

**THIRD FIVE-YEAR REVIEW REPORT FOR
MAYWOOD CHEMICAL CO. SUPERFUND SITE
BERGEN COUNTY, NEW JERSEY**



Prepared by

**U.S. Environmental Protection Agency
Region 2
New York, New York**

A handwritten signature in black ink, appearing to read "P. Evangelista".

**Pat Evangelista, Acting Director
Superfund & Emergency Management Division**

A handwritten date "8/13/19" in black ink.

Date

Table of Contents

LIST OF ABBREVIATIONS & ACRONYMS	2
I. INTRODUCTION	3
FIVE-YEAR REVIEW SUMMARY FORM	4
II. RESPONSE ACTION SUMMARY	5
Basis for Taking Action	5
Response Actions	5
Status of Implementation	9
IC Summary Table	9
Systems Operations/Operation & Maintenance	10
III. PROGRESS SINCE THE LAST REVIEW	11
IV. FIVE-YEAR REVIEW PROCESS	12
Community Notification, Involvement & Site Interviews	12
Data Review	13
Site Inspection	13
V. TECHNICAL ASSESSMENT	14
QUESTION A: Is the remedy functioning as intended by the decision documents?	14
QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?	15
QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?	17
VI. ISSUES/RECOMMENDATIONS	17
VII. PROTECTIVENESS STATEMENT	17
VIII. NEXT REVIEW	17
APPENDIX A – REFERENCE LIST	18
APPENDIX B – FIGURES & CHRONOLOGY TABLE	19

LIST OF ABBREVIATIONS & ACRONYMS

AEC	Atomic Energy Commission
ALARA	As Low As Reasonably Achievable
ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of Concern
cpm	counts per minute
EMP	Environmental Monitoring Program
EPA	United States Environmental Protection Agency
DOE	United States Department of Energy
EE/CA	Engineering Evaluation/Cost Analysis
FFA	Federal Facility Agreement
FUSRAP	Formerly Utilized Site Remedial Action Program
FYR	Five-Year Review
ICs	Institutional Controls
LUCIP	Land Use Control Implementation Plan
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MCW	Maywood Chemical Works
MFR	Memorandum for Record
MISS	Maywood Interim Storage Site
mrem/yr	millirem per year
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NJDEP	New Jersey Department of Environmental Protection
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
O&M	Operation and Maintenance
OU	Operable Unit
pCi/g	picoCuries per gram
pCi/l	picoCuries per liter
PRAR	Post Remedial Action Report
PRP	Potentially Responsible Party
RAO	Remedial Action Objectives
ROD	Record of Decision
RPM	Remedial Project Manager
UMTRCA	Uranium Mine Tailings Radiation Control Act
USACE	United States Army Corps of Engineer
UU/UE	Unlimited Use and Unrestricted Exposure

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP)(40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the third FYR for the Maywood Chemical Co. Superfund Site. The triggering action for this statutory review is the September 30, 2014 completion date of the previous FYR. The FYR has been prepared because hazardous substances, pollutants or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site has been divided into four Operable Units (OUs) to systematically address the contamination by responsible entity and media type, as follows: OU1 – Non- Formerly Utilized Sites Remedial Action Program (FUSRAP) Soil and Source Areas; OU2 – FUSRAP Soil and Buildings; OU3 – FUSRAP Groundwater; and OU4 – Non-FUSRAP Groundwater. The OU1 and OU4 response actions are being undertaken by Stepan, a Potentially Responsible Party (PRP). OU2 and OU3 response actions are being undertaken by United States Army Corps of Engineers (USACE), as lead federal facility for the portions of the site being addressed under the FUSRAP program. Only OU2 and the protectiveness of all response actions undertaken to date, which have been accomplished through excavation, transportation, off-site disposal of contaminated soil and institutional controls, is the subject of this FYR. The OU2 remedy is ongoing and has not been completed. OU1 Non-FUSRAP Soil and Source Areas is in the remedial design stage and the remedy has not been implemented. The OU3 FUSRAP Groundwater remedy relies heavily on OU2 being completed and will be evaluated once all accessible source material is excavated. OU4 Non-FUSRAP Groundwater does not yet have a Record of Decision (ROD).

The Maywood Chemical Co. Superfund Site FYR was led by Betsy Donovan, EPA Region 2, Remedial Project Manager (RPM). EPA Region 2 participants included: Lora Smith, Ph.D., Human Health Risk Assessor; Mindy Pensak, Ecological Risk Assessor; Diana Cutt, Hydrogeologist; and Shereen Kandil, Community Involvement Coordinator. The USACE and Stepan were notified of the initiation of the five-year review. The review began on February 6, 2019.

Site Background

Site Location and Description

The Maywood Chemical Co. Superfund Site consists of more than 90 industrial, residential, commercial and government properties contaminated by activities of the former Maywood Chemical Works (MCW) which began operations in the 1890's. The properties are in a highly-developed, mixed-use area of northeastern New Jersey in the Boroughs of Maywood and Lodi and the Township of Rochelle Park. The Site is actively used by industrial, commercial, residential and municipal entities, except for one vacant commercial property, formerly occupied by Sears, where soil remediation is currently taking place beneath a recently demolished seven-acre warehouse. Redevelopment plans for this property are in

the works. Current mixed land uses are expected to continue. The Site is located approximately 12 miles north-northwest of New York City and 13 miles northeast of Newark, New Jersey (Figure 3-1). A Site map is shown on Figure 1-1.

