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Level 2

Long-Term Stewardship Plan for Completed FUSRAP Sites

July 2023

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Abbreviations

ACM	asbestos-containing material
AEC	U.S. Atomic Energy Commission
ALARA	as low as reasonably achievable
^{241}Am	americium-241
ANL	Argonne National Laboratory
AOC	area of concern
ARAR	applicable or relevant and appropriate requirement
ARC	Albany Research Center
BNI	Bechtel National Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
cm	centimeters
^{60}Co	cobalt-60
COC	contaminant of concern
^{137}Cs	cesium-137
CTDEEP	Connecticut Department of Energy and Environmental Protection
DCGL	derived concentration guideline level
DOE	U.S. Department of Energy
dpm/100 cm^2	disintegrations per minute per 100 square centimeters
EPA	U.S. Environmental Protection Agency
ERDA	U.S. Energy Research and Development Administration
ESD	Explanation of Significant Differences
^{155}Eu	europium-155
FSS	final status survey
ft	feet
ft^2	square feet
ft^3	cubic feet
FUSRAP	Formerly Utilized Sites Remedial Action Program
GERE	Grant of Environmental Restriction and Easement
GM	General Motors
HEPA	high-efficiency particulate air
HHMS	Herring-Hall-Marvin Safe

IWL	industrial waste line
^{140}La	lanthanum-140
LANL	Los Alamos National Laboratory
LLRW	low-level radioactive waste
LM	Office of Legacy Management
LOOW	Lake Ontario Ordnance Works
LTS	long-term stewardship
LTS Plan	Long-Term Stewardship Plan
m^2	square meters
m^3	cubic meters
MassDEP	Massachusetts Department of Environmental Protection
M&C	Metals & Controls Inc.
MED	Manhattan Engineer District
mg/kg	milligrams per kilogram
µR/h	microroentgens per hour
MOU	Memorandum of Understanding
mrem	millirem
mrem/yr	millirem per year
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NJDEP	New Jersey Department of Environmental Protection
NLO	National Lead of Ohio
NMED	New Mexico Environment Department
NPL	National Priorities List
NRC	U.S. Nuclear Regulatory Commission
NYSDEC	New York State Department of Environmental Conservation
ORNL	Oak Ridge National Laboratory
OU	operable unit
PCB	polychlorinated biphenyl
pCi/g	picocuries per gram
pCi/L	picocuries per liter
PD	Performing Defendant
PL	Public Law
^{238}Pu	plutonium-238
^{239}Pu	plutonium-239

^{240}Pu	plutonium-240
^{226}Ra	radium-226
ROD	Record of Decision
^{90}Sr	strontium-90
TA	technical area
TEDE	total effective dose equivalent
^{230}Th	thorium-230
^{232}Th	thorium-232
^{234}U	uranium-234
^{235}U	uranium-235
^{238}U	uranium-238
USACE	U.S. Army Corps of Engineers
USC	*United States Code*
VP	vicinity property
yd^2	square yards
yd^3	cubic yards

1.0 Introduction

This document serves as the Long-Term Stewardship Plan (LTS Plan) for the Formerly Utilized Sites Remedial Action Program (FUSRAP) completed sites that have been released for unrestricted use based on the final radiological conditions at each site.

This document has a chapter for each FUSRAP site assigned to the U.S. Department of Energy (DOE) Office of Legacy Management (LM) for long-term stewardship (LTS) that does not warrant a standalone LTS Plan. Currently, only the Colonie, New York, Site has a standalone LTS Plan. Within each chapter is site-specific information that describes the following: site conditions, remedial action, LTS requirements, and references.

It should be noted that the two Tonawanda North, New York, Sites (Unit 1 and Unit 2) are addressed in one chapter because of similar site conditions, remedial action, and LTS requirements. The Painesville, Ohio, Site and Tonawanda North sites, which previously were addressed under individual LTS Plans, have been incorporated into this plan.

1.1 FUSRAP Background

In 1942, under the jurisdiction of the U.S. Army, the U.S. Army Corps of Engineers (USACE) established the Manhattan Engineer District (MED), also known as the Manhattan Project, as the agency responsible for early atomic weapons research and development. On January 1, 1947, in accordance with the Atomic Energy Act of 1946, all atomic energy activities transferred to the newly created U.S. Atomic Energy Commission (AEC). From 1942 to 1946, more than 10 contractors and several hundred subcontractors were involved in MED production, research, and development operations, and AEC continued the MED practice of contracting with industry, private contractors, and academic institutions to perform many of the actual operations.

FUSRAP was established in 1974 by AEC to evaluate and remediate sites where radioactive contamination remained from MED and AEC operations. In early 1974, AEC initiated the survey program to identify all formerly utilized sites involved with radioactive materials and to determine their radiological status. This survey program became FUSRAP. The responsibility for this survey was assigned to the AEC Division of Operational Safety. At that time, all divisions and field offices of AEC were required to search their files to identify any former government-owned or -leased sites and facilities that had been used in MED and AEC research or production activities. In addition, the files were searched for records identifying the radiological conditions at the termination of MED or AEC activities or the transfer of custodial responsibility for such sites, the current radiological condition of the sites, and the land use and ownership data. This effort identified many sites for which pertinent information was lacking or was insufficient to determine their radiological conditions. During the initial records review, FUSRAP personnel assessed the radiological conditions at more than 600 sites that were potentially involved in early atomic weapons and energy activities and identified 46 sites for cleanup.

Later in 1974, AEC was abolished, and its responsibilities were divided among the newly established U.S. Nuclear Regulatory Commission (NRC) and the U.S. Energy Research and Development Administration (ERDA). NRC assumed AEC's licensing and regulatory roles, and

ERDA assumed other programmatic AEC responsibilities, including FUSRAP. ERDA and its successor agency in 1977, DOE, began identifying and characterizing sites under FUSRAP.

DOE began remediating sites under FUSRAP in 1979. The initial remediation activities focused on sites where conditions were more straightforward in terms of size, nature, and extent of contamination rather than sites with more challenging and complex conditions, where remediation extended for several years or decades or may be in progress now. DOE implemented a multiphase approach to characterize sites, identify appropriate remedial activities, conduct remediation and waste disposal, prepare a final report, and assemble materials for a certification docket. DOE established programmatic guidelines for the cleanup of residual concentrations of radionuclides in soil, concentrations of airborne radon and radon decay products, external gamma radiation levels, surface contamination levels, and residual radionuclide concentrations in air and water. Certification was performed to verify that final site conditions met cleanup objectives, to assemble and document the data used in final decisions, and to archive the documentation in a format that permitted public availability. Both the remedial action contractor (or subcontractor) and an independent verification contractor reviewed final site radiological conditions to ensure that remedial objectives were achieved. To document completion of activities, a notice was typically placed in the *Federal Register*.

In 1997, Congress assigned responsibility for the characterization, remediation, and verification of FUSRAP sites to USACE. In 1999, a Memorandum of Understanding (MOU) was signed, and it defined the roles of DOE and USACE in administering and executing FUSRAP. From 1974 to 1997, DOE completed the remediation of 25 FUSRAP sites. Of the initial list of 25 sites, several sites required further remediation by USACE in subsequent years. Since 1997, DOE has maintained responsibility for identifying FUSRAP sites and for LTS of remediated sites.

This LTS Plan complies with the criteria outlined in the *Memorandum of Understanding Between the U.S. Department of Energy and the U.S. Army Corps of Engineers Regarding Program Administration and Execution of the Formerly Utilized Sites Remedial Action Program (FUSRAP)* (DOE and USACE 1999; DOE and USACE 2021), hereafter referred to as the MOU. The MOU addresses program administration and execution of FUSRAP and includes two supporting letters of agreement between the two agencies. The MOU stipulates that USACE would administer and execute cleanup at FUSRAP sites pursuant to the Energy and Water Development Appropriations Act of 1998 (Public Law 105-62 [PL 105-62]) and the Energy and Water Development Appropriations Act of 1999 (PL 105-245). Cleanup would be subject to regulation under Title 42 *United States Code* Section 9601 et seq. (42 USC 9601 et seq.), "Comprehensive Environmental Response, Compensation, and Liability Act" (CERCLA); Title 40 *Code of Federal Regulations* Section 300 (40 CFR 300), "National Oil and Hazardous Substances Pollution Contingency Plan" (NCP); and any subsequent laws specifically relating to FUSRAP, CERCLA, and the NCP. CERCLA Section 121(d) also requires that site cleanup follows state and federal applicable or relevant and appropriate requirements (ARARs), unless exempted by a waiver.

With the 1997 change in remediation responsibilities, the MOU between DOE and USACE established a 2-year maintenance and monitoring period following remediation, after which FUSRAP sites would transfer back to DOE for LTS responsibilities. DOE established LM in December 2003. LM is responsible for LTS of remediated FUSRAP sites. After transfer, it manages sites based on the requirements of the Records of Decision (RODs), the authority of the

Atomic Energy Act of 1954 as amended (42 USC 2011 et seq.), and other applicable laws and regulations under an LTS Plan.

FUSRAP sites on the National Priorities List (NPL) are regulated by state and federal environmental regulatory authorities. Sites that are not on the NPL are subject to the NCP but not regulated by additional authorities. If a site is not on the NPL, Congress granted USACE lead agency status, which includes the authority to establish cleanup criteria and certify that remedial action is complete.

In total, USACE has completed remediation at 10 sites and transitioned them to DOE for LTS, making a total of 34 completed FUSRAP sites (for this site count, Tonawanda North site Units 1 and 2 are listed together but counted as two sites). As noted above, of the initial list of the 25 DOE sites, several sites required further remediation by USACE. USACE is currently remediating 21 FUSRAP sites, which are referred to as "active sites." Figure 1-1shows the remediation time frames of the completed sites, along with the dates when the active sites were added to the program and their anticipated completion dates.

1.2 Maintaining Protectiveness

Most FUSRAP completed sites were remediated to a condition that allows unrestricted use and unlimited exposure. For unrestricted use and unlimited exposure, the cleanup criterion for sites remediated by DOE was a total effective dose equivalent (TEDE) of 100 millirem per year (mrem/yr) for a residential or subsistence farming exposure scenario. For sites remediated by USACE after 1997, the NRC standard TEDE of 25 mrem/yr was typically used as the release criterion. In both cases, through application of the as low as reasonably achievable (ALARA) approach, final dose rates were typically far less than the DOE criterion of 100 mrem/yr.

Generic limits were applied for radium and thorium in soil, and site-specific limits were derived for other radionuclides. As shown in the site chapters that follow, cleanup criteria were often contained in the archived DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, which has been updated to DOE Order 458.1 Chg 4 (LtdChg), or in the *U.S. Department of Energy Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites* (DOE 1987). Surface activity and radionuclide concentrations in soil presented in the following site chapters can be compared to these limits. If different guidelines and limits were derived for a site, those limits and their sources are presented in the site-specific chapters.

At some sites, DOE applied supplemental limits to elevated levels of radiological contamination that exceeded the established cleanup standards and were left in place. These supplemental limit areas were typically designated because of their inaccessibility beneath utility structures, railroads, or buildings. Table 1-1 indicates which sites have supplemental limits.

