, 459 Maywood Avenue, Maywood, NJ;
- DOE Public Information Center, 43 West Pleasant Avenue, Maywood, NJ.

Copies of this EE/CA document are available at each of these locations. Copies of the document also will be provided by mail upon request by calling DOE's toll-free number at 1-800-253-9759.

DOE will evaluate and respond to comments received during the public comment period. DOE is especially interested in input regarding the preferred alternative and any considerations for carrying out the proposed action. Final selection of an alternative will not be made until comments have been evaluated and concerns have been addressed. Written comments should be addressed to:

Susan M. Cange, Site Manager
U.S. Department of Energy
Former Sites Restoration Division
Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, TN 37831-8723

8. REFERENCES

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APPENDIX A

FLOODPLAIN ASSESSMENT FOR REMOVAL OF CONTAMINATED MATERIALS FROM VICINITY PROPERTIES AT THE MAYWOOD SITE

FLOODPLAINS AND WETLANDS ASSESSMENT FOR THE PROPOSED REMOVAL ACTION

B.1 INTRODUCTION

The Maywood site is comprised of properties in the boroughs of Maywood and Lodi and the township of Rochelle Park in Bergen County, New Jersey. The site includes the Maywood Interim Storage Site (MISS) and several vicinity properties, including the adjacent Stepan Company property and numerous residential, commercial, and governmental properties. MISS is owned by the U.S. Department of Energy (DOE) and is used for the storage of radiologically contaminated soil removed from several vicinity properties during previous interim actions. Radiological contamination at the Maywood site resulted from thorium processing operations conducted at the former Maywood Chemical Works (MCW) from 1916 to 1959, and the transport of radioactive materials by natural processes (i.e., air and water) and its relocation through human activities. Responsibility for the Maywood site was assigned to DOE by Congress under the Energy and Water Development Act of 1984.

This assessment evaluates the potential floodplains and wetlands impacts of an interim removal action proposed by DOE to be conducted at vicinity properties associated with the Maywood site. It serves to inform the public of the proposed removal activities and to present measures or alternatives to the proposed action which may lessen or mitigate adverse impacts, in accordance with the requirements of 10 CFR 1022. A Notice of Involvement was previously published in the Federal Register on July 6, 1993 (58 FR 36192), announcing that DOE was in the process of proposing options for the remediation of radiological contamination at the Maywood site. Four of the vicinity properties affected by the proposed removal action are located within the 100-yr floodplain of the Saddle River (99 Garibaldi Avenue, 106 Columbia Lane, Fireman's Memorial Park, and J.F. Kennedy Park); the 100-yr flood was chosen as the criterion of evaluation for floodplain effects because no critical actions, as defined in 10 CFR 1022, would occur as a result of the remediation of the Maywood site. Although wetlands are present within some areas of the Maywood site, no wetlands are present at the vicinity properties considered for the proposed removal action and no wetlands would be impacted by the proposed removal action.

B.2 PROPOSED ACTION

The DOE proposes to remove contaminated soil and debris from 37 non-DOE-controlled vicinity properties and transport these materials to a permanent disposal facility. These properties include 31 residential vicinity properties (one of which has been partially remediated), the unremediated portion of the Ballod property, three parks, a fire station, and a highway right-of-way. Although the contaminated materials at these properties are believed to pose no significant near-term threats to the public or the environment, DOE has determined that expedited response action to remove these materials (i.e., prior to remediation of the entire Maywood site) would reduce the potential for release of contaminants from these properties into the environment and minimize the related threats to human health and the environment. DOE

previously removed contaminated materials from 25 residential vicinity properties at the site during 1984 through 1986, and the proposed action would complete cleanup actions for all residential vicinity properties associated with the Maywood site.

This proposed action is one component of a comprehensive cleanup program planned for the Maywood site. Implementation of the remaining comprehensive cleanup measures will follow the completion of a remedial investigation/feasibility study (RI/FS) process. The RI/FS process will conclude with the issuance of a record of decision (ROD) that will identify the selected remedy for all contamination present at the Maywood site. The RI/FS process is being conducted according to the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA). In addition, DOE has chosen to integrate the values of the National Environmental Policy Act (NEPA), which assure that the socio-economic and potential cumulative impacts of a proposed action are considered as part of the decision-making process for that action. The proposed interim removal action is consistent with the overall cleanup strategy for the site.

B.3 FLOODPLAIN DESCRIPTION AND EFFECTS

The Saddle River is the major body of water into which the Maywood site properties drain, via Westerly Brook and Lodi Brook. Figure B-1 shows the site area, the drainage basins of Westerly and Lodi brooks, and the location of the Saddle River. Much of the original floodplains of Westerly Brook, Lodi Brook and Coles Brook are developed. The 100-yr floodplain for the Saddle River (including the southern end of Lodi Brook and the western end of Westerly Brook) is the only 100-yr floodplain (Figure B-2) in the immediate area that has been delineated on flood insurance maps by the Federal Emergency Management Agency (FEMA 1981 and 1984). The floodplains associated with the open channel portion of Westerly Brook north of MISS and Coles Brook are outside the 100-yr floodplain but within the 500-yr floodplain of the Saddle River (U.S. Department of Housing and Urban Development 1977). The proposed removal action would only affect properties in the floodplains of Lodi Brook and the Saddle River.

Lodi Brook is a perennial stream that begins in a low marshy area on commercial properties adjacent to MISS. From there, the brook flows southward through a box culvert, and remains underground except for small sections on both sides of Interstate 80, a small section along Route 17, and south of J.F. Kennedy Park. The brook joins the Saddle River downstream of the confluence of Westerly Brook and the Saddle River. Portions of four vicinity properties affected by the proposed removal action at the southern end of Lodi Brook are located in the 100-yr floodplain of the Saddle River (Figure B-2). These are the only properties associated with the proposed removal action within a 100-yr floodplain.