Waste and residues associated with radioactive thorium and chemical manufacturing processes were generated by the former MCW. The 30-acre MCW property was purchased by Stepan in 1959. Wastes from manufacturing processes were generally stored in open piles and retention ponds. Some wastes migrated off the property through two primary mechanisms: natural drainage and flooding events associated with the former Lodi Brook, which originated on the MCW property and; the use of the contaminated soils from the MCW as fill. Stepan had a Nuclear Regulatory Commission (NRC) license for the storage of thorium-bearing materials in Burial Pits 1, 2, and 3 on their property.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Maywood Chemical Co,		
EPA ID: NJD980529762		
Region: 2	State: NJ	City/County: Maywood, Lodi, Rochelle Park/Bergen County
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	Has the site achieved construction completion? No	
REVIEW STATUS		
Lead agency: Other Federal Agency <i>[If "Other Federal Agency", enter Agency name]:</i> U.S. Army Corps of Engineers		
Author name (Federal or State Project Manager): Betsy Donovan		
Author affiliation: EPA R2 RPM		
Review period: 10/1/2018 – 5/21/2019		
Date of site inspection: 2/13/2019		
Type of review: Statutory		
Review number: 3		
Triggering action date: 9/30/2014		
Due date (five years after triggering action date): 9/30/2019		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

Numerous investigations have taken place at the Site prior to and after the NPL listing, as described in the Chronology of Site Events Table in Appendix B. In 1992, DOE issued a Remedial Investigation Report for the Maywood Site, which was the basis for DOE's 1993 Final Baseline Risk Assessment for the Maywood Site. This baseline risk assessment identified radiological contaminants of concern (COCs) and their associated decay products in soils at the Site which posed an unacceptable risk from direct contact to employee and transient populations. COCs for soil and building materials were identified in the risk assessment as follows: Thorium-232 (Th-232); Uranium-238 (U-238); and Radium-226 (Ra-226). Radon-222 (Rn-222) was also identified as a COC for indoor air. An ecological risk assessment was conducted to evaluate potential effects from contamination at the Site. The ecological assessment compared contaminant concentrations detected in various media (soil, sediment and water) at the Site with literature on contaminant toxicity to biota. Because the future use of the Site was concluded to likely remain industrial and remedial action will likely remove contaminated soils to depths affecting ecological resources, the ecological assessment concluded that cleanup criteria for the remedy should not be based on potential risks to ecological resources.

Response Actions

Pre-ROD Removal Actions

1984-1985 Removal Action

DOE conducted removal actions at 26 properties between 1984 and 1985, based on the results of the 1981 radiological surveys. DOE's cleanup criteria were based on EPA's 40CFR192 Uranium Mine Tailings Radiation Control Act (UMTRCA). Excavation cut lines were based on soil sample results, and walkover gamma and downhole gamma logging surveys. The surface and subsurface readings of 11,000 and 40,000 counts per minute (cpm) were used as a correlation to 5 picoCuries per gram (pCi/g) and 15 pCi/g, respectively, for Th-232. At that time, commercial disposal facilities were not available for the volume of radioactive waste generated by the cleanup. Therefore, excavated soils were transported to the Maywood Interim Storage Site (MISS) for temporary storage. Post-remedial action sampling was undertaken to confirm the cleanup goals were met and included: surface gamma radiation scans; soil sampling for Ra-226, Th-232 and U-238; and exposure rate measurements. Details of the post-remedial action sampling are described in the first five-year review report.

1994-1996 Removal Action - MISS Disposal

By September 1994, commercial disposal facilities became available and DOE released an Engineering Evaluation/Cost Analysis (EE/CA) evaluating several potential removal alternatives for the MISS. DOE then selected a non-time critical removal action in an Action Memorandum for the removal of the interim waste storage pile to such a facility. Radioactive waste at the MISS was loaded into railcars and shipped to an off-site commercial disposal facility. This removal was initiated in 1994 and completed in 1996.

1995-1999 Removal Action

In September 1995, DOE released a separate EE/CA evaluating removal alternatives for the remaining residential, commercial and municipal properties. Soil cleanup criteria identified in the 1993 Dispute Resolution described below were used for the properties remediated from 1995 to 1999. Contaminated materials from 38 properties were excavated, transported to the MISS, loaded into railcars and shipped to an off-site commercial disposal facility in Utah. At properties where contamination was present below structural items such as houses and garages, underpins for wall footings of the structure were installed to support the structure and to facilitate removal of contaminated materials. Details of the post-remedial action sampling are described in the first five-year review report.

2000 Time Critical Removal Action

A time critical removal action was completed by USACE during the winter of 2000 to remove contaminated sediments from portions of Lodi Brook and swale located at the terminus of West Howcroft Road. The removal action re-established the hydraulic grade of the brook and swale, prevented additional flooding and prevented the transport or migration of any additional contaminated soil by flood water.

2002 Removal Action in Support of NJDOT Roadway Improvement Projects

This removal action was initiated in January 2002 and was transitioned into the OU2 remedial action cleanup work. This work was associated with: NJ Route (Rt.) 17 and Essex Street interchange and drainage improvements; NJ Rt. 17 drainage improvements; and Interstate (I)-80 sound barrier construction.

Federal Facility Agreement

1990 Federal Facility Agreement

In September 1985, ownership of the property that would become the MISS was transferred to the federal government. A September 17, 1990, Federal Facility Agreement (FFA) between EPA and DOE established terms and requirements of the CERLCA cleanup. In 1993, EPA and DOE disagreed on the soil cleanup criteria that should be applied to the radioactive materials remaining at the Site. Therefore, EPA and DOE entered a dispute resolution process. This disagreement was resolved in 1994 in a document known as the "Dispute Resolution" with site-specific cleanup criteria established at an average of 5 pCi/g combined Ra-226 and Radium- 228 (Ra-228), above background, for residential properties. For commercial properties, the dispute established cleanup criteria of an average of 15 pCi/g combined Ra-226 and Ra-228, above background, with an "as low as reasonably achievable" (ALARA) goal of 5 pCi/g. USACE determined that attainment of these cleanup criteria would assure compliance with the relevant and substantive requirements of the State of New Jersey radiation dose standards for the remediation of radioactive contaminated properties. Responsibility for cleanup of the Maywood FUSRAP Site was transferred from DOE to the USACE in October 1997. The FFA requirements were transferred to USACE.

Media-specific OU2 Remedial Action Objectives RAOs:

Source Media (soil and bulk waste)

- To eliminate or minimize the potential for humans to ingest, come into dermal contact with, or inhale particulates of radioactive constituents, or to be exposed to external gamma radiation.