In 2017, DOE held two technical workshops to discuss supplemental limits. The discussions focused on the following:

- The basis for DOE establishing the supplemental limit
- The current site status and use
- The approved land use at the time of cleanup

- The location of the inaccessible residual radiological contamination and its safe configuration
- Whether additional institutional controls or protective measures are necessary
- The risk (if any) to DOE

It was determined that these areas did not pose an unacceptable risk if the land use that was in place at the time of certification continued. Risk calculations show that if property owners were to make improvements to or eliminate existing structures within the supplemental limit areas, contamination levels are low enough that demolition debris would not need to be disposed of as regulated waste. No additional protective measures are required for the supplemental limit sites. LM has initiated a program of annual desktop assessments to track land use at the sites that have supplemental limit areas. The program also confirms that the exposure assumptions at the time of certification remain valid.

DOE must maintain protectiveness for as long as residual contaminants may pose a potential risk. The major contaminant at many FUSRAP sites is natural uranium (i.e., uranium in natural isotopic abundances that have not been enriched or depleted in uranium-235 [^{235}U]) that was previously refined at other locations where daughter products were removed. Other FUSRAP sites were involved in storage of or the actual processing of uranium ore, so uranium daughter products may be present in the waste stream. In all cases where supplemental limits were applied, because of the long half-lives of uranium and its daughter products, DOE assumes that LTS requirements will remain in effect in perpetuity or until site conditions change. For sites that were released for unrestricted use and that contain supplemental limits areas, DOE conducts an annual desktop assessment to ensure that land usage is consistent with the site certification land use according to the remedy and to determine whether a site visit is necessary. Results from the 2023 desktop assessments revealed no technical changes. Land use will change at some of the FUSRAP sites in the future. Often, the need for a use restriction is implied if current land use is industrial and conditions would not be acceptable for residential or another land use.

Table 1-1 was developed to provide a summary of the 33 FUSRAP completed sites contained within this plan. The Colonie site is covered under a standalone LTS Plan (DOE 2023). Table 1-1 identifies any institutional controls required by the ROD, DOE-implemented protective measures, and other supplemental limits, if any, that apply.

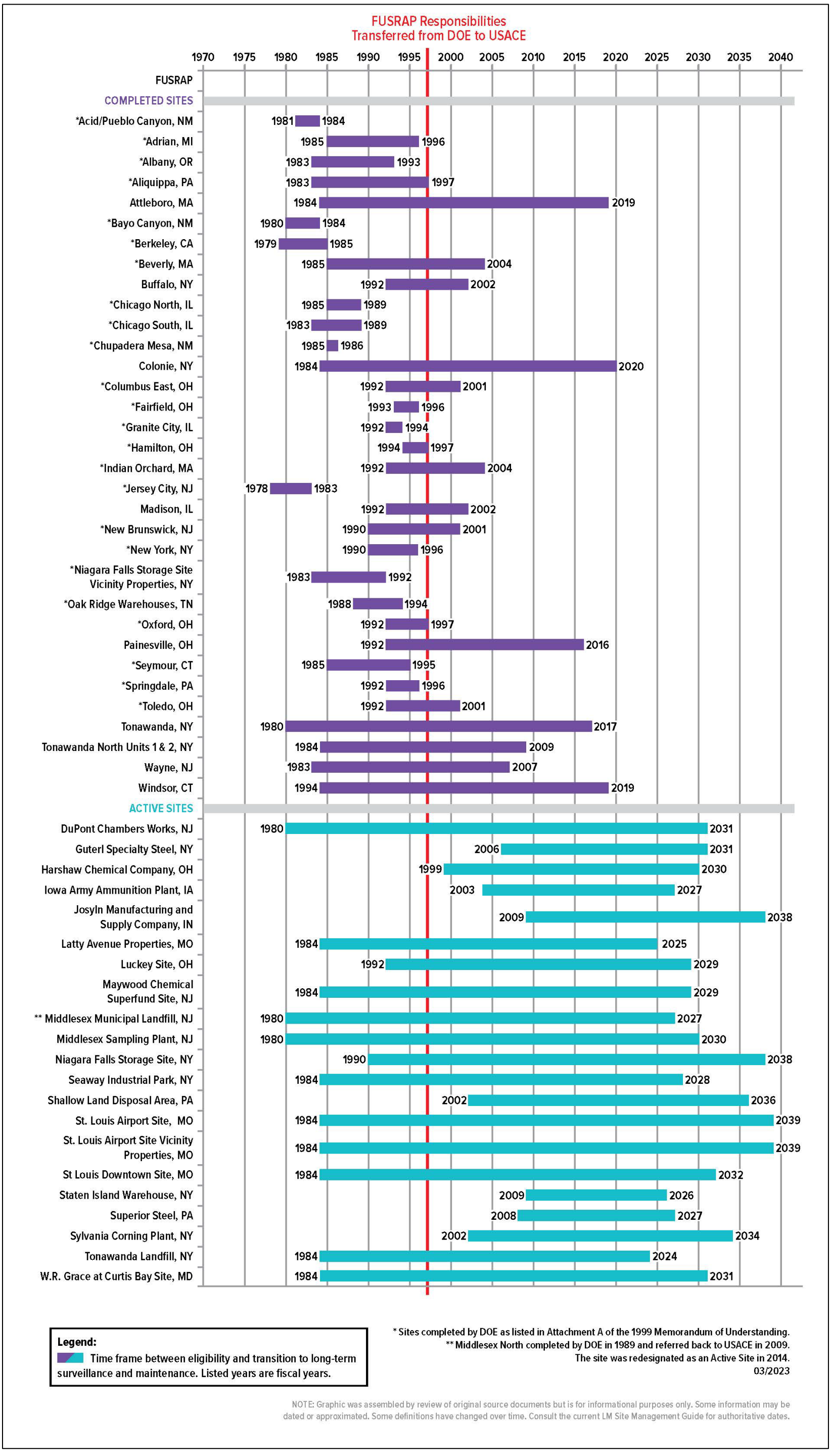


Figure 1-1. Timeline of FUSRAP Sites Transfer

Table 1-1. Summary of LTS Requirements for DOE FUSRAP Sites

Site Name and Category[a]	DOE LTS Requirements	Institutional Controls	Supplemental Limits[b]	Comments
Acid/Pueblo Canyon, New Mexico, Site (1)	Records management and stakeholder support.	None	No	Site managed by Los Alamos National Laboratory under an Order of Consent, with no further FUSRAP involvement.
Adrian, Michigan, Site (1)	Records management and stakeholder support.	None	Yes	Low levels of uranium contamination left in below-grade drains and utility chases. No additional protective measures by LM are warranted.
Albany, Oregon, Site (1)	Records management and stakeholder support.	None	Yes	Site is owned by the National Energy Technology Laboratory and is known as NETL-Albany; ^{232}Th in subfloor drains and soil; DOE determined that demolition debris will contain less than the authorized limit for ^{232}Th and no disposal restrictions will apply (Liedle 1991).
Aliquippa, Pennsylvania, Site (1)	Records management and stakeholder support.	None	Yes	Low levels of uranium left on building structures. The building is used as a warehouse. No additional protective measures by LM are warranted.
Attleboro, Massachusetts, Site (1)	Records management and stakeholder support.	None	No	Site under Administrative Order of Consent with the U.S. Environmental Protection Agency. Institutional controls managed by the Performing Defendants, not by LM.
Bayo Canyon, New Mexico, Site (2)	Records management and stakeholder support.	None	No	Strontium-90 contamination left in place within a 1.5-acre area; site managed by DOE and its Office of Environmental Management, and no further FUSRAP involvement is needed.
Berkeley, California, Site (1)	Records management and stakeholder support.	None	No	Health physics monitoring performed by the University of California under its state radioactive materials license.
Beverly, Massachusetts, Site (1)	Records management and stakeholder support.	None	No	Supplemental limits were applied to surface contamination fixed on concrete slabs. Slabs have since been demolished and debris did not exceed volumetric limits for disposal purposes. Materials to which supplemental limits were applied have been removed from the site. No need for restrictions on future use and no further LM waste management responsibility. Redeveloped as a multiresidential housing complex in 2019.
Buffalo, New York, Site (1)	Records management and stakeholder support.	None	No	None.
Chicago North, Illinois, Site (1)	Records management and stakeholder support.	None	No	Site currently used as a National Guard armory.
Chicago South, Illinois, Site (1)	Records management and stakeholder support.	None	No	Site is on the University of Chicago campus. DOE found contamination in sewers serving the affected buildings and indicated that documentation should be entered into the university's permanent record; supplemental limits were not formally applied. No additional protective measures by LM are warranted.
Chupadera Mesa, New Mexico, Site (1)	Records management and stakeholder support.	None	No	No further action taken under FUSRAP based on radionuclide levels that pose no unacceptable risk.
Columbus East, Ohio, Site (1)	Records management and stakeholder support.	None	No	None.
Fairfield, Ohio, Site (1)	Records management and stakeholder support.	None	Yes	The cleanup criterion was 35 pCi/g for uranium-238, and only one sample was elevated (134 pCi/g beneath the slab); the average concentration is 6.1 pCi/g. No additional protective measures by LM are warranted. (Note: This site probably should not have been identified as a supplemental limits site based on the data and analysis contained in the certification docket.)
Granite City, Illinois, Site (1)	Records management and stakeholder support.	None	No	None.
Hamilton, Ohio, Site (1)	Records management and stakeholder support.	None	No	None.
Indian Orchard, Massachusetts, Site (1)	Records management and stakeholder support.	None	No	Supplemental limits addressed uranium on building surfaces; buildings have since been demolished. Materials to which supplemental limits were applied have been removed from the site. No need for restrictions on future use and there is no further LM waste management responsibility.
Jersey City, New Jersey, Site (1)	Records management and stakeholder support.	None	No	Site redeveloped for commercial and residential use.
Madison, Illinois, Site (1)	Records management and stakeholder support.	None	Yes	Alternate limit applied to uranium in inaccessible areas beneath roof; dose to workers near these areas would be 8.3 mrem/yr. The risk for residential use was not assessed. No additional protective measures by LM are warranted.
New Brunswick, New Jersey, Site (2)	Records management and stakeholder support. The current property owner has primary responsibility for the biennial, or every other year, remedial action permit compliance. In 2016, LM agreed to sign Section K of the remedial action permit application.	Excavation restriction in area containing arsenic in soil that exceeds state standards; the deed notice was implemented in accordance with New Jersey regulations.	No	NJDEP issued a No Further Action determination for entire site (includes portion of public right-of-way); DOE-owned property sold to private party in 2009. The property owner inspects the site and submits a biennial certification to NJDEP every 2 years. Last certification was submitted in 2023. In 2019, the property was redeveloped as a waste transfer station.
New York, New York, Site (1)	Records management and stakeholder support.	None	No	None.