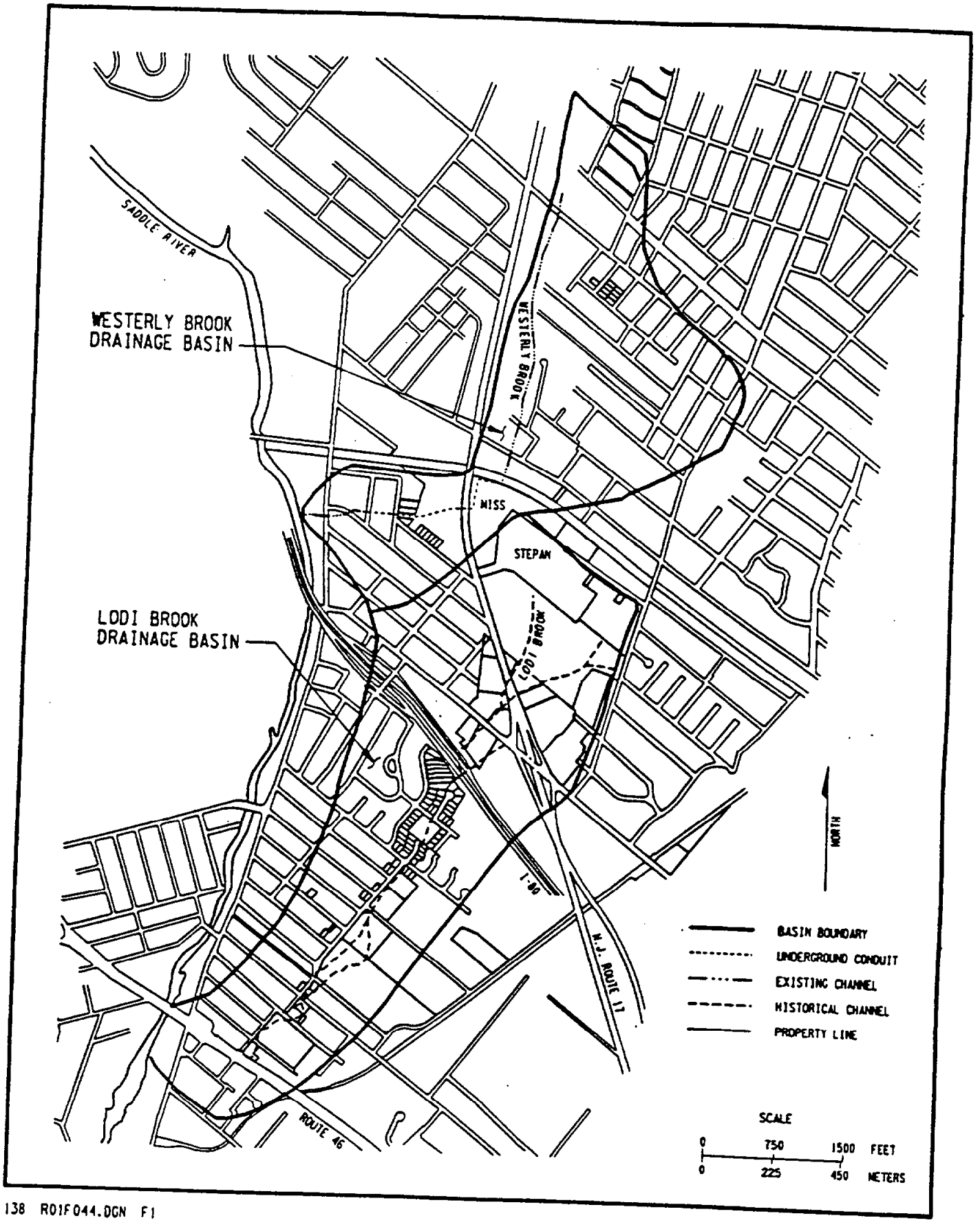

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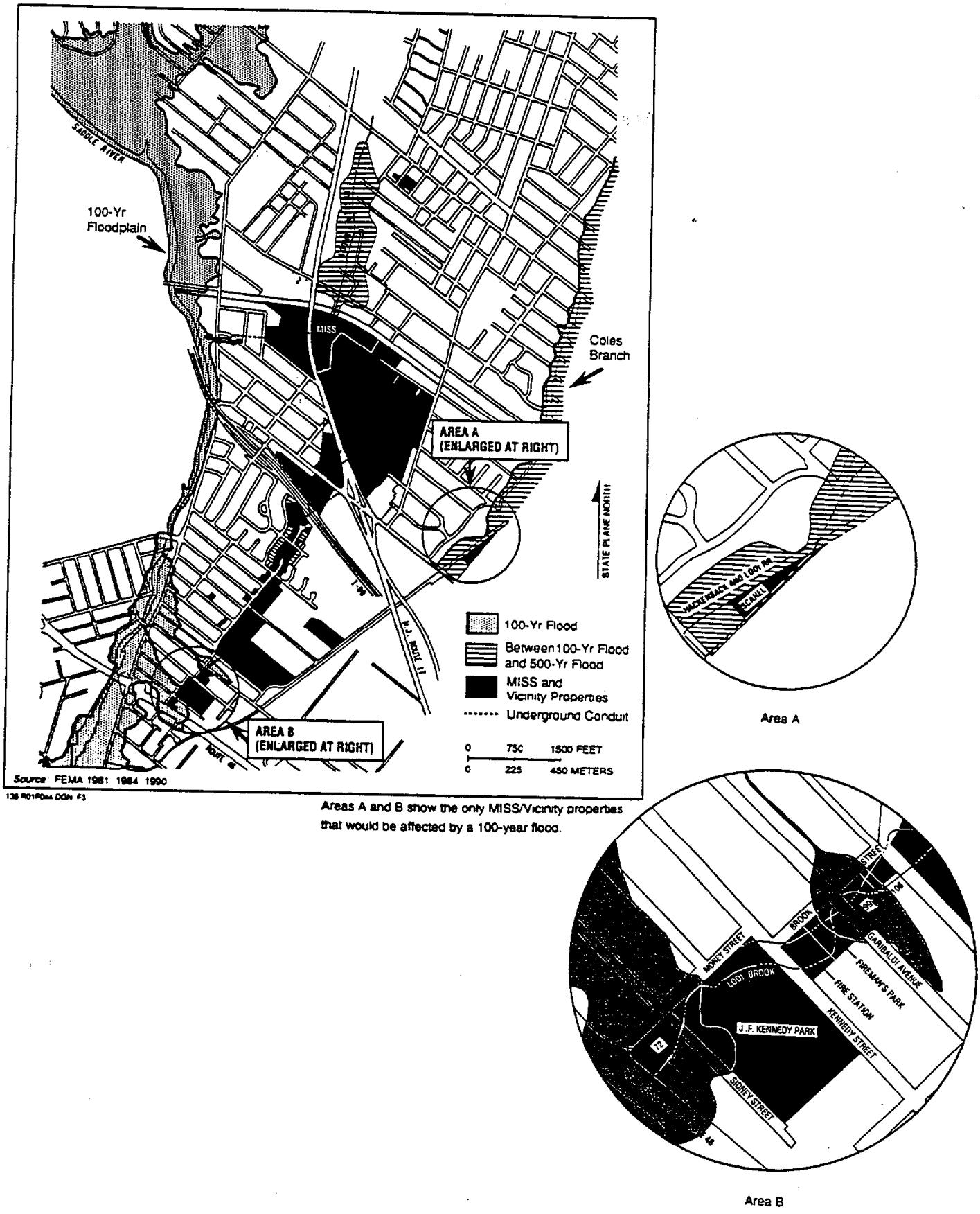
Figure B-1. Maywood Area Waterways



Areas A and B show the only MISS/Vicinity properties that would be affected by a 100-year flood.

Figure B-2. 100-Year Flood Zones in the Maywood Area

The proposed removal action would affect less than 1 hectare (2.5 acres) of the floodplains of the Saddle River and Lodi Brook. Based on the small size and isolated nature of the contaminated areas within the floodplain of the Saddle River and Lodi Brook that are designated for remediation under the proposed removal action, excavation and construction activities in the floodplain are not expected to cause any significant impacts. No permanent structures would be constructed in the floodplain, stream flow would not be obstructed by remediation activities, and all stream channels and associated floodplains would be returned to their original contours, revegetated and stabilized, and would retain their original capacity for retention of floodwater. The proposed removal action should not increase stream flow, impede flow, or cause upstream or downstream flooding.