- To reduce radium and thorium concentrations in soil including the NRC licensed burial pits to levels in accordance with EPA / DOE dispute resolution cleanup criteria. An average of 15 pCi/g combined Ra-226 and Th-232 above background for the subsurface soils with an ALARA goal of 5 pCi/g; institutional controls to prohibit future residential use will be used. For unrestricted use, the cleanup criterion is an average of 5 pCi/g combined Ra-226 and Th-232 above background for soil.
- To reduce Site concentrations of U-238 to 50 pCi/g (which is essentially 100 pCi/g total uranium) above background. These levels are considered protective for unrestricted use.
- To comply with exposure dose limits of 15 millirem per year (mrem/yr) as specified in NJAC 7:28-12.8(a)1.
- To reduce the potential for environmental impacts and reverse the temporary disturbance of existing wetland habitats through removal of sediments exceeding the cleanup criteria.
- To eliminate or minimize toxicity, mobility, and/or volume of contaminated soils.
- To eliminate or minimize the potential migration of COCs into stream and storm drain sediments by surface water runoff.
- To eliminate or minimize the potential migration of COCs by infiltration or percolation that would result in contamination of the groundwater.
- To comply with ARARs.

Buildings / Structures

- To comply with exposure dose limits of 15 mrem/yr as specified in NJAC 7:28-12(a)1.
- To prevent radon concentrations in buildings from exceeding 3 picoCuries per liter (pCi/L) above background as specified in NJAC 7:28-12.8(a)2.
- To eliminate or minimize toxicity or mobility, and/or volume of COCs.
- To comply with ARARs.

OU2 Remedy Components

The major components of the selected remedy under the 2003 OU2 ROD consist of:

- Excavation of accessible soils to meet ARARs and soil cleanup criteria for either restricted or unrestricted use as discussed above for each property using federally accepted averaging methods (e.g., Multi-Agency Radiation Survey and Site Investigation Manual [MARSSIM]) to demonstrate compliance with the criteria.
- Physical separation, using backhoes or other heavy construction equipment, of a portion of the excavated material to sort boulders and rocks, waste potentially requiring disposal as mixed waste (radioactive and hazardous waste), and bulk waste such as building rubble.
- Remediation of contaminated buildings/structures (or demolition and disposal as deemed appropriate at the time of work) in consultation with the property owners, as necessary to achieve the criteria of 15 mrem/yr above background as specified in NJAC 7:28-12.8(a) 1 and the 3 pCi/L Rn-222 limit in NJAC 7:28-12.8(a) 2.
- Excavation of inaccessible soils to meet ARARs and cleanup criteria for either restricted or unrestricted use as discussed above if the landowners make them accessible during remediation; otherwise, inaccessible soils currently located under buildings and roadways would be excavated and disposed off-site as they become accessible in the future (e.g., due to renovation or demolition activities).
- Demolition and disposal of structures on the MISS to access contaminated soils.

- Off-site disposal of all materials above the cleanup criteria at facilities authorized to accept radioactive waste in accordance with applicable regulations.
- Five-year reviews in accordance with CERCLA 121 (c) and 300.430(f)(4)(ii).
- Requesting notification of the USACE and EPA by local municipalities of any land use changes involving those properties where radioactivity remains above an average of 5 pCi/g of Ra-226 and Th-232 combined above background concentrations in soils.
- Periodic Rn-222 monitoring of structures over inaccessible soils to ensure that the structures continue to provide adequate protection from these soils; mitigation of Rn-222 (e.g., sealing foundation cracks, supplementing existing ventilation systems, etc.) would be performed if indoor air levels exceed 3 pCi/L above background.
- Working with local authorities and landowners to implement land use controls (e.g., deed notices, easements, covenants, zoning controls, etc.) on a property by property basis, as necessary, for those properties where radioactivity remains above an average 5 pCi/g of Ra-226 and Th-232 combined above background concentrations in soils and/or due to the presence of inaccessible soil. Objectives of the institutional controls would be to restrict land use to commercial/industrial, prohibit residential or unrestricted use, and prohibit excavation into designated restricted areas. Institutional controls would remain in place as long as Site contaminants remain above levels that allow for unrestricted use.

Contaminant of Concern		Cleanup Criteria
Radionuclides in Soil		Unrestricted use properties: an average of 5 pCi/g ¹ Ra-226 and Th-232 combined above background
	Ra-226	
	Th-232	Restricted use properties: an average of 15 pCi/g Ra-226 and Th-232 combined above background for subsurface soils with an ALARA goal of 5 pCi/g
	U-238	100 pCi/g total uranium, 50 pCi/g U-238
Exposure Dose Limit		15 mrem/yr ² above background dose limit specified in NJAC 7:28-12.8(a)1
Radon and Radon Decay Products in Structure		Indoor radon air concentration: 3 pCi/L ³ radon-222 (Rn-222) limit specified in the NJAC 7:28-12.8(a)2

1 - picoCuries per gram 2 - millirem per year 3 – picoCuries per liter

Anticipated Future Land Use

Twenty-four commercial and government properties are addressed under the 2003 OU2 ROD, with four properties added by USACE via a November 2014 memorandum. Based on the historical commercial/industrial use of the Site, the proximity of heavily used transportation corridors (e. g., State Route 17, Interstate-80), and the well-defined commercial/industrial districts, the use of the restricted use cleanup criteria were justified for and applied to select commercial and government properties. For the remaining OU2 properties, cleanup to the unrestricted use criteria is considered more appropriate since they are located within a less defined commercial district with encroaching residential developments on three sides. Sixty-four properties were addressed through removal actions by DOE and USACE prior to the OU2 ROD. These properties are known as Phase I properties and cleanup to the unrestricted use criteria at these 64 properties is considered appropriate.

Status of Implementation

Remedial actions have been undertaken or are underway at properties included in the 2003 OU2 ROD. Phase I properties were also included as part of the Site's FYRs. USACE estimates that the remaining OU2 remedial action work will take another four years to complete and is dependent on Congressional appropriation funding.