Table 1-1. Summary of LTS Requirements for DOE FUSRAP Sites (continued)

Site Name and Category[a]	DOE LTS Requirements	Institutional Controls	Supplemental Limits[b]	Comments
Niagara Falls Storage Site Vicinity Properties, New York, Site (1)	Records management and stakeholder support.	None	Yes	Supplemental limits were applied for radium-226 in the unexcavated portion of Central Drainage Ditch; there is no unacceptable risk under reasonable exposure scenario or if sediment were to be used as fill beneath a residence. VPs H' and X had been identified as eligible for FUSRAP and are currently under investigation by USACE. Another three properties are currently inaccessible. The state has applied deed restrictions to the VPs.
Oak Ridge, Tennessee, Warehouses Site (1)	Records management and stakeholder support.	None	No	None.
Oxford, Ohio, Site (1)	Records management and stakeholder support.	None	No	None.
Painesville, Ohio, Site (2)	Records management and stakeholder support.	None	No; however, annual verification is required to confirm industrial use of the site	None.
Seymour, Connecticut, Site (1)	Records management and stakeholder support.	None	Yes	Supplemental limits applied to uranium in drains beneath the remaining building. No risk to the construction worker is expected. No additional protective measures by LM are warranted.
Springdale, Pennsylvania, Site (1)	Records management and stakeholder support.	None	No	None.
Toledo, Ohio, Site (1)	Records management and stakeholder support.	None	No	Site cleanup included one VP (a residence).
Tonawanda, New York, Site (2)	Records management and stakeholder support.	None	No; however, annual verification is required to confirm industrial use of the site	None.
Tonawanda North, New York, Site, Units 1 and 2 (1)	Records management and stakeholder support.	None	No	Dose to urban farmer would be less than 25 mrem/yr; it is adjacent to closed municipal waste landfill.
Wayne, New Jersey, Site (1)	Records management and stakeholder support.	None	No	Site deleted from National Priorities List in 2012; it has been redeveloped as a playground and dog park.
Windsor, Connecticut, Site (1)	Records management and stakeholder support.	None	No	A mixed-use development was constructed in 2022.

Notes:
Refer to the *Long-Term Surveillance and Maintenance Plan for Colonie, New York, Site* (LMS/CLN/S13262) for LTS requirements for this site (DOE 2023).
[a] Category 1: Activities typically include records-related activities and stakeholder support.
Category 2: Activities typically include routine inspection (any site visit needed to verify the integrity of engineered or institutional barriers) and monitoring and maintenance, records-related activities, and stakeholder support.
[b] For sites that were released for unrestricted use and that do contain supplemental limits areas, DOE will conduct annual data verification to ensure that land usage is consistent with the site certification land use in accordance with the remedy.

Abbreviations:
NJDEP = New Jersey Department of Environmental Protection
pCi/g = picocuries per gram
^{232}Th = thorium-232
VP = vicinity property

The remainder of this document consists of a chapter for each of the 33 FUSRAP sites assigned to DOE for LTS that does not warrant a standalone LTS Plan. Within each chapter is site-specific information describing the following: site conditions, remedial action, LTS requirements, and references.

1.3 References

40 CFR 300. "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*.

42 USC 2011 et seq. "Atomic Energy Act of 1954," *United States Code.*

42 USC 9601 et seq. "Comprehensive Environmental Response, Compensation, and Liability Act" as amended, *United States Code*.

DOE (U.S. Department of Energy), 1987. *U.S. Department of Energy Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites*, Rev. 2, March.

DOE (Department of Energy), 2022. *Long Term Surveillance and Maintenance Plan for the Colonie, New York, Site*, February.

DOE and USACE (U.S. Department of Energy and U.S. Army Corps of Engineers), 1999. Memorandum of Understanding Between the U.S. Department of Energy and the U.S. Army Corps of Engineers Regarding Program Administration and Execution of the Formerly Utilized Sites Remedial Action Program (FUSRAP), March 17.

DOE and USACE (U.S. Department of Energy and U.S. Army Corps of Engineers), 2023. Joint U.S. Army Corps of Engineers and U.S. Department of Energy Office of Legacy Management Information Transfer/Transition Protocol for Formerly Utilized Sites Remedial Action Program LMS/S20093, May.

DOE Order 458.1 Chg 4 (LtdChg), Radiation Protection of the Public and the Environment, U.S. Department of Energy, September 15, 2020.

Liedle, 1991. S.D. Liedle, project manager, FUSRAP, Bechtel National Inc., letter (about Cleanup Criteria for the Albany Research Center) to D.G. Adler, site manager, Former Sites Restoration Division, U.S. Department of Energy, May 8.

PL 105-62. "Energy and Water Development Appropriations Act of 1998," Public Law.

PL 105-245. "Energy and Water Development Appropriations Act of 1999," Public Law.

USACE (U.S. Army Corps of Engineers), 2012. *Final Close-Out Report, W.R. Grace and Co./Wayne Interim Storage Site, Township of Wayne, Passaic County, New Jersey*, April.

2.0 Acid/Pueblo Canyon, New Mexico, Site

2.1 Site Conditions

The Acid/Pueblo Canyon, New Mexico, Site is in Los Alamos, New Mexico, approximately 25 miles northwest of Santa Fe. This FUSRAP site is accessible from Canyon Road, which runs just southeast of a former waste treatment plant. The Acid/Pueblo Canyon system starts with a small branch of Pueblo Canyon known as Acid Canyon and is among numerous canyons that cut into the Pajarito Plateau in north-central New Mexico (Figure 2-1).

Figure 2-1. Location of the Acid/Pueblo Canyon, New Mexico, Site

The Acid and Pueblo Canyons are deep, interconnected ravines that served as the discharge area for radioactive wastes resulting from research and processing operations associated with nuclear weapons development at the Los Alamos National Laboratory (LANL). Beginning in late 1943, untreated liquid waste from general laboratory, process chemistry, and radiochemistry operations was discharged from the main acid sewer line terminating at the head of the south fork of Acid Canyon. These effluents contained a variety of radionuclides, including tritium and isotopes of strontium, cesium, uranium, plutonium, and americium. The majority of the effluent was distributed throughout the soil and rock material of lower Pueblo Canyon. By June 1951, a treatment plant (TA-45) was constructed on the south rim of Acid Canyon to remove plutonium and other radionuclides from the waste streams originating from the original main laboratory technical area (TA)-1. The treated and untreated wastes were discharged from the main acid sewer line.

From its startup until mid-1953, the TA-45 plant treated wastes only from TA-1. Beginning in June 1953, additional radioactive liquid wastes from a new plutonium research laboratory

complex (TA-3) were piped to TA-45. Further additions to the system were added in September 1953 from the Health Research Laboratory (TA-43). Initially, the TA-3 waste was very dilute, and levels were monitored to determine whether treatment was required to meet criteria established for TA-45 releases. If treatment was not required, the raw waste was discharged to Acid Canyon. By December 1953, treatment was required for about 70% of the waste. In 1958, liquid wastes containing primary fission products from a new radiochemistry facility (TA-48) were added to the TA-45 load.

In July 1963, wastes from TA-3 and TA-48 were redirected to the new Central Waste Treatment Plant (TA-50). Liquid wastes from TA-43 were redirected to the sanitary sewer because only small quantities of dilute wastes were being generated by that time. Processing of TA-1 wastes continued at TA-45 until operations ceased in May 1964. The last releases to Acid Canyon (untreated low-level liquid wastes containing fission products from TA-1 decommissioning activities) occurred through June 1964.

Data had been collected since 1945 on the presence of radioactivity in the environment as a result of liquid waste operations at LANL. The initial study, made in September 1945, consisted of collection and analyses of surface water samples in Acid/Pueblo and Los Alamos Canyons. Water or sediments were sampled at additional stations in July 1946 and May 1947. Plutonium and polonium were found at varying concentrations throughout the canyons, with concentrations generally decreasing downgradient as the untreated wastes were diluted with sanitary effluent and storm runoff and by adsorption or ion exchange with sediments in the stream channel.

TA-45 was decommissioned in late 1966, and decontamination work in Acid Canyon continued into 1967. By June 1967, the treatment plant site and Acid Canyon were deemed sufficiently free of contamination to be released from AEC control without restriction. The property was then transferred to Los Alamos County.

Water quality monitoring by the U.S. Geological Survey continued until 1971. In 1972, LANL performed a radiation survey of the Pueblo Canyon bottom in the midreach of the canyon. With the exception of tritium, which was slightly elevated, concentrations of radionuclides in soil and vegetation were similar to regional background.

In 1976, the Acid/Pueblo Canyon site was identified as warranting reevaluation with modern instrumentation and analytical methods to determine whether further corrective measures were required. Results indicated that concentrations of plutonium in soil and external gamma radiation exceeded criteria at two locations: near the former vehicle decontamination facility and at the untreated liquid waste outfall. These areas were remediated in 1982. Additionally, two small areas in Acid Canyon below the canyon rim in an area of limited access, approach or exceed the plutonium-239 (^{239}Pu) criteria. The contamination was absorbed into the tuff to a depth of a few centimeters (cm) along the flow path of the former untreated waste effluent. Because of its relative inaccessibility and stability, this material is not considered to present a significant hazard either from exposure to the population or future transport and contamination of Lower Pueblo Canyon.

Today, the Los Alamos Nature Center/Pajarito Environmental Education Center is at the site of the former treatment plant. The open areas of the site are used by the public for recreational purposes.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were tritium, strontium-90 (^{90}Sr), cesium-137 (^{137}Cs), uranium, radium-226 (^{226}Ra), americium-241 (^{241}Am), ^{238}Pu, and ^{239}Pu.

2.2 Remedial Action

FUSRAP Eligibility Determination

The Acid/Pueblo Canyon site (Figure 2-2) was designated for remedial action under FUSRAP in 1976.

Cleanup Criteria

Remedial action criteria adopted for this site included external exposure rates and radionuclide concentrations in soil. The radiation exposure rate criterion was based on the annual limit for population exposures of 170 millirem (mrem). External radiation levels were therefore limited to 0.02 mrem per hour above background. Criteria adopted for radionuclide concentrations in soil were 100 picocuries per gram (pCi/g) for ^{90}Sr, ^{238}Pu, and ^{239}Pu; 20 pCi/g for ^{241}Am; 80 pCi/g for ^{137}Cs, 5 pCi/g for ^{226}Ra; and 40 pCi/g for natural uranium.

Figure 2-2. Pueblo Canyon, New Mexico, Looking Upstream, September 2006

Remedial Action

The decontamination and decommissioning of the treatment plant that was constructed on the site began in late 1966. Both the treatment plant and its associated vehicle decontamination

facility were demolished. The contaminated building materials, sewer pipe, and soil were disposed of at LANL radioactive waste disposal areas. Decontamination of portions of Acid Canyon included the removal of contaminated rock from the cliff face where the effluent had flowed and removal of contaminated rock, soil, and sediment from the canyon floor.

In spring 1967, additional decontamination began; it included other portions of buried waste lines in the TA-45 area, more contaminated rock, and the flow-measuring weir from Acid Canyon. By July 1967, the TA-45 site and Acid Canyon were considered sufficiently free of contamination to allow unrestricted access and removal of "Contaminated Area" signs. Remaining residual radioactivity at that time was documented to be less than 500 counts per minute of alpha activity (as measured by a portable air proportional alpha detector) in some generally inaccessible spots and was not considered to be a health hazard.