Excavation of contaminated soil from vicinity properties partially located in the 100-yr floodplain of the Saddle River would not subject lives or property to an increased risk of flooding. Restoration of the drainageways and affected floodplains to their original contours and original channel profiles would maintain existing flood protection benefits.

B.4 WETLANDS DESCRIPTION AND EFFECTS

Wetlands within the geographic scope of the Maywood site identified on the New Jersey Department of Environmental Protection Freshwater Wetland Maps (Hackensack SW) are shown in Figure B-3. These maps indicate the presence of wetlands on MISS and on properties in the immediate vicinity of MISS. No wetlands included on National Wetland Inventory maps compiled by the U.S. Fish and Wildlife Service are within the geographic scope of the Maywood site.

No wetlands are known to be associated with the vicinity properties included in the proposed removal action, and the proposed action would result in no adverse impact to wetlands.

B.5 ALTERNATIVES FOR THE PROPOSED REMOVAL ACTION

Alternatives identified for the proposed removal action included: (1) no action; and (2) expedited removal of the contaminated materials from the affected vicinity properties and off-site commercial disposal of the wastes. Alternative 2 has been selected as the proposed action.

Under the no-action alternative, no remediation would occur at the Maywood site vicinity properties until the record of decision for the Maywood site is issued; remediation of these properties would be conducted as a component of the site-wide cleanup activities. This alternative would result in no near-term disturbance of any floodplains or wetlands areas. However, concentrations of radioactive contaminants of concern would remain at levels above DOE guidelines, including areas within the 100-yr floodplain, and the potential for the inadvertent spread of contamination would remain.

The expedited removal alternative involves the excavation of soils contaminated above site-specific cleanup criteria [i.e., residual concentrations may not exceed 5 pCi/g above

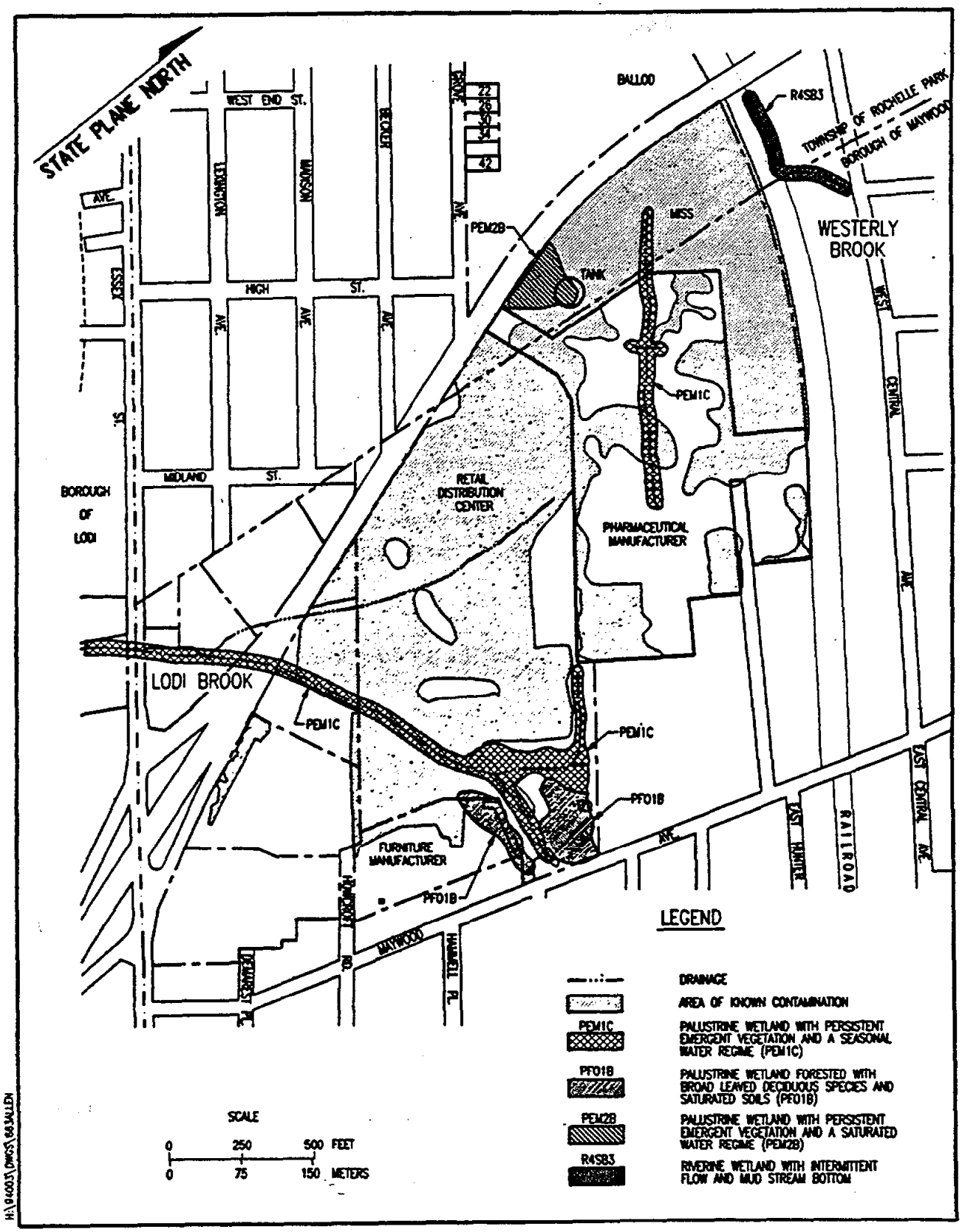


Figure B-3. Wetlands at the Maywood Site

background for thorium-232 and radium-226 combined (the primary contaminants of concern), averaged over any area of 100 m^2 and any 15-cm depth interval] at each of the affected vicinity properties. Excavation activities at four properties at the southern end of Lodi Brook (99 Garibaldi Avenue, 106 Columbia Lane, Fireman's Memorial Park, and J.F. Kennedy Park) would occur within the 100-yr floodplain of the Saddle River (Figure B-2) during the proposed removal action. After the initial disturbance from excavation and backfill, the adverse effects of remediation would be mitigated.

The approximate boundaries of excavation on each property would be established based on existing radiological data, supplemented by additional radiological survey activities conducted prior to and during excavation. Each property owner's consent to remove the contaminated soil from the property would be secured through an access agreement defining DOE's responsibilities and liabilities with regard to the cleanup. Appropriate measures will be employed to reduce potential adverse impacts on the environment and minimize health risks, including surface water (run-off/run-on) controls, erosion controls, and dust controls. Following removal of contaminated soils, the excavated areas would be backfilled with clean soil, and restored according to the agreement established with each property owner (e.g., establishment of grass, repair of asphalt or concrete surfaces, fence repair or replacement, etc.). Environmental monitoring would be implemented throughout the removal action to ensure compliance with all pertinent requirements.

All areas excavated in the floodplain would be restored to their natural contours to ensure that the proposed action would not subject lives or property to any increased risk of flooding. On completion of remediation activities, the affected floodplain areas would be stabilized by seeding and mulching in accordance with New Jersey soil erosion and sediment control standards. Areas in floodplains would not be used for storage purposes.

Excavated materials would be transported off-site for disposal at a commercial disposal facility. Off-site disposal facilities under consideration for these wastes would be located in the arid portions of the western United States. No adverse impacts to floodplains or wetlands would result from the proposed off-site disposal.