Radiological data collected during investigations were used to plan remediation activities. Excavation was performed based on the excavation limit depicted on the design drawings showing the extent of contamination at each of these properties. Excavated materials were transported to the MISS for temporary storage, and subsequently transported off-site to a facility authorized to accept radioactive waste in accordance with applicable regulations. Post-remedial action sampling at the remediated properties was conducted utilizing a MARSSIM-based approach. The sampling consisted of gamma walkover surveys and soil sampling. Following verification that cleanup criteria had been met, excavated areas were backfilled with clean fill. Radiological results for the backfill were compared to applicable guidelines. Backfill and clean overburden soil results were below applicable regulatory criteria. Upon completion of the remedial actions, the property was restored to its original condition. Post Remedial Action Reports (PRARs) are prepared for each property to document the attainment of the cleanup criteria.

Based on the available PRARs, all the remediated properties were deemed to have met the respective cleanup criteria for restricted use or unrestricted use, as specified in the 2003 ROD except for five properties where inaccessible contamination was present. At these five properties, due to safety concerns and structural stability issues, contaminated soils could not be removed from areas underneath and immediately adjacent to, permanent structures such as buildings, a pump station, a sewer force main, a natural gas pipeline and/or utility pole. As such, rather than the unrestricted use originally specified in the 2003 OU2 ROD, these five properties have restricted use designations, with proposed implementation of institutional controls (i.e., administrative, legal, and/or physical measures that control potential or actual human health risks), as required by the OU2 remedy. Contaminated soil which is considered inaccessible will be addressed in the future when it is made accessible by property owners by removal of the permanent structure. In addition, a Memorandum of Understanding, dated June 9, 2000, between the USACE New York District and the State of New Jersey Department of Transportation is in effect for future work to be performed at highway projects involving the removal of soil potentially contaminated with radioactive substances.

Excavation & Off-Site Disposal - More than 225,000 cubic yards of radiologically-contaminated soil were removed from the Site and disposed at off-site facilities that are permitted to accept the waste since the 2014 Five-Year Review was completed. The total volume of contaminated soil shipped for the project to date is 751,526 cubic yards.

Institutional Controls - Institutional controls in the form of deed notices, pursuant to NJDEP regulations, are actively being pursued by the USACE for properties where unrestricted cleanup criteria have not been met or inaccessible contamination remains on the property. Two deed notices were recorded with the Bergen County Clerk in 2017 and 2018. Several other deed notices have been prepared and are under review. Per the Deed Notice requirements, USACE will determine the protectiveness of the soil remedial action by determining whether any actual or pending zoning or land-use change is consistent with restrictions. USACE is also required to inspect the site to identify whether any excavation or other disturbance activities have taken place. USACE is responsible for monitoring for radon in buildings where contamination remains under the foundation and NJDEP biennial certification reporting requirements.

IC Summary Table

Table 2: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions			ICs Needed	ICs Called for in the Decision Documents	Title of IC Instrument Implemented and Date (or planned)
Soil	Yes	Yes	13 commercial or government parcels. Status as follows: 2 final; 7 processing; and 4 with remedial action underway and therefore cannot be finalized until limits of restricted areas are defined.	Restricted use areas identified to prevent exposure and spread of contaminated soil that does not meet the unrestricted use criteria.	Deed Notice Planned completion 6/28/2024

Systems Operations/Operation & Maintenance

Monitoring - Annual monitoring of air, surface water, sediment and groundwater is carried out, in accordance with the *General Environmental Protection Plan (November 1999)*, to ensure the local community is protected.

The remedial activities completed for Phase I properties allowed an unrestricted use designation; therefore, operation and maintenance activities were not required at these properties. For OU2 properties, inaccessible soils underneath permanent structures are known to be present at four properties which were designated for restricted use. Post-remediation radon testing was performed at these four properties and interior gamma survey and inspection for any cracks in basement slabs have also been conducted. Periodic radon monitoring at these properties is included in the USACE's Land Use Control Implementation Plan (LUCIP). Inspections, monitoring and biennial reporting to NJDEP are required at properties with Deed Notices.

Additionally, in accordance with the requirements of the General Environmental Protection Plan, FUSRAP Maywood Superfund Site, Maywood, New Jersey, November 24, 1999 (USACE 1999), an Environmental Monitoring Program (EMP) was established for the Site. One of the main objectives of the EMP is to ensure that the public and the environment are adequately protected from FUSRAP contaminants present at the Site. The results of the EMP are documented in an Annual Monitoring Report for each calendar year. Prior to the establishment of the USACE EMP, DOE conducted a Site-wide environmental surveillance program to monitor conditions at the Site.

Potential Site impacts from climate change have been assessed, and the performance of the remedy is currently not at risk due to the expected effects of climate change in the region and near the Site.

III. PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determinations and statements from the **last** FYR as well as the recommendations from the **last** FYR and the current status of those recommendations.

Table 3: Protectiveness Determinations/Statements from the 2014 FYR

OU #	Protectiveness Determination	Protectiveness Statement
2	Will be Protective	The remedy currently being implemented at OU2 is expected to be protective of human health and the environment upon completion. In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks in these areas.

Table 4: Status of Recommendations from the 2014 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
2	The selected remedy for OU2 soil and buildings has not been fully implemented. Additional remedial actions and institutional controls, which are part of the OU2 remedy, are needed.	Implement the Land Use Control Implementation Plan to fulfill the institutional control requirements for any property where radioactivity remains above the 2003 OU2 ROD unrestricted use cleanup criteria for soil and where inaccessible radioactive soil contamination remains in place.	Ongoing	Two Deed Notices were recorded with the Bergen County Clerk in 2017 & 2018. Additional Deed Notices are being prepared.	6/28/2024
2	New EPA Radiation Exposure guidance was issued in June 2014	Evaluate new guidance and determine if it affects the OU2 remedy.	Completed	USACE Memo For The Record (8/1/2018) and NJDEP Correspondence (12/18/2018) regarding the new EPA radiation guidance provided information on how the OU2 remedy meets the current protectiveness criterion and dose-based recommendation of 12 mrem/yr for ARARs.	1/18/2019

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

On October 1, 2018, EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at 42 Superfund sites in New York and New Jersey, including the Maywood Chemical Co. Site. The announcement can be found at the following web address:

<https://www.epa.gov/aboutepa/fiscal-year-2019-five-year-reviews>. In addition to this notification, a public notice was made available by posting on USACE and EPA websites and at the FUSRAP Public Information Center, stating that there was a FYR and inviting the public to submit any comments to EPA. The results of the review and the report will be made available at the Site information repositories located at the USACE’s FUSRAP Public Information Center, 75A West Pleasant Avenue, Maywood, New Jersey 07607 or <http://fusrapmaywood.com/> or at EPA’s website <https://www.epa.gov/superfund/maywood-chemical>.