In 1976 and 1977, radiological surveys were performed in Acid Canyon to define areas requiring remedial action under FUSRAP. The surveys identified the former untreated waste effluent outfall and the former vehicle decontamination facility as areas where radiological contamination in soil exceeded cleanup criteria. The selected remedial action was based on extensive radiological characterization and comprehensive engineering assessments. Remedial action took place in August 1982 and consisted of the removal of contaminated material. All contaminated materials were disposed of at the LANL Radioactive Waste Disposal Area G (TA-54). The excavated and disturbed areas were left to stabilize and revegetate naturally.

Release Survey

Postremedial action survey data indicate that the radiological condition of the site complies with applicable DOE standards and guidelines for cleanup and that radiological conditions are protective of human health and the environment (DOE 1984).

Independent Verification

LANL conducted a postremedial action survey, but an independent verification of final radiological conditions was not performed.

Use Restrictions

There are no current use restrictions under FUSRAP. Restrictions could be imposed under the Order of Consent, which is described in the following subsection.

Assessment of Risk

Because the site was remediated to the conservative dose-based standards, no site-specific risk assessment was performed.

The Acid/Pueblo Canyon site is currently managed by LANL. Effective March 1, 2005, LANL, New Mexico Environment Department (NMED), and DOE entered into an Order of Consent to address groundwater contamination from the laboratory facility. The Order of Consent establishes requirements and a timetable for environmental cleanup. The DOE Office of Environmental Management funds the work necessary to meet Order of Consent requirements, and the National Nuclear Security Administration is responsible for managing and performing

the work. The Order of Consent was revised in June 2016, modified in 2017, and is available at https://hwbdocuments.env.nm.gov/Los%20Alamos%20National%20Labs/Permit/37925.pdf.

Certification and Regulator Concurrence

A notice of cleanup certification for the site was published on October 29, 1984 (49 FR 43493). The notice states that unrestricted use presents no radiological hazards to the public.

Agreements and Permits

There are no agreements or permits.

2.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Acid/Pueblo Canyon site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Acid/Pueblo Canyon site.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at
https://www/energy.gov/lm/articles/acidpueblo-canyon-new-mexico-site-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to the Acid/Pueblo Canyon site.

Monitoring

No monitoring is required at the Acid/Pueblo Canyon site.

Field Operations

No field operations are required at the Acid/Pueblo Canyon site.

Regulatory Interfaces

No regulatory interfaces are required at the Acid/Pueblo Canyon site.

2.4 References

49 FR 43493. U.S. Department of Energy, "Statement of Certification: Former Site of the Radioactive Liquid Waste Treatment Plant (TA-45) and Effluent Receiving Areas of Acid, Pueblo, and Los Alamos Canyons," *Federal Register*, October 29, 1984.

DOE (U.S. Department of Energy), 1984. *NM.03-5 – Certification Docket for the Former Site of the Radioactive Waste Treatment Plant (TA-45) and the Effluent Receiving Areas of Acid, Pueblo, and Los Alamos Canyons, Los Alamos, New Mexico*, Office of Nuclear Energy, Office of Terminal Waste Disposal and Remedial Action, Division of Remedial Action Projects, October.

3.0 Adrian, Michigan, Site

3.1 Site Conditions

The Adrian, Michigan, Site is at 1450 East Beecher Street, on the eastern side of Michigan Route 52 in Adrian, Michigan. The town of Adrian is approximately 20 miles southwest of Ann Arbor, Michigan, and 30 miles northwest of Toledo, Ohio (Figure 3-1).

Figure 3-1. Location of the Adrian, Michigan, Site

During the 1950s, the Bridgeport Brass Company operated the Special Metals Extrusion Plant at the Adrian site under AEC contract AT-(30-1)-1405. The plant operations extruded uranium metal that was used to fabricate reactor fuel elements for reactors at the DOE Hanford Site in Washington and the DOE Savannah River Site in South Carolina. Activities at the site included the preparation of material for extrusion, abrasive sawing, storing, packaging, and shipping.

At the end of the contract, the site was decontaminated to comply with radiological protection standards in effect at the time. The site was sold to Martin Marietta in the early 1960s and then to General Motors (GM) in 1974.

In 1977, Oak Ridge National Laboratory (ORNL) conducted a radiological survey and found residual contamination beneath the floor of the plant. Additional contamination was discovered beneath the manufacturing area and remediated during new construction that took place in 1985.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were from uranium metal (depleted and natural uranium) and as much as 2.1% enriched ^{235}U.

3.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined the Adrian site's eligibility for FUSRAP in 1985.

Cleanup Criteria

The Adrian site was remediated to criteria established in DOE Order 5400.5 (archived).

Basic Dose Limits

The basic limit for the annual radiation dose (excluding radon) received by an individual member of the general public is 100 mrem/yr (DOE Order 5400.5, archived). In implementing this limit, DOE applied ALARA principles to set site-specific guidelines.

Site-Specific Soil Guidelines

The criterion for soil cleanup was 35 pCi/g for total uranium.

Site-Specific Liquid Effluent Criterion

The criterion for oil-water solutions cleanup was 300 picocuries per liter (pCi/L) for total uranium (10 CFR 20).

Indoor/Outdoor Structure Surface Contamination

The residual contamination guidelines from DOE Order 5400.5 (archived) for fixed and transferable radioactive contamination are listed in Table 3-1.

Table 3-1. Archived DOE Order 5400.5 Residual Contamination Guidelines

Radionuclide	Average (dpm/100 cm^2)	Maximum (dpm/100 cm^2)	Removable (dpm/100 cm^2)
Uranium natural, ^{235}U, ^{238}U, and associated decay products	5000 (alpha)	15,000 (alpha)	1000 (alpha)
Beta/gamma emitters (radionuclides with decay modes other than alpha emissions)	5000 (beta/gamma)	15,000 (beta/gamma)	1000 (beta/gamma)

Abbreviation:
dpm/100 cm^2 = disintegrations per minute per 100 square centimeters

These guidelines are comparable to those currently used by the U.S. Environmental Protection Agency (EPA) and NRC.

Because only trace concentrations of radium and thorium exist in uranium metal after processing, only extremely low concentrations of these two radionuclides were detected in characterization samples. Only the uranium isotopes contributed significantly to the radioactive contamination at the site.

Oil and asbestos-containing material (ACM) were the only nonradioactive hazardous constituents mingled with residual uranium materials at concentrations requiring remedial action. All oil-containing material and ACM with residual radioactive substances were removed from the site, solidified, stabilized, and transported for disposal at a licensed facility in Clive, Utah.

The site-specific criterion used at the site for the oil and water or liquid waste containing uranium was 300 pCi/L total uranium. This site-specific concentration was established based on the derived concentration guide of 600 pCi/L total uranium for discharges of wastewater containing uranium from facilities to surface waters and the NRC concentration limit of 300 pCi/L for natural uranium in liquid effluent discharges to unrestricted areas (10 CFR 20). Using the ALARA principle, DOE selected the more restrictive NRC value for use at this site.

Supplemental limits were applied to residual radioactive material left in the oil collection system discharge manholes, piping, and pipe chase. Under typical circumstances, the DOE maximum limit for uranium residuals is 15,000 disintegrations per minute per 100 square centimeters (dpm/100 cm^2). For this facility, DOE determined that it would be acceptable to decontaminate the accessible contaminated areas and to fill the affected subsurface pipes, manholes, and sumps with grout or controlled low-strength material to ground level. This method would result in leaving the remaining inaccessible contamination in place while rendering the possibility of human exposures unlikely. Therefore, adoption of a specific surface activity guideline was unnecessary.

Remedial Action

In 1994, DOE conducted a detailed radiological survey at the site. Results from that survey showed that the manholes, sumps, pipe chases, and associated piping were contaminated with uranium. In 1995, DOE conducted additional remedial actions at the site. Contaminated inactive lines within the pipe chase were cut, wiped to remove the oily film, and disposed of as low-activity radioactive waste. Approximately 30% of the pipe hangers and brackets were clean and left in place. Gang or multisupports were decontaminated and abandoned in place. The walls and floors of the pipe chase were decontaminated using simple decontamination techniques. The decontamination effort successfully removed all uranium in the pipe chase to levels below the surface radioactivity criteria.

Most of the oil collection system sumps, manholes, and drain lines contained an oil-water and sludge mixture that was removed during decontamination efforts. The liquid and sludge material were removed by pumping it into drums. After removal of liquid and sludge, any remaining debris was removed to allow decontamination of the wall and floor surfaces of the sump or manhole. The walls and floors were decontaminated using a high-pressure water wash, after which the walls and floors were wiped with soapy rags. The drain lines were decontaminated to the extent possible; surveyed; and then plugged or filled with foam, flowable concrete (grout), or a mixture of sand, cement, and water. Remedial actions successfully removed uranium to levels below the surface radioactivity criteria at the 42-inch sump and at manholes M1 and M15.

Manholes M2 and M25 were inaccessible and were filled with flowable concrete via their duct banks from other manholes. GM filled manhole M16 and the associated drain line with concrete during previous renovation activities. GM had covered floor drains in the area of the former extrusion operations with a new floor slab during previous construction work, and the drains

could not be located during the investigation and remedial action. Remedial action at the site was completed in July 1995.

The areas where residual uranium remains in concentrations greater than the surface radioactivity guidelines specified in DOE and NRC regulations include sump No. 3; the oil trap pit; manholes M2, M16, and M25; and drain lines.

Where residual uranium remains, potential doses under conservative site worker scenarios were assessed to determine possible health effects of leaving this material in place. Results from this hazard assessment show that supplemental limits, as described in DOE Order 5400.5 (archived), are warranted for the site. Supplemental limits may be applied in place of the primary limits established by DOE guidelines where the cost of remediation would be unreasonably high compared to the long-term benefits and the residual contamination does not pose a present or future risk to workers or the public. Currently, the areas that are governed under the supplemental limit guidelines include the drain system beneath the building (drain lines consist of 1225 feet [ft] of 4-inch diameter piping), the manhole waste volume estimated at about 20 cubic meters (m^3), and a sump that is 48 inches in diameter by 20 ft deep.

Release Survey

After remediation, all accessible residual radioactive material above the current guidelines was removed, the underground sumps and manholes were backfilled with flowable concrete or grout, and all associated piping was plugged or filled. These inaccessible residual contaminants remain in a safe configuration and any future removal will not require disposal as regulated waste.

The estimated dose to plant or renovation workers does not exceed 2.5 mrem/yr. Residential use was considered an implausible future land use scenario, and dose modeling for that land use was not performed. Analytical results of soil samples collected in the remediated exterior soil area indicated that radionuclide concentrations were low (1.8 pCi/g ^{238}U, 0.90 pCi/g ^{226}Ra, and 0.50 pCi/g thorium-230 [^{230}Th]).

DOE personnel most recently visited the site in July 2010 to determine if the land use had changed. Signage indicated that the plant was now a manufacturing facility for Inteva Products. The site is in an area used predominantly for mixed residential and commercial purposes. No apparent change to the plant or the surrounding area had occurred since the previous visit in 2007. Figure 3-2 shows a contaminated manhole at the site before remediation. Figure 3-3 shows a remediated area of concrete, and Figure 3-4 is a view of the site in 2010.