B.6 SUMMARY AND CONCLUSIONS

The proposed removal of residual radioactive materials above site-specific cleanup criteria from vicinity properties at the Maywood site would require activity in a very small area (approximately 1 ha) within the 100-yr floodplain of the Saddle River and Lodi Brook. Remediation activities would result in minor short-term and temporary impacts to floodplains, but would not increase stream flow under base-flow or storm-flow conditions, or cause upstream or downstream flooding. Impacts to floodplains would be mitigated through best management practices to control erosion and siltation. Following remediation, any affected stream areas or drainageways and associated floodplains would be returned to their original contours and stabilized by permanent seeding and mulching in accordance with New Jersey soil erosion and sediment control standards.

The proposed removal action would not be expected to impact any identified wetlands. Wetlands which may be affected during the future comprehensive remediation of the overall Maywood site would be controlled through a proactive wetlands mitigation plan designed specifically to restore or enhance the current functions of all affected wetlands.

B.7 REFERENCES

Federal Emergency Management Agency, 1981, *Flood Insurance Rate Map for the Township of Rochelle Park, New Jersey, Bergen County*. Community Panel No. 340070 0001 A. National Flood Insurance Program. Map revised December 18.

Federal Emergency Management Agency, 1984, *Flood Insurance Rate Map for the Borough of Lodi, New Jersey, Bergen County*. Community Panel No. 340047 0001 C. National Flood Insurance Program. Map revised December 4.

U. S. Department of Housing and Urban Development, 1977, *Flood Hazard Boundary Map H-01 and Flood Insurance Rate Map I-01 for Borough of Maywood, New Jersey, Bergen County*. Community Panel No. 340050 0001 A. Federal Insurance Administration. December 30.

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APPENDIX B

REGULATORY REQUIREMENTS FOR THE PROPOSED ACTION

TABLE A-1. Requirements Potentially Applicable to the Maywood Phase I Removal Action

Potential Requirement	Description	Determination	Comments
FEDERAL REQUIREMENTS			
Atomic Energy Act of 1954 (AEA), as amended (42 USC 2011-2297G-4)	Establishes authority for licensing and regulating radioactive materials.	Applicable	Establishes DOE's authority and responsibilities for managing radioactive materials.
Radiation Protection for Occupational Workers (10 CFR Part 835)	Specifies occupational radiation protection standards and program requirements for DOE and DOE contractor operations; includes basic dose limits of 5000 mrem/year for radiation workers and 100 mrem/year for the public, and derived air concentration limits for radionuclides in air; requires all radiation exposure to be reduced ALARA.	Applicable	The proposed action will comply with these requirements.
Clean Air Act, as amended; National Primary and Secondary Ambient Air Quality Standards (42 USC 7401-7671, 40 CFR 50)	Establishes National Primary and Secondary Ambient Air Quality Standards for certain pollutants, including total particulate matter.	Applicable	Excavation equipment exhaust and fugitive dust could potentially contribute to air quality deterioration.
Ambient Air Quality Surveillance (40 CFR 58, 58 FR 8452)	Requires enhanced monitoring of ozone and its precursors. States must include photo-chemical assessment monitoring in their State Implementation Plans for serious to extreme ozone non-attainment areas.	Applicable	New Jersey is classified as a severe ozone non-attainment area.
National Emission Standards for Hazardous Air Pollutants (42 USC 7401-7671, 40 CFR 61)	Emissions of radionuclides from any DOE facility to the ambient air shall not exceed levels that would result in an effective dose equivalent of 10 mrem/year.	Applicable	These requirements are considered pertinent for the protection of the public during implementation of the proposed action.
Federal Water Pollution Control Act, Clean Water Act (33 USC 1251-1387): Water Quality Standards (40 CFR 131), National Pollutant Discharge Elimination System (40 CFR 122-125)	Establishes water quality standards for surface waters and pretreatment standards for waste waters released to publicly-owned treatment works (POTWs).	Applicable	Any wastewater or stormwater resulting from the proposed action will be collected, tested, and treated, if necessary, prior to release, in accordance with the NPDES requirements.

Table A-1. (Continued)

Potential Requirement	Description	Determination	Comments
Floodplain Management (Executive Order 11988, 40 CFR 6.302(b))	Federal agencies must avoid, to the maximum extent possible, any adverse impacts associated with direct and indirect development of a floodplain.	Applicable	Portions of several properties affected by the proposed action are in a 100-year floodplain. Mitigative measures would be taken to minimize potential impacts.
Occupational Safety and Health Act, General Industry Standards (29 USC 651-678, 29 CFR 1910) and Safety and Health Standards (29 CFR 1926)	Specifies health and safety standards for hazardous waste operations, including limits for exposure to noise, ionizing radiation and certain hazardous materials, including radionuclides. Establishes requirements for worker training, development of emergency response and safety and health plans, and the type of safety equipment and procedures to be followed for hazardous waste site operations.	Applicable	Since these requirements are part of an employee protection law rather than an environmental protection law, with which CERCLA response actions should comply, they are not subject to the ARAR process. However, they constitute requirements for worker protection with which the proposed action will comply.
Resource Conservation and Recovery Act (RCRA) (40 CFR 260-268)	Sets standards for management of hazardous waste, including generation, transportation, record-keeping, manifesting, treatment, and disposal.	Not a requirement	No RCRA-regulated hazardous waste is expected to be generated by the proposed action.
Toxic Substances Control Act (15 USC 2601 et seq., 40 CFR 761)	Regulates polychlorinated biphenyl (PCB) cleanup and disposal.	Not a requirement	No PCBs or other TSCA-regulated waste is expected to be generated by the proposed action.
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings (42 USC 2022, 40 CFR 192)	Establishes requirements for control of residual radioactive material at uranium and thorium processing or depository sites, and during site restoration. Specifies concentration limits for Ra-226 or Ra-228 in soil, limits for gamma radiation exposure and radon decay product concentrations in habitable structures, and annual dose limits from planned releases to the environment.	Not a requirement	Since the site is not a designated mill tailings site, these requirements are not strictly applicable. They could be considered relevant and appropriate because of the similar nature of contaminants and site conditions; however, equivalent requirements are specified under DOE Order 5400.5 (and proposed rule 10 CFR 834), with which the proposed action will comply.
Hazardous Materials Transportation Act, as amended by the Hazardous Materials Transportation Uniform Safety Act (49 USC 1801-1819, 49 CFR 171-174, 177)	Establishes the requirements for transportation of hazardous (including radioactive) materials, including classification, packaging, labeling, marking, shipping and placarding requirements.	Not a requirement	Potentially applicable to transportation of radioactive materials off-site; however, it is anticipated that all wastes generated during the proposed removal action will contain radioactivity concentrations below 2000 pCi/g, the threshold subject to classification as radioactive material under these transportation regulations.