As the lead federal agency, DOE and its successor, USACE, established and maintain an extensive community involvement program. EPA has coordinated with the lead federal agencies throughout the project to ensure that the local community is kept well informed of cleanup activities. Communications with the property owners, surrounding community and local government officials is an ongoing and critical component of the remedial work. A Public Information Center with project records was established in the business district of Maywood, New Jersey. Project updates are prepared and sent out to the local community on a routine basis. USACE's project website includes project documents, maps, notices and updates. The nature of the work requires constant communication with property owners where cleanup is required from initial investigations until final property status reporting.

Data Review

The Annual Environmental Monitoring Reports used in preparing this Five-Year Review Report covered the calendar years 2014 through 2017 (the 2018 report is expected to be released later in 2019). The annual EMP is implemented for the Site to ensure that the public and the environment are adequately protected from FUSRAP contaminants, through annual monitoring of the air, surface, sediment, and groundwater at the Site. Based on the 2017 Annual Monitoring Report, the monitoring results were within the historical ranges and comparable to those reported in previous years. The measured concentrations of radionuclides of concern in sediment samples collected in Westerly and Lodi brooks did not exceed the soil cleanup criteria established in the OU2 ROD during the five-year review period. Sediment and surface water concentrations measured during the annual environmental sampling events are significantly below the referenced radiological benchmarks protective of aquatic habitats.

Data collected as part of the PRAR for individual property remedial actions were reviewed. In addition, data from the radiological characterization reports, 2013 Property Assessment Tech Memo and other Site investigation reports and Annual Monitoring Reports from 2014 to 2017 were reviewed to prepare this report to ensure that where remediation has been completed, remediation goals have been achieved.

Site Inspection

The inspection of the Site was conducted on February 13, 2109. In attendance were Betsy Donovan, EPA RPM, Elizabeth LaBlanc, EPA Regional Counsel, James Moore, USACE Project Manager; and John Canby, USACE. The purpose of the inspection was to assess the protectiveness of the remedy.

The USACE Maywood FUSRAP project team members discussed remedial action progress since the last five-year review was completed and provided several drawings that noted excavation areas completed. A tour of the MISS soil stockpile, railroad load-out system used for transportation of waste for off-site disposal, active construction areas on MISS and other properties. The team did not conduct interviews during the Site inspection because Site communication activities for the ongoing and future cleanup work were deemed sufficient. USACE maintains a robust communications program for the ongoing soil cleanup work which includes a website, a public information center located in Maywood, newsletters outreach to the local community and elected officials.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

ANSWER A: Yes, the remedy is functioning as intended by the 2003 OU2 ROD. However, for the remedy to be protective in the long-term, institutional controls need to be in effect for properties where radioactivity remains above 5 pCi/g of Ra-226 and Th-232 combined above background concentrations for soil.

- Summary of Data Review – Post Remedial Action Reports (PRARs), Deed Notices, and 2014 – 2017 Annual Monitoring Reports, were the main sources of data reviewed for this report.
- Remedial Action Performance and Monitoring Results - The remedial action consisting of excavation and off-site disposal of soils exceeding the 2003 OU2 ROD cleanup criteria is progressing and continues to be implemented as designed. The remedial action is performing as expected, with RAOs being achieved in a reasonable timeframe.
- System Operations/O&M - The past and current operations maintain the effectiveness of the remedial actions undertaken at the OU2 properties.
- Opportunities for Optimization – In 2018, based on results of chemical and radiological analyses, NJDEP determined that certain soil met the definition of clean fill and concrete that met the definition of “Uncontaminated Surface Soil” could be used without restriction. To date, USACE has re-used about 12,000 cubic yards of soil and 9,000 cubic yards of crushed concrete as backfill primarily at the former Sears property. This has significantly reduced costs and impacts from trucking backfill to the Site from distant locations.
- Early Indicators of Potential Remedy Problems - Early indicators of potential remedy problems were not identified in this five-year review.
- Implementation of Institutional Controls and Other Measures - Per the 2003 OU2 ROD, institutional controls are required for properties with inaccessible soils or properties exhibiting residual radioactivity in soil above an unrestricted use cleanup criteria (i.e., an average of 5 pCi/g of Ra-226 and Th-232 combined above background). Two deed notices have been recorded with the Bergen County Clerk and others have been drafted. USACE has a LUCIP; and USACE is negotiating land use controls with property owners. Addresses and figures where “Call Army Corps Before Digging” areas are identified have been posted on the USACE Maywood project website.
- Exposures at the OU2 properties with ongoing remedial action, which could potentially result in unacceptable risks, are being controlled through access controls, fencing, security guard, warning signs, work place management practices, property owner notifications, monitoring, existing zoning ordinances and communication with local officials and affected property owners. In addition, properties with inaccessible contamination are routinely monitored for gamma exposure rates and radon in buildings.

In all cases, the measurements have not required further actions and meet applicable gamma dose and radon levels.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

QUESTION B SUMMARY:

DOE conducted the Baseline Risk Assessment in 1993 in accordance with EPA Risk Assessment Guidance for Superfund (RAGS) at the time, as well as Residual Radiation (RESRAD) computer modeling. The process used remains valid.

Contaminants of concern (COCs) for soils and building materials identified on the OU2 properties are Thorium-232, Radium-226, Uranium-238, and their associated decay products, including Radon-222 in indoor air.