Postremedial action surveys demonstrated and certified that the site met DOE's radiological decontamination criteria and standards. The standards are established to protect members of the general public and occupants of the property to ensure that future use of the property will not result in radiological exposure above applicable guidelines.

Figure 3-2. Manhole at the Adrian, Michigan, Site Before Remedial Action, December 1974 (DOE Digital Archive)

Figure 3-3. Adrian, Michigan, Site Remediated Area, July 1995 (DOE Digital Archive)

Figure 3-4. Adrian, Michigan, Site, July 2010

Independent Verification

The results of the independent verification survey demonstrate that all contaminated areas were remediated to radionuclide concentrations and activity levels below the applicable DOE guideline limits. A visual examination of the site and a review of the project management contractor's radiological survey and postremedial action reports concluded that the site met the objectives of DOE's FUSRAP program.

Use Restrictions

The site was released for unrestricted use (assumes continued industrial land use).

Assessment of Risk

Because the site was remediated to the conservative dose-based standards, no site-specific risk assessment was performed. No additional protective measures by DOE are warranted following the 2017 technical workshop review of site conditions and risk.

Certification and Regulator Concurrence

A notice of cleanup certification for the site was published on January 29, 1997 (62 FR 4273–4274). The notice states that the property is in compliance with DOE's radiological decontamination criteria and standards. The standards are established to protect members of the general public and occupants of the property and to ensure that future use of the property will not

result in radiological exposure above applicable guidelines. The certification docket was prepared in December 2002 (DOE 2002).

Agreements and Permits

There are no agreements or permits.

3.3 LTS Requirements

The following section presents the reporting and fieldwork requirements for LTS at the Adrian site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls required at the Adrian site. The Adrian postclosure documents do not refer to the need for long-term institutional controls because the site has been remediated for unrestricted use.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at
https://www.energy.gov/lm/articles/adrian-michigan-site-fact-sheet.

Desktop Assessment

The desktop assessment is applicable to the Adrian site. For sites that were released for unrestricted use and contain supplemental limits areas, DOE will conduct annual data verification to ensure that land usage is consistent with the site certification land use in accordance with the remedy and determine if a site visit is necessary. The latest desktop assessment was conducted in February 2023.

Monitoring

No monitoring is required at the Adrian site.

Field Operations

No field operations are required at the Adrian site.

Regulatory Interfaces

No regulatory interfaces are required at the Adrian site.

3.4 References

10 CFR 20. "Standards for Protection Against Radiation," *Code of Federal Regulations*.

62 FR 4273–4274. U.S. Department of Energy, "Certification of the Radiological Condition of the General Motors Site in Adrian, Michigan," *Federal Register*, January 29, 1997.

DOE (U.S. Department of Energy), 2002. *MI.01-7 – Certification Docket for the Remedial Action Performed at the General Motors Site in Adrian, Michigan, Revision 1*, Document No. 2140, December.

DOE Order 458.1 Admin Chg 3, Radiation Protection of the Public and the Environment, U.S. Department of Energy, archived September 15, 2020.

4.0 Albany, Oregon, Site

4.1 Site Conditions

The Albany, Oregon, Site—formerly known as the Albany Research Center (ARC) property (City of Albany, Deed Book 161, page 421, No. 17277)—is owned by the National Energy Technology Laboratory and is known as NETL-Albany and covers approximately 42 acres. It is at 1450 Queen Avenue SW, Albany, Oregon (see Figure 4-1).

Figure 4-1. Location of the Albany, Oregon, Site

The site consists of three main areas: ARC that comprises a number of buildings in the northern and central sections of the site, a 2-acre inactive biomass research facility that occupies the center of the site, and a 14-acre open area in the back of the site.

ARC was established in 1943 to investigate innovative approaches for developing strategic mineral resources in the United States, reducing costs for metallurgical manufacturing processes, developing materials to fight corrosion, and other activities relevant to metallurgical research. From 1948 to 1956, the U.S. Bureau of Mines melted, machined, welded, and alloyed thorium at the site for AEC and later, until 1978, worked with uranium and thorium for the ERDA, a predecessor agency of DOE. Some of the operations also included separation, purification, and processing of limited quantities of uranium. Wastes from AEC and ERDA activities were treated at the site, and portions of the facility were used for temporary storage or disposal of materials containing low levels of thorium, uranium, and associated decay products. In addition to the work for DOE predecessors, ARC has performed work with radioactive materials under jurisdiction of NRC.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were natural uranium and thorium, some of which was commingled with solid polychlorinated biphenyls (PCBs).

4.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined the Albany site's eligibility for FUSRAP in 1983.

Cleanup Criteria

Remedial action guidelines (DOE 1987) for ^{226}Ra and ^{232}Th in soil are the same; there is no generic guideline for uranium in soil. Characterization data indicated that these radionuclides were in secular equilibrium; therefore, compliance with the remedial action guidelines for ^{226}Ra and ^{232}Th ensured that the concentration of ^{238}U was acceptably low. For soil, the remedial action guidelines for ^{226}Ra or ^{232}Th concentrations were 5 pCi/g above background concentrations when averaged over the first 6 inches of soil below the surface or 15 pCi/g when averaged over any 6-inch-thick soil layer below the surface layer.

In surface areas where ^{232}Th was the primary contaminant, the limit was 1000 dpm/100 cm^2 average or 3000 dpm/100 cm^2 maximum for surface contamination and/or 200 dpm/100 cm^2 for removable contamination. In surface areas where ^{238}U was the primary contaminant, remedial action was conducted if direct surface measurements revealed activity levels greater than 5000 dpm/100 cm^2 average or 15,000 dpm/100 cm^2 maximum and/or levels greater than 1000 dpm/100 cm^2 for removable contamination.

During remediation of the lime pit and adjacent areas at the Albany site, solid PCB contamination was encountered in the soil. The Toxic Substances Control Act requires that materials containing PCB concentrations of 50 parts per million and greater and PCB-contaminated surfaces with concentrations greater than 100 milligrams per 100 square centimeters be managed as PCB-contaminated waste (40 CFR 761).

Supplemental limits were applied to limited occurrences of fixed beta surface activity remaining on the surface of drains, subfloor pipes, soils, and certain processing equipment (Table 4-1). No disposal restrictions will apply to these materials in the future.

Where ^{238}U was the primary contaminant, but in mixed ratios with ^{232}Th, supplemental guidelines were used (Liedle 1991; DOE 1990).

The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 and 1.0 millirad per hour, respectively, at 1 cm (0.4 inch).

Table 4-1. Supplemental Limits for Selected Areas at the Albany, Oregon, Site

Supplemental Limits for Selected Areas[a]		
Building	**Area**	**Average[b] Fixed Contamination (dpm/100 cm^2)**
17	Lab 10 (floor)	5000
17	Lab 10 (other)	4000
17	Attic	5000
31	Attic	2500
30	Fabrication Room	4000
28	First Floor/Lime Pit walls	5000/2400[c,d]
4	Forklift	1600

Notes:

[a] Supplemental guidelines were used in place of routine residual guidelines in areas where ^{238}U was the primary contaminant but was present in mixed ratios with ^{232}Th.

[b] Areas containing removable contamination were to meet the ^{232}Th criterion (200 dpm/100 cm^2).

[c] Soil containing thorium at concentrations of less than 5 pCi/g and PCBs at less than 1 part per million was mixed with clean topsoil fill and placed back into the pit.

[d] This guideline was used for any contamination found within the top 15 cm (6 inches) of the walls; the criterion for any contamination below 15 cm was the soil guideline for residual ^{232}Th (15 pCi/g).

Remedial Action

During the era of AEC and ERDA contracts (1946–1977), process buildings and surroundings were decontaminated to guidelines then applicable to AEC, ERDA, and DOE. Subsequent decontamination guidelines were stricter, and records relating to the previous decontamination efforts were not adequate to determine whether the buildings and surrounding areas met DOE's newer radiological guidelines. As a result, DOE performed a radiological assessment in 1978. The results of the assessment indicated that although the levels of contamination at ARC did not pose an immediate health hazard, further decontamination of the property was warranted. DOE conducted another radiological survey in early 1984 using the 1978 assessment information to determine the locations and boundaries of above-guideline contamination.

Portions of 18 buildings and 37 exterior locations at ARC were designated as needing remediation under FUSRAP. Eleven buildings and 31 exterior locations were remediated in 1987 and 1988; parts of 15 buildings, some of which were remediated in 1987 and 1988, and 5 exterior locations were remediated in 1990 and 1991. The remedial action activities performed from July 1987 to January 1988 and from August 1990 to April 1991 are referred to as Phase I and Phase II, respectively. Remedial action of the site included decontamination of buildings (Figure 4-2 and Figure 4-3) and excavation, backfilling, and seeding of excavated areas. Contaminated waste was transported to the DOE Hanford Site near Richland, Washington, for disposal.

Phase I of the remediation consisted of decontamination of most of the areas at the site. Post-Phase I surveys identified additional areas needing cleanup, and these were remediated from August 1990 to April 1991 during Phase II. These areas were primarily buildings but also included a PCB-contaminated lime pit used to segregate heavy metals from waste residue. This mixed PCB–radioactive waste was removed from the pit and placed in 55-gallon drums for shipping to the DOE Hanford Site for disposal. In total, approximately 2977 cubic yards (yd^3) of soil (from an area of 7236 square yards [yd^2]), 400 yd^3 of building debris, and 67 yd^3 of equipment were removed from the Albany site.

Figure 4-2. Scrubbing and Sanding at Building 31, Albany, Oregon, Site (DOE Digital Archive)

Figure 4-3. Radiological Survey Support Work at the Albany, Oregon, Site, December 31, 1991 (DOE Digital Archive)

Release Survey

Postremedial action survey data indicate that the radiological condition of the Albany site complies with applicable DOE standards and guidelines for cleanup of residual radioactive contamination. Based on a review of this postremedial action data, DOE determined that radiological conditions at the Albany site comply with decontamination criteria to protect human health and the environment and has released the site for unrestricted use. The site has been restored to a condition acceptable to the owner.

Independent Verification

Oak Ridge Associated Universities prepared a verification report for the Phase I work. It concluded that remedial actions effectively satisfied the established DOE guidelines and that the documentation supporting the remedial action process is adequate and accurate.

The verification report for the Phase II work concluded that the radiological status of the buildings and outdoor areas was accurately described and that remedial objectives and generic guidelines or supplemental limits were met.

Use Restrictions

The site was released for unrestricted use. DOE determined that no disposal restrictions were necessary for drains, pipes, and soil beneath the buildings that contain residual ^{232}Th in excess of generic release criteria.

Assessment of Risk

No additional protective measures by DOE are warranted following the 2017 technical workshop review of site conditions and risk, as the risk calculations show no unacceptable risk with current land use. The assessment performed during the 2017 technical workshop determined that as long as the site's residual contamination remains inaccessible, it would remain in a safe configuration and that if a property owner makes improvements to or eliminates existing structures where inaccessible contamination resides, the demolition debris will not need to be disposed of as regulated waste.