Table A-1. (Continued)

Potential Requirement	Description	Determination	Comments
Radiation Protection of the Public and the Environment (DOE Order 5400.5)	Establishes requirements for DOE facilities and operations for control of radiation exposure to the public. Radiation exposure to any member of the public from DOE operations may not exceed 100 mrem/year effective dose equivalent above background for continuous exposure and may not exceed 500 mrem/year in any single year; further, all radiation exposures must be reduced to levels as low as reasonably achievable (ALARA). Concentrations of radionuclides in air in uncontrolled areas may not exceed specified Derived Concentration Guides. Specifies concentration limits for Ra-226, Ra-228, Th-230, and Th-232 in soil.	To be considered	Although not yet promulgated standards, the DOE Order requirements were developed for protection of the public and the environment, and are mandatory requirements for DOE activities; these requirements will be codified in a formal rule at 10 CFR 834 (proposed 3/23/93, 58 FR 16268), which would be applicable upon final promulgation. The proposed action will comply with these requirements.
Radioactive Waste Management (DOE Order 5820.2A)	Specifies requirements for managing DOE radioactive waste.	To be considered	Although not promulgated standards, these requirements constitute requirements for protection of the public with which the proposed action will comply.
Environmental Protection, Safety, and Health Protection Standards (DOE Order 5480.4)	Establishes requirements for the application of mandatory environmental protection, safety, and health (ES&H) standards applicable to all DOE and DOE contractor operations.	To be considered	Although not promulgated standards, these requirements are derived from such standards and constitute requirements for protection of the public with which the proposed action will comply.
National Historic Preservation Act, as amended (16 USC 470, 40 CFR 6.301(b), 36 CFR 800)	The effect of any federally assisted undertaking must be taken into account for and district, site, building, structure, or object that is included or eligible for inclusion in the National Register of Historic Places.	Not a requirement	No such properties are known to exist in the area affected by the proposed action, so no adverse impacts to such properties is expected; however, if these resources were affected, the requirement would be applicable.
Archeological and Historical Preservation Act (16 USC 469, 40 CFR 6.301(c))	Prehistorical, historical, and archeological data that might be destroyed as a result of a federal, federally assisted, or federally licensed activity or program must be preserved.	Not a requirement	No adverse impacts to such data is expected to result from the proposed action; however, if these data were affected, the requirements would be applicable.
Historic Sites, Buildings, Objects, and Antiquities Act (16 USC 461-469, 40 CFR 6.301(a))	Requires federal agencies to consider the existence and location of landmarks on the National Registry of Natural Landmarks to avoid undesirable impacts on each landmark.	Not a requirement	No such resources are known to exist in the area affected by the proposed action, so no adverse impacts to such resources are expected; however, if these resources were affected, the requirement would be applicable.

Table A-1. (Continued)

Potential Requirement	Description	Determination	Comments
Fish and Wildlife Coordination Act (16 USC 661-668, 40 CFR 6.302(g), 50 CFR 27)	Requires consultation when federal department or agency proposes or authorizes any modification of any stream or other water body, and adequate provision for protection of fish and wildlife resources. Lists actions prohibited in areas belonging to National Wildlife Refuge System.	Not a requirement	The proposed action does not require modification of any stream or other water body. Site is not in the National Wildlife Refuge System.
Endangered Species Act (16 USC 1531-1544, 50 CFR 17.402, 40 CFR 6.302(h))	Federal agencies must ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify any critical habitat.	Not a requirement	No critical habitat exists in the affected area, and no adverse impacts on threatened or endangered species are expected to result from the proposed action.
Clean Water Act, Dredge or Fill Requirements (33 USC 1251-1387, 40 CFR 230-231, 33 CFR 320-330)	Requires permits for discharge of dredged or fill material into waters of the United States, including wetlands.	Not a requirement	No jurisdictional wetlands are present in the area affected by the proposed action.
Protection of Wetlands (Executive Order 11990, 40 CFR 6.302(a))	Federal agencies must avoid, to the maximum extent possible, any adverse impacts associated with the destruction or loss of wetlands and the support of new construction in wetlands if a practicable alternative exists.	Not a requirement	No jurisdictional wetlands are present in the area affected by the proposed action.
Wilderness Act (16 USC 1131; 50 CFR 35.1)	Administers federally owned wilderness areas to avoid impacts.	Not a requirement	No wilderness area exists on-site or adjacent to the area affected by the proposed action.
National Wildlife Refuge System (16 USC 668, 50 CFR 27)	Restricts activities within a National Wildlife Refuge	Not a requirement	No National Wildlife Refuge area exists on-site or adjacent to the area affected by the proposed action.
Scenic Rivers Act (16 USC 1271, 40 CFR 6.302(e))	Prohibits adverse impacts on a scenic river.	Not a requirement	No scenic river exists on-site or adjacent to the area affected by the proposed action.
Coastal Zone Management Act (16 USC 1451)	Requires that activities within coastal zone be conducted in accordance with state-approved management program.	Not a requirement	Affected area is not located in the coastal zone.

Table A-1. (Continued)

Potential Requirement	Description	Determination	Comments
STATE REQUIREMENTS			
New Jersey Hazardous Materials Transportation Regulations (NJAC Title 7)	Establishes the requirements for transportation of hazardous (including radioactive) materials. Materials regulated by the Atomic Energy Act and hazardous chemicals may not be transported through the state of New Jersey without prior written approval by all authorities having jurisdiction in such matters and by the New Jersey Department of Environmental Protection.	Applicable	Applicable to transportation of radioactive materials off-site. The State of New Jersey has not officially adopted the Federal Hazardous Materials Transportation Regulations, although for the most part the Federal regulations have been incorporated into the New Jersey regulations.
New Jersey Spill Prevention Regulations (NJAC 7:1E)	Prohibits the discharge of petroleum and other hazardous substances to land and water.	Applicable	No discharge of petroleum or hazardous materials is planned for the proposed removal action. Any accidental spillage would be mitigated in accordance with these requirements.
New Jersey Surface Water Quality Standards (NJAC 7:9B)	Establishes numerical criteria for the control of toxic pollutants in surface waters.	Applicable	The proposed removal action would be conducted to prevent adverse impacts to surface water quality.
New Jersey Soil Erosion and Sediment Control Statute (NJSA 4:29-39)	Requires the implementation of soil erosion and sediment control measures whenever more than 5000 ft^2 of land surface is disturbed. Administered by local soil conservation districts of the state Dept. of Agriculture.	Applicable	All excavation and construction activities under the proposed removal action would be conducted using appropriate erosion and sedimentation controls.
New Jersey Air Pollution Control Regulations (NJAC 7:27)	Establishes limitations on air pollution sources, including limitations on smoke emissions from combustion of fuel by vehicles, earth-moving equipment, and mobile generators.	Applicable	All vehicles and equipment used during the proposed removal action would meet these requirements. No permanent air pollution sources would be associated with this action.
New Jersey Stream Encroachment Permit Program (NJAC 7:7a-7.6)	Requires permits for construction, installation, or alteration of any structure or permanent fill along, in, or across the channel or floodplain of any stream.	Applicable	The proposed removal action may require the placement of fill in streams or floodplains.
New Jersey Water Supply Allocation Permits (NJAC 7:19-1.1)	Requires obtainment of permit for diversion of surface water or groundwater in excess of 100,000 gallons/day, except for emergency or short-term diversions.	Applicable	The proposed removal action potentially may include diversion of surface waters addressed by this requirement.
New Jersey Uniform Construction Code Regulations (NJAC 5:23)	Requires construction permit for the construction, enlargement, alteration or demolition of a building or structure. Includes requirements for asbestos, fire, and radon.	Applicable	The proposed removal action would be expected to require underpinning of some buildings or structures during excavation activities.