Toxicity factors and contaminant characteristics have not changed in a way that could affect the protectiveness of the remedy. In June 2014, the Office of Superfund Remediation and Technology Innovation (OSRTI) released the “Radiation Risk Assessment at CERCLA Sites: Q&A,” which changes the Superfund recommendation on what is considered a protective dose-based ARAR from 15 mrem/year to 12 mrem/year (equating to a 3×10^{-4} risk). This value was evaluated in the context of the OU2 remedy, by USACE in a Memorandum for Record (MFR), dated August 1, 2018. EPA agrees with the USACE MFR findings that this change in recommended dose will not impact OU2 regarding the protectiveness determination of the remedial action because the OU2 ROD remedial alternative action level is based on the DOE and USEPA dispute resolution criteria of 1994. The USACE evaluated the protectiveness of the dispute criteria in Appendix C of the Feasibility Study by conducting a risk assessment for Compliance with CERCLA and a dose assessment to demonstrate compliance with the NJDEP ARAR NJAC 7:28-12. While NJAC 7:28-12 cites the dose criterion of 15 mrem/yr, the soil criteria for the OU2 remedial action was not based on 15 mrem/yr; instead, it was based on soil concentrations agreed to in the dispute resolution. As demonstrated in the FS (App. C, Table C-6) and presented in the ROD Table 7, the dispute criteria and the remedial action at OU2 conservatively result in a dose of 7 mrem/yr to the residential receptor and 6 mrem/yr to the industrial and transient receptors. Further, post remediation sampling confirms the actual post-remedial action residuals are well below the ROD criteria and below backfill criteria, thus the true dose from the remedial action is actually below that presented in ROD Table 7.

By using the dispute resolution criteria and proving its protectiveness as related to ARARs rather than starting with an ARAR dose limit and determining the criteria, USACE complied with the terms of the dispute resolution and subsequent ARARs. Thus, the remedy is protective under a 12 mrem/yr protectiveness evaluation. USACE notes that risk drives the remedial action and, as presented in the ROD and FS, the dispute criteria resulting risk is 1×10^{-4} . Actual residual risk is significantly less due to residuals being less than what was modeled and additionally being covered with backfill. NJDEP Bureau of Environmental Radiation sent a December 18, 2018 letter in support of the USACE MFR, including an explanation of uncertainties used in risk calculations, and asserted that the cleanup is at least as stringent as a dose criterion of 12 mrem/yr. EPA is in agreement with the position presented by USACE and NJDEP and concludes that the remediation of OU2 thus far is in compliance with the new dose-based recommendation from the guidance.

The 1993 Risk Assessment concluded that remedial action would likely remove contaminated soils to depths affecting ecological resources. The habitat at the Maywood Site and surrounding and downstream properties is typical of urban areas, and generally consists of early to late old-field stages, usually along transportation rights-of-way or unused corners of commercial/industrial properties. Overall there is very little wildlife habitat near the Site, other than ornamental plantings, mowed lawns and scattered patches of wooded and herbaceous vegetation along stream corridors and dividing lines of commercial/industrial properties. Some wetland vegetation is present along the brooks and some drainage swales within the boundaries of the FUSRAP Maywood Site. Westerly and Lodi Brooks are underground for most of their length; near the Saddle River, riparian vegetation is found along the banks of both brooks.

Over 225,000 cubic yards of radiologically-contaminated soil was removed from the Site and disposed at permitted off-site facilities since the last FYR. Excavation of contaminated soil has prevented further release to environment, thus mitigating/minimizing human health impacts. Based on the available PRARs all the remediated properties were deemed to have met the respective cleanup criteria as specified in the 2003 ROD except for five properties where inaccessible contamination was present and for various safety and/or structural reasons could not be removed. As such, rather than the unrestricted use originally specified in the ROD, these five properties have restricted use designations, with proposed implementation of institutional controls (ICs), as required by the OU2 remedy. Contaminated soil which is considered inaccessible will be addressed in the future when it becomes accessible by removal of the permanent structure. The remedy will be fully protective once all accessible contaminated soil is removed and when ICs are in place at all properties where unrestricted cleanup criteria have not been met or inaccessible contamination remains to prevent it from human contact or becoming mobilized.

Soil vapor intrusion (SVI) is evaluated when soils and/or groundwater are known or suspected to contain VOCs. Although VOCs were not identified as COCs for OU2, the potential for the vapor intrusion pathway at other OUs will be evaluated and included in future FYRs. The potential for radon to migrate indoors is being evaluated in buildings that have not been released for unrestricted use.

Although the ecological risk assessment screening and toxicity values used to support the OU2 ROD may not necessarily reflect the current values, the remedial action objectives for source media (soil and bulk waste) remain protective of the environment and the selected remedy consisting of the excavation of contaminated soils and burial pits along with the excavation of contaminated sediments from wetland habitats and off-site disposal of contaminated material eliminates any potential risk from surface soil contaminants to terrestrial receptors.

The exposed populations and exposure pathways evaluated as part of the 1993 Baseline Risk Assessment evaluated the following adult receptors: residents, employees, and transients (e.g., visitors, customers, trespassers, and commuters) and pathways: ingestion, dermal contact with, or inhale particulates of radioactivity. While children were not evaluated as residents or transients, many of the properties were remediated to unrestricted use and those that were not are not appropriate for children to spend considerable time (e.g., the MISS, Stepan Company and NYS&W Railway). Exposure pathways remain appropriate currently and for the next five years.

The general remedial action objectives (RAOs) for OU2 are to prevent or mitigate further release of FUSRAP waste to the surrounding environment and to meet the established cleanup criteria and comply with ARARs. In addition to reducing the radioactive COCs to the remediation cleanup criteria, RAOs also include the elimination or minimization of the potential for humans to ingest, come into dermal contact with, or inhale particulates of

radioactivity. The remedy was necessary to achieve the RAOs selected for the Site.

QUESTION C: Has any **other** information come to light that could call into question the protectiveness of the remedy?

ANSWER C: There is no new information to call into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

No issues were identified as part of this FYR.

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)		
<i>Operable Unit:</i> OU2	<i>Protectiveness Determination:</i> Will be Protective	<i>Planned Completion Date:</i> 6/28/2024
<i>Protectiveness Statement:</i> The remedy currently being implemented at OU2 is expected to be protective of human health and the environment upon completion. In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks in these areas.		