Certification and Regulator Concurrence

Following remediation, DOE certified that the site complied with applicable cleanup criteria and standards and released the property for unrestricted use (DOE 1993). A notice of cleanup certification for the site was published on February 23, 1993 (58 FR 11041). The notice states that the property is in compliance with DOE's radiological decontamination criteria and standards. The standards are established to protect members of the general public and occupants of the property and ensure that future use of the property will not result in radiological exposure above applicable guidelines.

Agreements and Permits

There are no agreements or permits.

4.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Albany site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

No regulator institutional controls were imposed according to the site certification and backup documentation. There are no institutional controls in place for the Albany site.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at https://www.energy.gov/articles/albany-oregon-site-facts-sheet.

Desktop Assessment

Although an annual desktop assessment is not applicable to the Albany site, an assessment will be conducted at 5-year intervals to review site conditions. The first 5-year desktop assessment was conducted in February 2023.

Monitoring

No monitoring is required at the Albany site.

Field Operations

No field operations are required at the Albany site.

Regulatory Interfaces

No regulatory interfaces are required at the Albany site.

4.4 References

40 CFR 761. U.S. Environmental Protection Agency, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," *Code of Federal Regulations*.

58 FR 11041. U.S. Department of Energy, "Statement of Certification: Albany Research Center, Former MED/AEC/ERDA Operations," *Federal Register*, February 23, 1993.

DOE (U.S. Department of Energy), 1987. *U.S. Department of Energy Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites*, Rev. 2, March.

DOE (U.S. Department of Energy), 1990. *Approval of Supplemental Limits at the Albany Research Center*, memorandum by Acting Chief J.W. Wagoner II, Off-Site Branch, Division of Eastern Area Programs, Office of Environmental Restoration, September 12.

DOE (U.S. Department of Energy), 1993. *OR.01-13- Certification Docket for the Remedial Action Performed at the Albany Research Center in Albany*, Oregon 1987–1988 and 1990–1991, April.

DOE Order 458.1 Chg 4 (LtdChg), *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, September 15, 2020.

Liedle, 1991. S.D. Liedle, project manager, FUSRAP, Bechtel National Inc., letter (about Cleanup Criteria for the Albany Research Center) to D.G. Adler, site manager, Former Sites Restoration Division, U.S. Department of Energy, May 8.

5.0 Aliquippa, Pennsylvania, Site

5.1 Site Conditions

The Aliquippa, Pennsylvania, Site (formerly the Aliquippa Forge site) is at the intersection of Beaver Avenue and First Street in Aliquippa, Pennsylvania, which is approximately 15.6 miles northwest of Pittsburgh (Figure 5-1).

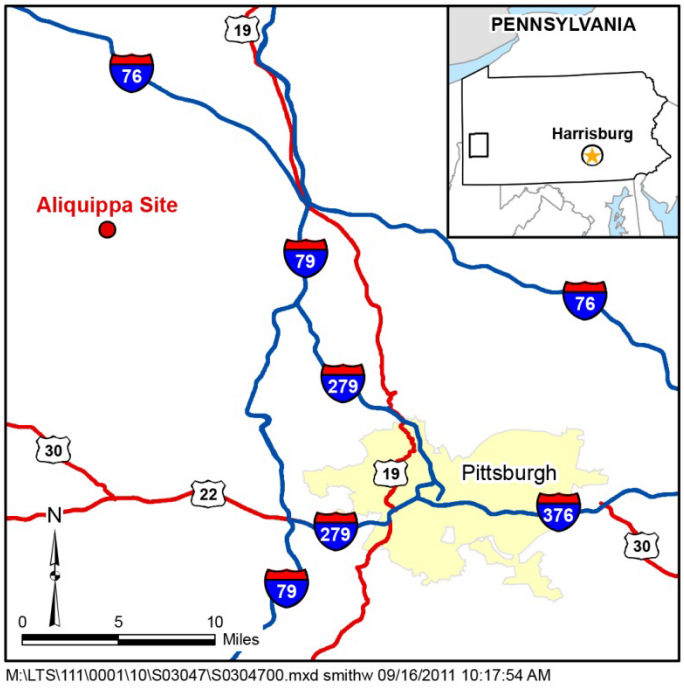


Figure 5-1. Location of the Aliquippa, Pennsylvania, Site

From mid-1948 to late 1949, Vulcan Crucible Steel Company operated a uranium-rolling process in Building 3 under a contract with AEC. The building contained two furnaces for heating billets, a rolling mill, and cutting and extruding equipment. Uranium billets were sent to the 26,000-square-foot structure and formed into rods, which were then boxed and shipped to other facilities. Building 8, the other affected building on this site, extended north of Building 3 and housed two large air compressors; it had a total floor space of approximately 5400 square feet (ft^2). Building 8 has since been demolished. After completion of AEC operations, the Aliquippa site was decontaminated to then-applicable guidelines.

The compressor building foundation in front of the building, left of the door, and the well in the foreground of the building, were later abandoned.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were ^{238}U, ^{234}U, and ^{235}U.

5.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined the Aliquippa site was eligible for FUSRAP in 1983.

Cleanup Criteria

The Aliquippa site was remediated to the guidelines in accordance with DOE Order 5400.5 (archived).

The site-specific soil guideline is 100 pCi/g for total uranium (50 pCi/g for ^{235}U) averaged over any 1100 ft^2 (100 square meters [m^2]) area and any 15-centimeter-thick layer below the surface. The average concentration of ^{238}U in background soil samples for the Aliquippa Forge site is 1.4 pCi/g. The background value was determined by analyzing several soil samples from areas chosen based on their proximity to the site, relative independence from potential influence of the site, and representativeness of area geology and land uses.

Supplemental limits were applied to beta-gamma emitter activity that exceeded authorized limits on roof and support structures.

Remedial Action

In 1978, Argonne National Laboratory (ANL) conducted a radiological survey at the site and identified radioactive contamination exceeding DOE guidelines on floors, walls, and overhead beams. The site was designated for remediation under FUSRAP in August 1983. A 1987 radiological survey identified 14 areas of contamination in and around Building 3. In 1998, Bechtel National Inc. (BNI) conducted interim remedial activities to allow restricted use of the buildings by Aliquippa Forge. In 1992, the Oak Ridge Institute of Science and Education performed a radiological survey for remedial design of Building 3, the outdoor area along the western side of the building, and portions of Building 8.

Before remedial action began, the contaminated areas of both buildings were more accurately defined, revealing more residual uranium contamination than had been originally identified. In Building 3, contaminated areas included approximately 11,000 ft^2 of overhead area (11 trusses, roof panels, two exhaust turrets and associated ducts, light fixtures, wiring, and conduit); 990 yd^3 of soil and concrete from the west bay area; 1100 ft^2 of contaminated walls; 19,000 ft^2 of contaminated floors; 5 yd^3 from a mica pit; 14 yd^3 from the west cutter pit; and 35 yd^3 of soil from along the western side of the building. The contamination for Building 8 consisted of 530 ft^2 of overhead area (three trusses and roof panels); 5800 ft^2 of floor area; 1140 ft^2 of wall area; and 13 yd^3 of brick and soil. These areas were decontaminated in 1993 and 1994 using high-efficiency particulate air (HEPA) filtered vacuums for dust; wire brushes, scrapers, and sandpaper for rust; excavation for soil and concrete; and removal of equipment, exhaust turrets, ductwork, and ventilators. Approximately 100 yd^3 of building material waste was reduced in size and sent to a licensed disposal facility in Clive, Utah. Figure 5-2 through Figure 5-5 show photographs of the relevant areas.

Figure 5-2. Front of Remediated Building Where AEC Work Occurred, Aliquippa, Pennsylvania, Site, September 2005

Figure 5-3. Rear of Remediated Building, Aliquippa, Pennsylvania, Site, September 2005

Figure 5-4. Building Interior, Aliquippa, Pennsylvania, Site, September 2005

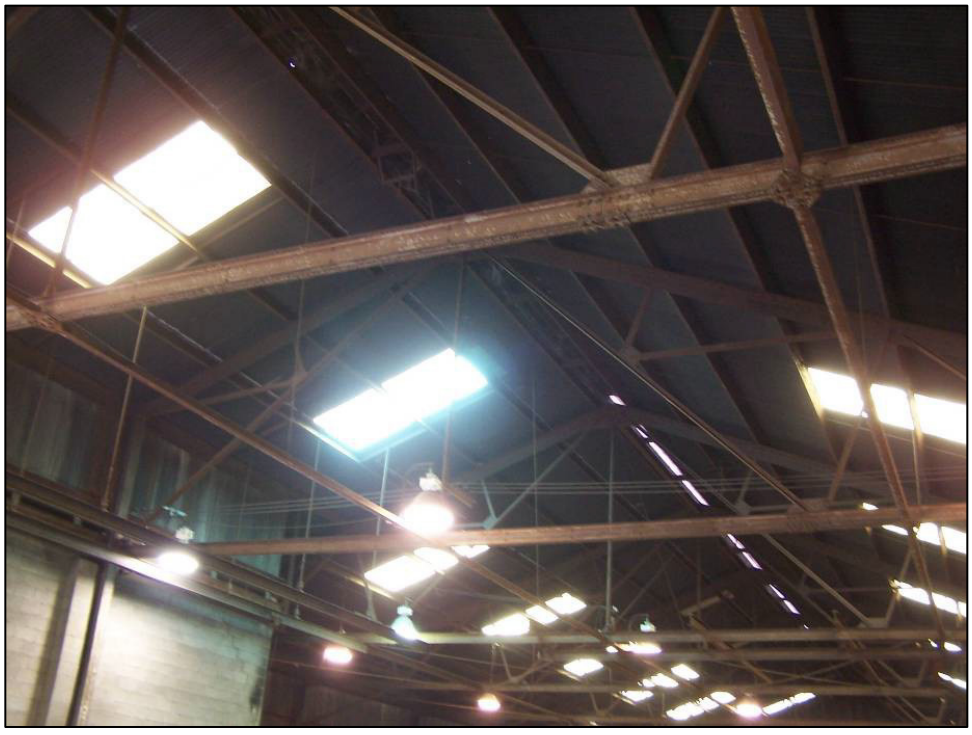


Figure 5-5. Roof System Where Supplemental Limits Were Applied, Aliquippa, Pennsylvania, Site, September 2005

DOE verified that no residual contamination above applicable guidelines was detected in any area of Building 3 or Building 8 except Building 3 roof panel joints on the western side, the area between the roof panels and purlins (dust and debris), and three concrete support pedestals. A risk assessment concluded that the material left in place would not pose an unacceptable present or future risk to workers or members of the public, and supplemental limits were approved for these areas.

Release Survey

Following the final remediation, DOE certified that the site complied with applicable cleanup criteria and standards and released the property for unrestricted use. Supplemental limits were applied to uranium contamination remaining in roof panel laps and fixed to roof support structures and three interior concrete pedestals.

Independent Verification

While most of the residual contamination at the site was removed by remedial actions conducted under FUSRAP, residual radioactivity in excess of the DOE surface contamination guidelines remains in several locations. Supplemental limits were applied to those locations.