Table A-1. (Continued)

Potential Requirement	Description	Determination	Comments
New Jersey Road Impact Regulations (NJAC 16:41-5.1, 7.1)	Requires a permit from the NJDOT: to install, convert, or relocate drainage facilities across state property or along the side of a state highway; and for the use of a state highway right-of-way.	Applicable	The proposed removal action would require the use of state highway right-of-way covered under this regulation.
New Jersey Noise Control Regulations (NJAC 7:29-1)	Establishes noise level limitations for industrial and commercial operations.	Applicable	The proposed removal action would be conducted in compliance with all noise limitations.
New Jersey Pollutant Discharge Regulations (NJAC 7:14A)	Establishes controls and permitting requirements for discharge of pollutants to surface or ground waters.	Not a requirement	No discharges to surface or ground waters are planned for the proposed removal action. Source, byproduct, and special nuclear material regulated under the AEA are not regulated by this program.
New Jersey Groundwater Quality Standards (NJAC 7:9-6.1)	Establishes numerical criteria for the control of toxic pollutants in groundwater. State criteria for radionuclides are equivalent to federal SDWA criteria.	Not a requirement	The proposed removal action includes excavation of surface and near-surface soils. No impact to groundwater is anticipated. Any remediation of groundwater at the Maywood site would be addressed under the comprehensive RI/FS program.
New Jersey Drinking Water Quality Standards (NJAC 7:10-1)	Establishes numerical criteria for the control of contaminants in drinking water. State criteria for radionuclides are equivalent to federal SDWA criteria.	Not a requirement	The proposed removal action would not impact drinking water quality.
New Jersey Stormwater Pollution Prevention Regulations (NJAC 7:14A-3.1)	Establishes requirements for permits to discharge of stormwater associated with industrial activities to storm sewers and other outlets that drain to receiving surface water.	Not a requirement	The proposed removal action would be conducted to minimize any stormwater discharge. The area disturbed during the excavation activities would be below the threshold for these requirements.
New Jersey Freshwater Wetlands Permit Program (NJAC 7:7A-11.1)	Requires permit to engage in any regulated activity in and around freshwater wetlands and associated transition areas. (Operates in lieu of the U.S. Army CoE program.)	Not a requirement	No jurisdictional wetlands are present in the area affected by the proposed action and no wetlands impacts would be anticipated.
New Jersey Well Permit and Well Closure Regulations (NJAC 58:4A-4.1)	Establishes requirements for the drilling and closure of water wells and the licensing of water well drillers.	Not a requirement	No drilling or closure of water wells is included in the proposed removal action.

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APPENDIX C

RADIOLOGICAL DOSE ASSESSMENT FOR THE PROPOSED REMOVAL ACTION

C.1 INTRODUCTION

Potential radiation doses were assessed for current and likely future exposure conditions under each of the Alternatives considered in the Engineering Evaluation/Cost Analysis (EE/CA) for the selected Maywood vicinity properties. This evaluation included potential exposures to remedial action workers during the implementation of the proposed removal action and potential exposures to residents or site occupants following completion of the removal action. Alternatives considered in this EE/CA include:

- Alternative 1, No Action: Under this Alternative, no remedial action would be undertaken at these vicinity properties until the Record of Decision (ROD) for the overall Maywood site is completed. Residual radioactive materials above site-specific criteria would continue to be present and current exposure conditions would continue.

- Alternative 2, Excavation and Commercial Disposal: Under this Alternative, residual radioactive materials above site-specific criteria (5 pCi/g above background for thorium-232 and radium-226 combined, and 100 pCi/g for total uranium) would be excavated and removed from these vicinity properties for off-site commercial disposal.

The following sections summarize the dose assessment for each alternative, including characterization of the radionuclide source term, determination of appropriate exposure conditions for each alternative, and estimates of potential doses for each alternative.

C.2 ALTERNATIVE 1: POTENTIAL RADIATION EXPOSURES AND DOSES

Under Alternative 1, no action would be taken to remediate the vicinity properties until a final decision is made regarding remediation of the overall Maywood site. This alternative involves no immediate change in current exposures to radioactive materials at these properties. A comprehensive analysis of the potential radiation exposures under the No Action Alternative for current and likely future conditions at these vicinity properties is provided in the Baseline Risk Assessment (BRA) for the Maywood site (DOE 1993). The BRA analysis did not consider each of the individual vicinity properties, but rather grouped similar properties into "property units", based on factors such as land use and contaminant levels; property units for the vicinity properties considered in this EE/CA include residential properties (Units 1 and 2), municipal properties (Unit 4), and the Ballod property (Unit 6B). The assumptions and results of the BRA for these property units are summarized below.

Mean and Reasonable Maximum Exposure (RME) estimates of radionuclide concentrations in surface and subsurface soils at each of these property units are presented in Table C-1. As summarized in Table C-2, the BRA analysis predicts potential radiation doses ranging from < 1 to 246 mrem/year to current receptors at the vicinity properties considered in this EE/CA. Under a future use scenario where a residence is established on the unremediated portion of the Ballod property, potential doses could be up to 2800 mrem/yr. These estimates are based upon conservative assumptions (i.e., assumptions more likely to overestimate, rather

Table C-1. Radionuclide Concentrations in Soil (above background).

Location	Property Unit	Surface Soil Conc. (pCi/g)			Subsurface Soil Conc. (pCi/g)		
		Th-232	Ra-226	U-238	Th-232	Ra-226	U-238
Mean Concentrations							
Residential	Unit 1	2.88	0.52	3.39	1.57	0.30	2.32
	Unit 2	9.05	1.08	8.43	5.53	0.74	5.15
Municipal Parks	Unit 4	1.21	0.17	0.96	2.11	0.11	0.84
Ballod	Unit 6B	ND	ND	ND	69.81	0.39	84.71
RME Concentrations							
Residential	Unit 1	3.51	0.60	3.73	1.90	0.36	2.60
	Unit 2	11.3	1.25	10.58	7.25	0.86	6.70
Municipal Parks	Unit 4	1.91	0.24	1.21	3.06	0.15	1.08
Ballod	Unit 6B	ND	ND	ND	185.	0.86	228.

Notes: Short-lived decay products are assumed to be in secular equilibrium with each of the parent radionuclides, and uranium-235 and its decay products are assumed to be present at 5% of the U-238 concentration in each case.
ND = No Data

Table C-2. Potential Radiation Doses for the No-Action Alternative.

Location	Property Unit	Effective Dose Equivalent (mrem/yr)			
		Current Use		Future Use	
		Mean	RME	Mean	RME
Residential	Unit 1	6	12	6	12
	Unit 2	51	246	51	246
Municipal Parks	Unit 4	0.3	5	32	54
Ballod	Unit 6B	2	10	1060	2799

than underestimate, actual radiation doses). For the current use scenarios, the receptors were assumed to include a resident at the residential properties, and a transient individual occasionally visiting the site for the municipal and Ballod properties; for future use conditions, residential exposures were assumed at all properties. Additional details are provided in the BRA (DOE 1993).