VIII. NEXT REVIEW

The next FYR report for the Maywood Chemical Co. Superfund Site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

- Memorandum for Record, August 1, 2018 (USACE)
- Letter regarding USACE August 1, 2108 MFR, December 18, 2018 (NJDEP)
- Concrete Reuse Approval Letter, August 23, 2108 (NJDEP)
- Fill Reuse Approval Letter, August 23, 2108 (NJDEP)
- DRAFT ANNUAL ENVIRONMENTAL MONITORING REPORT, 2017 (USACE)
- ANNUAL ENVIRONMENTAL MONITORING REPORT, 2016 (USACE)
- ANNUAL ENVIRONMENTAL MONITORING REPORT, 2015 (USACE)
- ANNUAL ENVIRONMENTAL MONITORING REPORT, 2014 (USACE)

APPENDIX B

- Figure: Site Location
- Figure: Site Map
- Table: Chronology of Site Events

Figure: Site Location Map

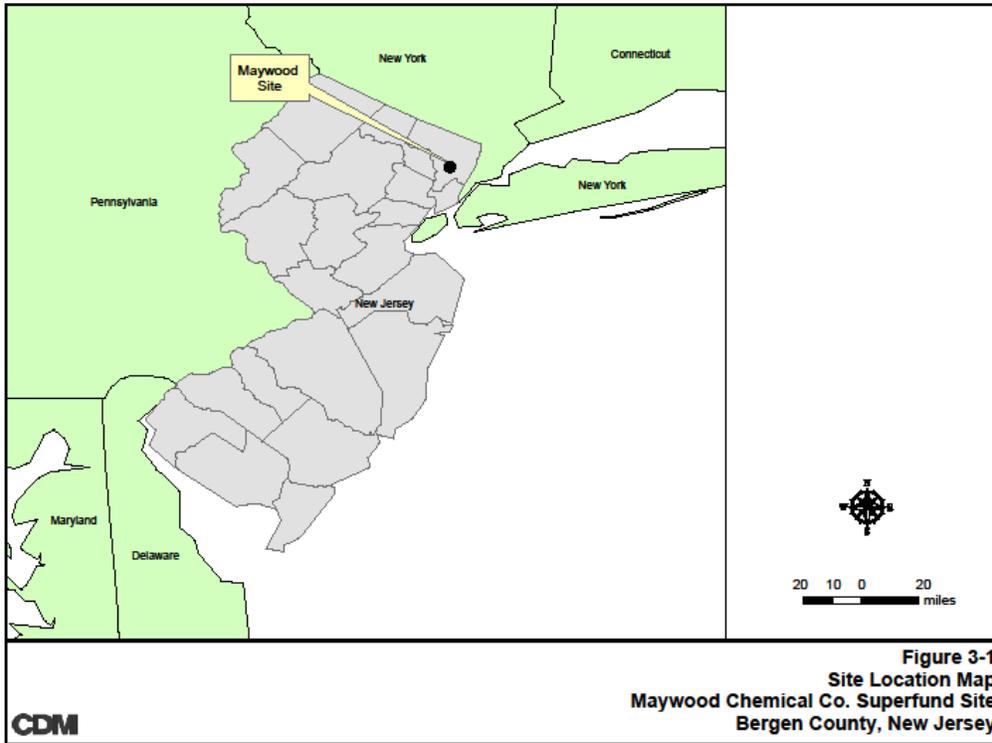
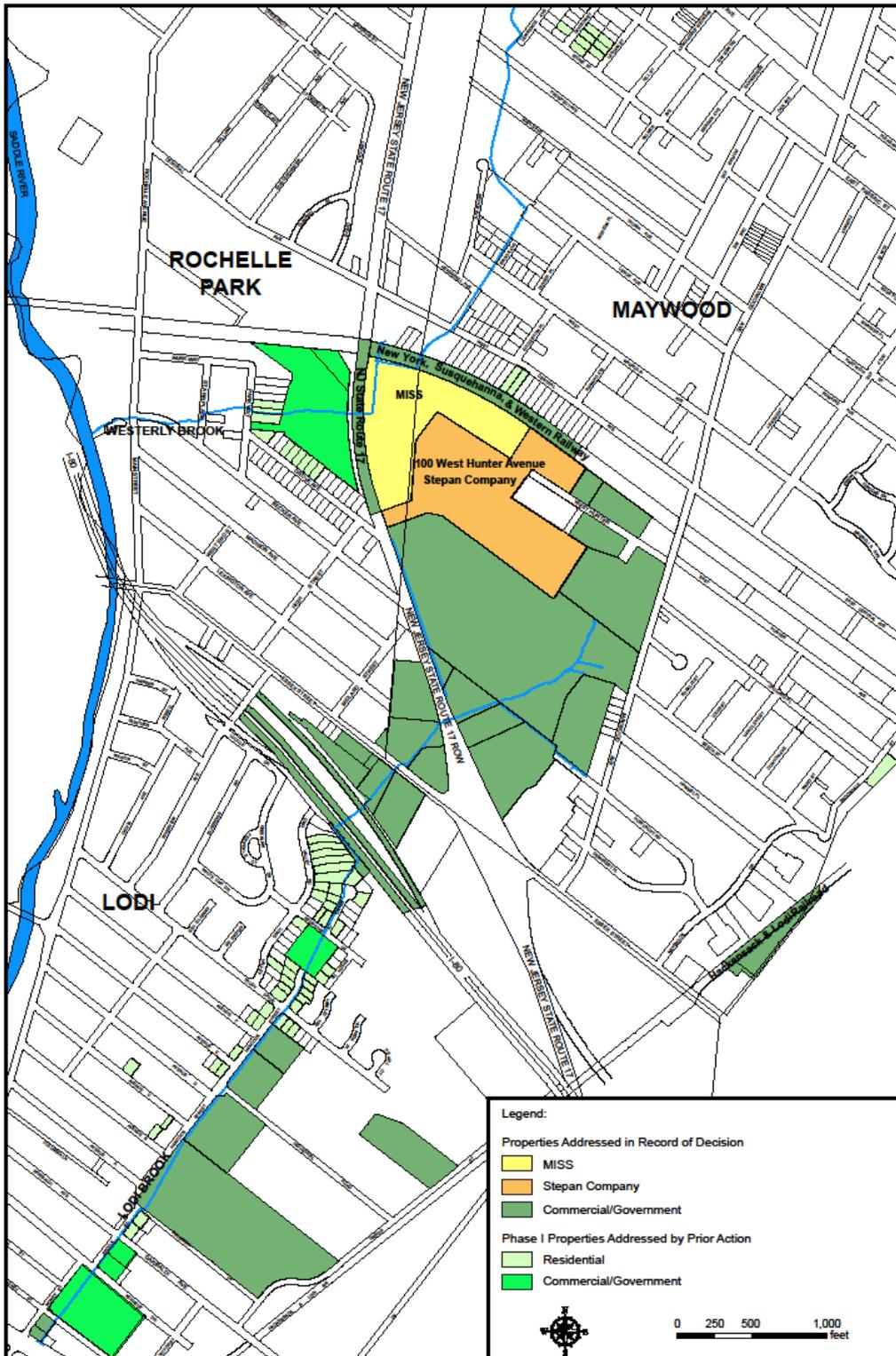