Use Restrictions

This site was released for unrestricted use. DOE certified that reasonably foreseeable use of the site will result in no radiological exposure above current radiological guidelines established to protect members of the general public as well as occupants of the site.

Assessment of Risk

Because the site was remediated to the conservative dose-based standards, there was no site-specific risk assessment performed. No additional protective measures by DOE are warranted following the 2017 technical workshop review of site conditions and risk.

Certification and Regulator Concurrence

A notice of cleanup certification for the site was published on October 30, 1996 (61 FR 55982). The notice states that the property complies with DOE's radiological decontamination criteria and standards. The certification docket was prepared in November 1996 (DOE 1996).

Agreements and Permits

There are no agreements or permits.

5.3 LTS Requirements

The following section presents the reporting and fieldwork requirements for LTS at the Aliquippa site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

Regulator-imposed institutional controls are not applicable according to the site certification and backup documentation. There are no institutional controls in place for the Aliquippa site.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at https://www.energy.gov/articles/aliquippa-pennsylvania-fact-sheet.

Desktop Assessment

The desktop assessment is applicable to the Aliquippa site. For sites that were released for unrestricted use and that contain supplemental limits areas, DOE will conduct annual data verification to ensure that land usage is consistent with the site certification land use in accordance with the remedy and determine if a site visit is necessary. The latest desktop assessment was conducted in February 2023.

Monitoring

No monitoring is required at the Aliquippa site.

Field Operations

There are no field operations required at the Aliquippa site.

Regulatory Interfaces

No regulatory interfaces are required at the Aliquippa site.

5.4 References

61 FR 55982. U.S. Department of Energy, "Statement of Certification: Aliquippa Forge Site in Aliquippa, Pennsylvania," *Federal Register*, October 30, 1996.

DOE (U.S. Department of Energy), 1996. *Certification Docket for the Remedial Action Performed at the Aliquippa Forge Site in Aliquippa, Pennsylvania*, PA.7-4, Former Sites Restoration Division, Oak Ridge Operations Office, November.

DOE Order 458.1 Chg 4 (LtdChg), *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, September 15, 2020.

6.0 Attleboro, Massachusetts, Site

6.1 Site Conditions

The Attleboro, Massachusetts, Site, also known as the Shpack Landfill Superfund Site, is owned by the Norton Township Conservation Commission and covers approximately 9.4 acres. It is at 68 Union Road, Attleboro, Massachusetts (see Figure 6-1).

Figure 6-1. Location of the Attleboro, Massachusetts, Site

The site is divided by the border of the town of Norton and city of Attleboro. Approximately 6 acres are within the town of Norton, and about 3.4 acres are in Attleboro. The site is bordered on the north and northwest by Peckham Street (owned by the city of Attleboro) and Union Road (owned by the town of Norton); on the west and southwest by an approximately 55-acre Attleboro Landfill Inc. facility; and on the north and eastern boundaries by the Chartley Swamp, a vegetated wetland area (DOE 2017).

The Shpack Landfill operated from 1946 through the early 1970s, accepting domestic and industrial wastes, including inorganic and organic chemical waste and low-level radioactive waste (LLRW). Operations were shut down by a court order in 1966, and the facility ceased operations in the early 1970s. The areas where wastes were dumped were then enclosed by a chainlink fence. In 1978, NRC conducted radiological surveys at the site after being contacted by a concerned citizen who had detected elevated radiation levels in the area. NRC's investigation identified radioactive materials, primarily radium and uranium, in the landfill. NRC determined that Metals & Controls Inc. (M&C), which merged with Texas Instruments Inc. in 1959, had disposed of trash and other materials associated with nuclear fuel production at the site. M&C fabricated enriched uranium foils beginning in 1952. After its merger with Texas Instruments Inc.,

it continued operations using enriched and natural uranium to fabricate nuclear fuel for the U.S. Navy and commercial customers under contract to AEC.

An investigation into the nature and extent of the contamination at the Shpack landfill site was begun by the Performing Defendants (PDs) in 1990 after they entered into an Administrative Order on Consent with EPA. USACE and DOE are not identified as PDs. The selected remedy documented in the ROD was implemented in two parts, based upon operable units (OUs). The part concerning OU-1 addressed the FUSRAP-related radioactive contaminated materials; the part concerning OU-2 addressed nonradiological contamination to be addressed by the PDs following completion of the FUSRAP remedial action.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were total uranium, ^{234}U, ^{235}U, ^{238}U, and ^{226}Ra.

6.2 Remedial Action

FUSRAP Eligibility Determination

The Attleboro site was designated for remediation under FUSRAP in 1980 (DOE 1980; DOE 1981).

Cleanup Criteria

EPA developed remediation goals for radiological contaminants in soil (without groundwater consumption) that are consistent with its acceptable risk of 1×10^{-5} excess lifetime cancer risk and the Massachusetts Department of Environmental Protection (MassDEP) 10 mrem/yr allowable dose limit as defined in Title 105 *Code of Massachusetts Regulations* Section 120.291 (105 CMR 120.291), "The Control of Radiation." Because no site-specific goals for groundwater cleanup were developed, federal and state drinking water standards were used as remediation goals for radiological contaminants in groundwater and surface water. Those cleanup levels are listed in Table 6-1 (EPA 2004).

Table 6-1. Cleanup Levels for the Attleboro, Massachusetts, Site

Remediation Goals for Surface and Subsurface Soil	
Radium-226	3.1 pCi/g
Uranium-234	220 pCi/g
Uranium-235	52 pCi/g
Uranium-238	110 pCi/g
Total uranium	1100 ppm
Remediation Goals for Groundwater and Surface Water	
Total uranium	30 µg/L
Radium-226	5 pCi/L

Abbreviations:
µg/L = micrograms per liter
ppm = parts per million

Remedial Action

The selected remedy for OU-1 included excavation and offsite disposal of radioactively contaminated waste material that exceeded cleanup levels. FUSRAP remedial action was performed by USACE contractor Conti Federal Services Inc. from 2002 to 2011, with management and oversight by USACE. Seventeen survey units were remediated by removing soil until the residual contamination measured below soil cleanup levels. The average depth of excavations ranged 4–6 ft below ground surface, with a maximum depth of 17 ft below ground surface.

Excavated materials were mechanically screened and segregated into three waste streams based on size: 1 inch minus, 1–4 inches, and 4 inch plus. The waste streams were then divided into stockpiles for characterization to determine offsite disposal requirements. Stockpiles exceeding the site remedial limits were packaged and shipped to an approved and NRC-licensed LLRW disposal facility. Stockpiles that did not exceed radiological site remedial limits but exceeded chemical site remedial limits were stockpiled onsite for containment and management during the PDs' chemical remediation phase. Stockpiles that did not exceed radiological and chemical remediation goals were cleared for onsite backfill. In total, approximately 57,805 yd^3 of material were excavated, screened, and characterized; of this total, 50,908 yd^3 were shipped offsite to EnergySolutions Inc. in Utah primarily as LLRW waste. An additional 6449 $yd^3$of debris also exceeded site radiological cleanup levels and required offsite disposal at the EnergySolutions facility in Utah (USACE 2016).

In addition to soil excavation, remedial activities included the restoration or replication of impacted wetlands and extension of the public water supply line to two residences adjacent to the site.

Release Survey

A consultant for USACE performed a final status survey (FSS) to document that cleanup criteria for radiological contaminants were achieved in the excavations. The contractor conducted the FSS in accordance with EPA's *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)* (RC et al. 2000). The FSS was used to demonstrate that the median radiological concentrations in each survey unit met radiological cleanup levels established for the site. FSS results demonstrated that all survey units met the release criteria set forth in the ROD for an adjacent resident scenario.

Independent Verification

No independent verification was performed for this site.

Use Restrictions

The site was released for unrestricted use based upon the scenario of an adjacent resident without groundwater exposure. The site is also deemed protective for passive recreational use. Groundwater contamination was addressed by connecting impacted residents to a public water line and through the imposition of institutional controls, described in Section 6.3 of this chapter. As discussed in Section 6.3, all institutional controls at the site are managed by the PDs not LM.

Assessment of Risk

The majority of the site area is deemed protective for unrestricted release for the adjacent resident without groundwater consumption and has been released from radiological controls. Residual risk has been addressed through institutional controls.

Certification and Regulator Concurrence

EPA provided USACE a letter dated April 4, 2013, stating that radiological contamination at the site was remediated in compliance with the ROD (USACE 2016). EPA also stated in its letter that remaining site cleanup (OU-2 non-FUSRAP contamination) was officially transferred from USACE to EPA and the PDs. Additionally, the site was delisted from the NPL in September 2017.

Agreements and Permits

There are no agreements or permits related to DOE actions. A Grant of Environmental Restriction and Easement (GERE) was recorded for the site. The GERE prohibits activities and use of the site that may present an unacceptable risk to human health and will provide site access to the PDs for associated monitoring and operations and maintenance activities. There is a utility easement for multiple overhead transmission lines owned by National Grid traverses the site (Figure 6-2).

6.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Attleboro site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

The ROD required the PDs to implement institutional controls necessary to restrict future use of the property and groundwater. Implementation of the institutional controls will be the responsibility of the PDs and MassDEP, not LM. In accordance with the "Institutional Control Plan," Appendix W of the *Final Remedial Construction and Demonstration of Compliance Report, Shpack Landfill Superfund Site, Attleboro and Norton, Massachusetts* (ERM 2015), restrictions have been put into place to prohibit residential, agricultural, or other uses of the site that might present an unacceptable risk to human health; prohibit construction of any structures at the site, unless vapor intrusion screening criteria are met and the construction is designed to prevent vapor intrusion; and prohibit groundwater extraction and excavation below the seasonally high water table at the site.

A few small, isolated areas of residual radioactive contamination could not be excavated around the bases of National Grid's onsite utility poles (Figure 6-2). National Grid is required by EPA to comply with institutional controls for the site, including the use of a soil management plan, should a need arise to excavate around the utility poles in the future. Any soil disturbance of the utility poles will be coordinated through EPA and MassDEP. This coordination will include notification to DOE by EPA or MassDEP if radioactive contamination is expected so that cost allocation for the response, transportation, and disposal of the radioactively contaminated waste can be determined.

Figure 6-2. Overhead Transmission Lines Owned by National Grid, 2016

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changing site conditions.

The LM site fact sheet can be found at https://www.energy.gov/articles/attleboro-massachusetts-site-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to the Attleboro site.

Monitoring

LM responsibilities are limited to managing site records and responding to stakeholder inquiries.

Other anticipated LTS requirements, which are not the responsibility of LM, consist of groundwater monitoring, Five-Year Reviews, and monitoring groundwater institutional controls. The PDs have agreed that the City of Attleboro will perform the groundwater monitoring,

enforce the institutional controls as necessary, and prepare and submit annual reports to EPA and MassDEP regarding the status of institutional controls. The ROD states that EPA will conduct the Five-Year Reviews.

EPA completed the First Five-Year Review in August 2018 (EPA 2018). EPA stated that the remedy is considered protective of human health and the environment. The next Five-Year Review report will be completed in June 2023, 5 years after the signature date of the First Five-Year Review. EPA removed the site from the NPL in October 2017.