C.3 ALTERNATIVE 2: POTENTIAL RADIATION EXPOSURES AND DOSES

Under Alternative 2, contaminated soil and debris would be excavated from the vicinity properties. Following excavation, all contaminated materials would be transported off-site to an appropriately licensed commercial disposal facility. For this alternative, estimates of potential radiation dose have been evaluated for a remedial action worker and a member of the public during implementation of the removal action, and for the public following completion of the removal action.

Potential Radiation Dose to the Remedial Action Worker

For Alternative 2, the maximum potential exposure would be received by the remedial action worker during implementation of the removal action (e.g., during excavation and construction activities). Potential exposure pathways for the worker include direct external exposure, inhalation of resuspended particulates, inhalation of radon decay products, and incidental soil ingestion. All activities associated with the implementation of Alternative 2 would be conducted according to the site-specific health and safety plan to protect workers and the public. The potential radiation doses to workers conducting the removal action would be kept as low as reasonably achievable (ALARA) by strict compliance with environmental, safety, and health protection guidelines and appropriate engineering practices for radiation protection. Since these factors are not considered in this assessment, actual exposures are expected to be well below the estimates presented here.

The potential radiation dose to workers implementing the proposed removal action was estimated using the RESRAD computer code (Version 5.6)(Yu et al., 1993a). For the purpose of this evaluation, radionuclide concentrations in contaminated soils were considered separately for the Ballod property and all other residential and municipal properties considered in this EE/CA due to the much higher contaminant concentrations at Ballod. Average soil concentrations for the residential and municipal vicinity properties are assumed to be 11.3 pCi/g for thorium-232, 10.6 pCi/g for uranium-238, 1.25 pCi/g for radium-226 (i.e., the maximum value reported in Table C-1 for Units 1, 2, and 4, for each radionuclide). For the Ballod property, radionuclide concentrations of 185 pCi/g for thorium-232, 228 pCi/g for uranium-238, and 0.86 pCi/g for radium-226 were assumed (DOE 1993). In each case, short-lived decay products were assumed to be in equilibrium with the parent radionuclide, and uranium-235 and its decay products were assumed to be present at 5% of uranium-238 concentration (i.e., based on typical isotopic distributions for natural uranium). Potential exposure pathways considered

in this evaluation included external gamma exposure, inhalation of contaminated dust and radon gas, and incidental ingestion of contaminated soil.

It was assumed that the hypothetical worker receiving the maximum exposure would spend a maximum of 1500 hours per year (8 hours/day x 5 days/week x 9 months/year) in the contaminated area at the residential and municipal vicinity properties. For the remediation of the Ballod property, a total exposure duration of 500 hours was assumed. It was assumed that the remedial action worker would have a breathing rate of 1.2 m^3/hour, and would be exposed to an average concentration of contaminated particulates in air of 100 $\mu g/m^3$. The worker was also assumed to ingest contaminated soil at a rate of 100 mg/day as a result of incidental hand-to-mouth contact. Exposure assumptions are summarized in Table C-3 and site-specific geotechnical parameter assumptions are summarized in Table C-4.

The maximum radiation dose to the hypothetical worker from exposure to site contaminants during removal activities at the residential and municipal vicinity properties was estimated at 38 mrem/year (84% from external gamma exposure and 13% from inhalation of contaminated dust). The maximum dose to the hypothetical remedial action worker at the Ballod property was estimated at 198 mrem/year (83% mrem/year from external gamma exposure, 15% from inhalation of contaminated dust, and 1.5% from incidental ingestion of contaminated soil).

These dose estimates to the hypothetical worker experiencing the maximum exposure are based on very conservative (health protective) exposure assumptions. They do not take into account mitigative measures (such as dust suppression, respiratory protection, protective clothing) which would be used during the proposed removal action. The potential radiation doses to workers performing the removal action would be kept as low as reasonably achievable (ALARA) by appropriate health physics practices and by strict compliance with DOE environmental, safety, and health protection guidelines. Mitigative measures would be implemented to minimize the amount of airborne contamination. Workers also would wear respiratory protection equipment, if necessary, to reduce the likelihood of inhaling contaminated particulates, and lapel air monitors would be worn to verify the safety of the working environment. A comprehensive personnel dosimetry program would be implemented to monitor all radiation exposures and doses to workers throughout the removal action. Therefore, actual exposures and risks would be significantly lower than the estimates presented above.

Potential Radiation Dose to the Public During Implementation of the Removal Action

During construction and transportation activities associated with Alternative 2, a resident or employee at the affected properties or a nearby property could receive a radiation dose above normal background exposure. The primary exposure pathway for the off-site public would be inhalation of contaminated dust. The dose to the off-site receptor from external gamma radiation would be negligible because the external gamma exposure rate decreases rapidly with distance from the source.

Table C-3. Site-Specific Exposure Parameter Assumptions for Alternative 2[a].

Parameter	Units	Assumed Value	
		RA Worker (During Removal)	Resident (After Removal)
Exposure time indoors	h/d	0	16.4
Exposure time outdoors	h/d	8	0.44
Exposure frequency	d/yr	188 (62.5 @ Ballod)	350
Exposure duration	yr	3	30
Area of exposure unit	m^2	1000	300
Contaminated zone thickness	m	2	0.6
Depth of clean cover soil	m	0	0.15 - 1
Indoor gamma shielding factor	-	-	0.3
Inhalation rate	m^3/hr	1.2	0.83
Dust loading in air	$\mu g/m^3$	100	100
Soil ingestion rate	mg/d	100	100
Water ingestion rate	l/d	0	2.0
Fraction of drinking water from on-site well	-	0	1
Ingestion of home-grown produce	g/d	0	80

[a]The basis for assumed parameter values is discussed in the Baseline Risk Assessment (DOE 1993), except as noted in text.

Table C-4. Site-Specific Geotechnical Assumptions[a]

Parameter	Assumed Value
Contaminated zone total porosity	0.45
Contaminated zone hydraulic conductivity	1.23 m/yr
Saturated zone total porosity	0.45
Saturated zone hydraulic conductivity	123 m/yr
Saturated zone hydraulic gradient	0.01
Unsaturated zone thickness	1 to 4.6 m (1 m assumed)
Unsaturated zone total porosity	0.45
Unsaturated zone effective porosity	0.26
Unsaturated zone hydraulic conductivity	1.23 m/yr
Precipitation Rate	1.07 m/yr
Runoff Coefficient	0.25
Soil density	1.6 g/cm^3
Soil erosion rate [b]	6 x 10^{-5} m/yr
Distribution coefficient, K_d [c]	Thorium - 60,000 Radium - 450 Uranium - 450 Lead - 900 Actinium - 1,500 Protactinium-2,500

[a]Assumed parameter values are taken from the Baseline Risk Assessment (DOE 1993), except as noted.
[b]Reference: Yu et al. 1993b
[c]Reference: Baes et al. 1984; Sheppard and Thibault 1990

The radiation dose to the maximally exposed member of the public during the removal action, therefore, would be bounded by the inhalation dose to the removal action worker discussed previously. The maximum incremental radiation dose to the general public from implementation of the proposed remedial action is estimated to be less than 5 mrem/year for Alternative 2. Again, appropriate health physics precautions and engineering measures would be employed during all excavation, transportation, and disposal activities to minimize airborne releases of radioactivity and protect the public from unnecessary exposure, so actual exposures are likely to be even lower than estimated here.