Figure: Site Map



Source: Modified from FUSRAP website (www.fusrapmaywood.com, 3/4/2009)

CDM

Figure 1-1
Site Map
Maywood Chemical Co. Superfund Site
Bergen County, New Jersey

Table: Chronology of Site Events

Table: Chronology of Site Events	
Event	Date(s)
Maywood Chemical Works (MCW) receives Atomic Energy Commission (AEC) License R-103 for thorium possession, processing and re-sale.	1954
Processing of monazite sands for rare earths and thorium ceases.	1956
AEC License R-103 expires.	1957
Stepan Chemical Company buys MCW and applies for AEC license “to cover our operations as processors and exporters of source material.” Application states “active manufacturing in the Thorium Plant is at a standstill.”	1959
Stepan receives an AEC radioactive materials license.	1961
Based on AEC inspections and information related to a property west of NJ State Route 17, known as the Ballod property, Stepan agreed to take certain corrective actions and began to clean up residual thorium waste, by partially stabilizing residues and tailings.	1963
Stepan removed approximately 19,100 cubic yards (cy) of contaminated soil from the Ballod property and placed it into three burial pits (1, 2 & 3) on the Stepan property.	1966-1968
EPA added the site to the Superfund National Priorities List. In late 1983, Congress assigned DOE a research and development project to clean up the radioactive wastes at the site (via the FY84 Energy and Water Appropriations Act).	1983
DOE assigned the site to the Formerly Utilized Sites Remedial Action Program (FUSRAP). The site consists of a total of 88 designated industrial, residential, commercial and government properties.	1983
DOE began investigating the site and surrounding area. Vicinity properties on Grove Avenue and Parkway in Rochelle Park were surveyed in late 1983, and nine of the surveyed properties were designated for remedial action as a result. In addition, a “drive-by” gamma survey followed by ground surveys that included limited sampling was completed for properties in Lodi.	1983-1984

<p>Approximately 35,000 cy of contaminated materials were removed from the Ballod property and from 17 vicinity properties on Davison Avenue, Latham Street, Grove Avenue, and Parkway in Maywood and Rochelle Park. An additional 500 cy of contaminated materials were removed from eight vicinity properties located on Avenue C, Avenue F, Hancock Street, and Trudy Drive in Lodi, and another portion of the Ballod property in Rochelle Park. The excavated materials were stored in a protective enclosure cell on a portion of 100 West Hunter Avenue (now known as the Maywood Interim Storage Site (MISS)) which DOE acquired in 1985 to expedite cleanup of the vicinity properties.</p>	1984-1985
<p>Federal Facility Agreement (FFA) signed by EPA and DOE</p>	1990
<p>A time-critical removal action was undertaken by DOE to decontaminate one additional residential property in Lodi due to the significantly elevated gamma exposure rates measured inside the residence.</p>	1991
<p>DOE issued <i>Remedial Investigation Report for the Maywood Site</i>.</p>	1992
<p>DOE <i>Final Baseline Risk Assessment for the Maywood Site</i></p>	1993
<p>Additional cleanup criteria for the radionuclide contamination in soil at the site were established in 1994. DOE implemented interim property cleanups as removal actions as described in the September 1995 <i>Engineering Evaluation/Cost Analysis (EE/CA) for the Cleanup of Residential and Municipal Vicinity Properties at the Maywood Site, Bergen County, New Jersey</i> under CERCLA.</p>	1994-1995
<p>Cleanup at fourteen residential properties, four municipal properties (three parks and a fire station) and one commercially zoned property was initiated. Previously stored excavated materials were removed from the MISS and sent to a permanent, off-site commercial disposal facility.</p>	1995-1997
<p>USACE performed remediation of the remaining 23 vicinity properties. During these cleanup actions, an additional five properties in Lodi and Maywood were remediated as the contamination extended onto adjacent undesignated properties.</p>	1997-1999
<p>A time critical removal action was completed by USACE during the winter of 2000 to remove contaminated sediments from portions of Lodi Brook and a</p>	2000

swale located at the terminus of West Howcroft Road. The removal action re-established the hydraulic grade of the brook and swale, prevented additional flooding, and prevented the transport or migration of contaminated soil by flooding water.	
USACE issued <i>Engineering Evaluation/Cost Analysis for a Removal Action in Support of NJDOT Roadway Improvement Projects at the FUSRAP Maywood Superfund Site (FMSS)</i> .	2001
The <i>Feasibility Study for Soils and Buildings at the FUSRAP Maywood Superfund Site</i> was completed and submitted for public comment along with the <i>Proposed Plan for Soils and Buildings at the FUSRAP Maywood Superfund Site</i> .	2002
EPA and USACE signed the <i>Record of Decision (ROD) for Soils and Buildings at the Maywood Superfund Site</i> .	2003
Remedial design for FUSRAP Soils and Buildings start	2003
Remedial design for FUSRAP Soils and Buildings complete	2004
On-site FUSRAP Soils and Buildings remedial action construction start	2004
Post Remedial Action Reports for individual properties	2005 to present
First & Second five-year review reports	2009, 2014
USACE Technical Memo assessing all property investigations and cleanups to date	2013