Potential Radiation to the Public Following the Removal Action

Following completion of the removal action, concentrations of all radionuclides of concern in soils at the vicinity properties would be reduced to levels below the site-specific criteria. These concentrations would be similar to the range of naturally occurring concentrations of these radionuclides in the U.S. An estimate the potential radiation dose that could result from these residual concentrations has been developed to ensure that the proposed removal action will protect the public from any unacceptable radiation exposures over the long-term.

Site-specific cleanup criteria for the proposed removal action have been developed by DOE and EPA. For these vicinity properties, the residual concentration of thorium-232 and radium-226 combined may not exceed 5 pCi/g above background in surface or subsurface soils (averaged over any area of 100 m^2 and any depth interval of 15 cm). DOE has also derived a site-specific cleanup guideline for uranium of 100 pCi/g (total uranium); however, since uranium is generally co-located with thorium-232 at the Maywood site, and in similar or lower concentrations (see Table C-1), it is likely that residual concentrations of uranium will be well below this criterion. For the purpose of this analysis, residual concentrations of uranium-238 are assumed to be equivalent to residual concentrations of thorium-232. Based on the relative magnitude of measured concentrations of thorium-232, radium-226, and uranium-238 in soils are these properties, the residual source term is assumed to be 4 pCi/g for thorium-232, 1 pCi/g for radium-226, and 4 pCi/g for uranium-238; all radioactive decay products are assumed to be in secular equilibrium with the parent radionuclide, and uranium-235 (and decay products) is assumed to be present at 5% of the uranium-238 concentration.

The residual radionuclide concentrations assumed for this analysis are considered to be extremely conservative based on an analysis of post-remediation characterization data at similar vicinity properties cleaned up during 1984 and 1985. A review of these data indicate that residual concentrations of thorium-232 averaged approximately 2 pCi/g above background, and radium-226 and uranium concentrations were generally at or near background levels; this is despite the fact that these previous removal actions were based on cleanup criteria of 5 pCi/g for thorium and radium in surface soils and 15 pCi/g in subsurface soils. Therefore, the source term considered in this analysis may significantly overestimate actual concentrations following completion of the removal action.

Exposure assumptions for the residual dose assessment were selected to maintain consistency with those previously approved in the Baseline Risk Assessment (DOE 1993) where possible; parameters for which different assumptions were made to better reflect site-specific conditions are discussed below. Key parameter values assumed for the residual risk analysis are summarized in Tables C-3 and C-4.

Site-specific data were used to estimate the characteristics (area, depth, and thickness) of the contaminated zone that would be left following remediation. Contaminated soils at many of the vicinity properties along the former course of Lodi Brook are located below substantial layers of clean fill material. Following excavation of contaminated soils, the excavation sites would be backfilled with clean soil (typically 1 to 3 m). For purposes of this analysis, it is conservatively assumed that 1 meter of clean fill would be emplaced over the residual radioactive materials; results are also provided for a "minimum-cover" case, assuming a cover of only 0.15 m of clean fill. Site characterization data indicate that the average area of the remediated zone at these properties would be approximately 300 m^2, and the thickness of the residual radioactive materials (i.e., the layer of soils with residual radionuclide concentrations below the 5 pCi/g criterion but above background) would be approximately 0.6 m. Surface soils are assumed to be subject to erosion, with an average erosion rate of 6×10^{-5} m/year (Yu et al., 1993b), representing a typical non-agricultural site with an average 2% slope.

Estimates of residual dose were derived both for the conditions immediately following remediation, and also for the future time following remediation where the greatest residual risk is predicted, out to a period of 1000 years. The 1000-year period was selected as a reasonable maximum time horizon, as predictions at longer times become increasingly uncertain. Estimates of total effective dose equivalent to potential residents at the site following completion of remedial action are summarized in Table C-5.

Under expected conditions, the 1-meter clean soil cover over residual contaminants significantly limits potential exposure pathways. Direct gamma exposure is effectively shielded by the soil cover and only small quantities of radon are released through the surface soils to contribute to the effective dose equivalent (i.e., the indoor radon exposure pathway is estimated to contribute ~100% of the total dose). Under the assumed minimum-cover conditions (i.e., 0.15 m clean soil cover over residual radioactive materials), external gamma exposure (~66-78%) and ingestion of homegrown produce from a garden in the remediated area (~16-33%) are the dominant exposure pathways following remediation; the dose is estimated to increase slightly over time due to the assumed erosion of the clean soil cover. Again, these estimates are based upon conservative assumptions, such that actual doses are expected to be even lower.

Table C-5. Estimated Dose from Residual Soil Concentrations.

Resident Scenario	Effective Dose Equivalent (mrem/year)
Expected-Condition[a]	0.4
Minimum-Cover[b]	3 (6)[c]

[a]Expected condition: 1 meter clean cover over residual radioactive materials.
[b]Minimum-cover conditions: 0.15 m clean cover over residual radioactive materials.
[c]First value represents time=0; parenthetical value is maximum dose/risk over the period of analysis (t=1000 years), if different from t=0.

C.4 REFERENCES

Baes, C.F., et al., 1984, "A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides Through Agriculture," ORNL-5786.

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U. S. Department of Energy, 1993, "Baseline Risk Assessment for the Maywood Site, Maywood, New Jersey," March 1993.

Yu, C., et al., 1993a, "Manual for Implementing Residual Radioactive Material Guidelines", Draft.

Yu, C., et al., 1993b, "Data Collection Handbook to Support Modeling the Impacts of Radioactive Material in Soil", ANL/EAIS-8, April 1993.

APPENDIX D

COST BASIS FOR REMOVAL ACTION ALTERNATIVES

Table D-1. Cost Basis for Proposed Removal Action (30-Year Cost, 1995$)

Activity	Alternative 2 Excavation & Commercial Disposal
Monitoring, Sampling & Analysis [a]	969,411
Site Development [b]	1,422,283
Building & Services [c]	1,329
Excavation & Backfill [d]	4,879,044
Disposal [d]	7,657,354
Transportation [d]	5,029,875
Site Inst. Controls, Surv. & Maint. [e]	53,726
Other Remedial Action Costs [f]	2,979,924
Subtotal Remedial Action	23,002,946
Remedial Design [g]	2,300,295
Other [h]	5,900,806
Subtotal Project	31,204,047
Contingency (25%)	7,801,012
Program Support (15%)	5,850,759
TOTAL COSTS	**$ 44,855,817**

[a] Includes all monitoring, sampling, analysis, and verification testing.
[b] Includes mobilization, demobilization, and site preparation/development.
[c] Includes utilities, etc.
[d] Assumes excavation volume of 28,613 yd^3 and a 30% expansion factor for excavated materials.
[e] Includes institutional controls, surveillance, and maintenance activities for the removal action and O&M periods.
[f] Includes all field support required for the removal action, such as site management, engineering, technical support, and environmental compliance.
[g] Includes all design engineering and support activities (10% of remedial action cost [excluding monitoring] assumed).
[h] Includes all home office support required for the removal action, such as program management, engineering, technical support, and environmental compliance.