Field Operations

There are no field operations required at the Attleboro site.

Regulatory Interfaces

No regulatory interfaces are required at the Attleboro site.

6.4 References

105 CMR 120.291. "The Control of Radiation," *Code of Massachusetts Regulations.*

DOE (U.S. Department of Energy), 1980. *Designation for Remedial Action of the Shpack Landfill, Norton, Massachusetts*, memorandum by Assistant Secretary for Nuclear Energy George W. Cunningham, December 17.

DOE (U.S. Department of Energy), 1981. *Shpack Landfill, Norton, Massachusetts*, memorandum by Oak Ridge Operations Manager R.J. Hart, January 27.

DOE (U.S. Department of Energy), 2017. *Site-Specific Transition Plan for the Attleboro, Massachusetts, FUSRAP Site*, LMS/ATT/S12892, Office of Legacy Management, May.

EPA (U.S. Environmental Protection Agency), 2018. *First Five-Year Review Report for Shpack Landfill Superfund Site Attleboro/Norton, Massachusetts*, Document ID 100010199, August.

EPA (U.S. Environmental Protection Agency), 2002. *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, EPA 402-R-97-016, August.

EPA (U.S. Environmental Protection Agency), 2004. *Shpack Landfill Superfund Site Record of Decision Summary*, Document ID 214530, September.

ERM (Environmental Resources Management), 2015. *Final Remedial Construction and Demonstration of Compliance Report, Shpack Landfill Superfund Site, Attleboro and Norton, Massachusetts*.

USACE (U.S. Army Corps of Engineers), 2016. *Final Site Closeout Report for Operable Unit 1 Radiological Remediation Shpack Landfill FUSRAP Superfund Site, Norton/Attleboro, Massachusetts*, December.

7.0 Bayo Canyon, New Mexico, Site

7.1 Site Conditions

The 1.5-acre Bayo Canyon, New Mexico, Site is 25 miles northwest of Santa Fe and 60 miles north-northeast of Albuquerque. Bayo Canyon is one of numerous canyons cut into the Pajarito Plateau in north-central New Mexico (Figure 7-1). The TA-10 site in the canyon lies partly in Los Alamos County and partly in Santa Fe County, approximately 3 miles from the town of Los Alamos and 5 miles northwest of White Rock. This 1.5-acre FUSRAP site is in TA-10, and the footprint is shown in Figure 7-2.

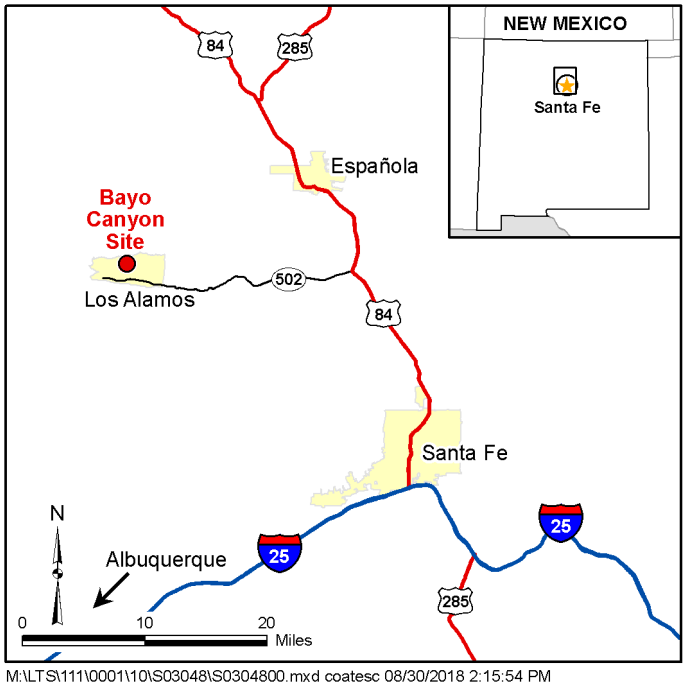


Figure 7-1. Location of the Bayo Canyon, New Mexico, Site

The original 350-acre site (TA-10) was owned by the federal government from 1943 through 1967 as part of LANL operations. MED constructed facilities in a portion of Bayo Canyon in 1943 and 1944. TA-10 was utilized by MED and later AEC between 1944 and 1961 as a firing site for high-explosive experiments in conjunction with research on nuclear development. The experiments were conducted by the University of California under contract with AEC. On July 1, 1967, the 1.5-acre site was transferred by quitclaim deed to the present owner, Los Alamos County.

The experiments employed conventional explosives in conjunction with natural and depleted uranium (^{238}U), lanthanum-140 (^{140}La), and ^{90}Sr. A detonating explosive shot dispersed "shrapnel" throughout the canyon, some of which was radioactive.

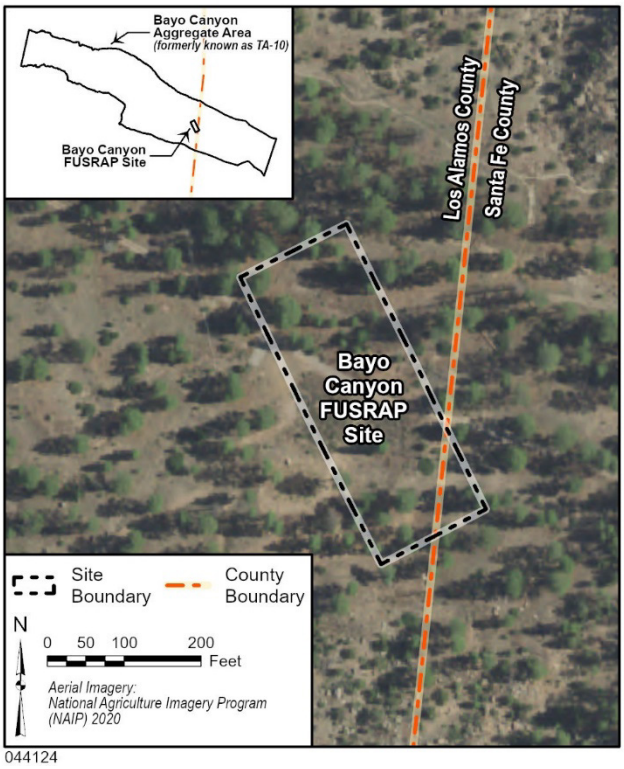


Figure 7-2. Footprint of the Bayo Canyon, New Mexico, Site

Onsite radiochemistry laboratories prepared the radiation source for blast by radiochemically separating the ^{140}La from a solution containing the radioactive parent barium-140 (the daughter of cesium-140) and from other impurities, including ^{90}Sr. The radioactive liquids and solid wastes from the radiochemistry laboratory were dispersed into leach pits, from which a certain amount of subsurface strontium migration occurred.

TA-10 contained a radiochemistry laboratory, solid waste disposal facilities, two assembly buildings, an inspection building, a personnel building, control buildings at two detonation control complexes (with adjacent firing pads), and contaminated leach pits from the radiochemistry laboratory. In the early 1960s, TA-10 was cleaned up to standards existing at the time.

All physical facilities have either been burned or demolished. The debris from the buildings, sewer facilities, and surface were disposed of in the contaminated waste burial site, which is on the 1.5-acre FUSRAP site.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were ^{90}Sr and uranium (natural and depleted).

7.2 Remedial Action

FUSRAP Eligibility Determination

In 1980, DOE determined that the 1.5-acre Bayo Canyon site was eligible for FUSRAP.

Cleanup Criteria

The cleanup criteria for ^{90}Sr in soil was 100 pCi/g.

Remedial Action

As part of FUSRAP, LANL resurveyed the canyon in 1976. The survey identified 1.5 acres that encompassed the former radiochemistry laboratory and soils and liquid waste disposal area. Subsurface soil samples collected within the 1.5-acre area identified residual ^{90}Sr between 8 and 40 ft below ground surface. After evaluating the three remedial action alternatives and given the level of contamination, DOE selected the "minimal action" scenario to leave the material undisturbed. DOE placed six monuments inscribed with "Buried Radioactive Material" around the area; the monuments note that the ^{90}Sr will have decayed below cleanup criteria by 2142.

Release Survey

In August 1982, the selected remedial action was implemented. Although a deed restriction on the 1.5-acre area was drafted by DOE and subsequently submitted to Los Alamos County, the document was never filed with Los Alamos or Santa Fe County due to unresolved liability issues.

Independent Verification

None. LANL conducted a postremedial action survey, but an independent verification of final radiological conditions was not performed.

Use Restrictions

As previously noted, there is no deed restriction in place at the site.

Assessment of Risk

The 1.5-acre site was determined to contain subsurface contamination of ^{90}Sr above the radiological unrestricted release standard. The remedial measures implemented included placing six monuments to delineate boundaries of the area where levels of ^{90}Sr were above the radiological standard and requesting that Los Alamos County file a deed restriction for the area. The deed restrictions would limit excavation of the site property until 2142, when the ^{90}Sr contamination has decayed to acceptable radiological levels. Due to unresolved liability issues, the deed restrictions were never filed (DOE 2003).

Certification and Regulator Concurrence

No executed DOE certification statement or *Federal Register* Notice of Certification was found in project files. There is a Draft Certification Docket, dated December 1983 (Jennison 1983; DOE 1983).

Agreements and Permits

A restrictive covenant addressing excavation restrictions was specified as a part of the remedy, but it was not recorded in public land records.

Because this site is part of the LANL New Mexico facility, it is included in the Order of Consent discussed in Section 1.2, between LANL, DOE, and NMED to address the potential release of contamination from the LANL facility. It is available at https://hwbdocuments.env.nm.gov/Los%20Alamos%20National%20Labs/Permit/37925.pdf.

7.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Bayo Canyon site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

Because the deed restriction was not filed, there are no institutional controls in place for the Bayo Canyon site.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at https://www.energy.gov/articles/bayo-canyon-new-mexico-site-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to the Bayo Canyon site.

Monitoring

In accordance with requirements at the conclusion of the 1967 remedial action, LM does not conduct monitoring, maintenance, or site inspections at the Bayo Canyon site. The Bayo Canyon FUSRAP site is owned by Los Alamos County and managed as part of open space that is routinely used by the public for recreational purposes.

Field Operations

In 2019, LM conducted a radiological survey and completed removal of a fence surrounding the 1.5-acre FUSRAP-remediated site, leaving only the monuments and protective bollards in place at the site. No additional protective measures or maintenance was warranted at the time.

Regulatory Interfaces

No regulatory interfaces are required at the Bayo Canyon site.

7.4 References

DOE (U.S. Department of Energy), 1983. *NM.01-5 – Draft DOE Certification Docket for the Bayo Canyon Site, Los Alamos, New Mexico*; December.

DOE (U.S. Department of Energy), 2003. *NM.01-6 – Final Report on Remedial Action at the Bayo Canyon Site, Los Alamos, New Mexico*, Document Number 2143, prepared by Bechtel National Inc., August.

Jennison, 1983. Mary Alice Jennison, Environmental Controls and Analysis Directorate, Eastern Technology Division, The Aerospace Corporation, letter (about Draft Certification Package: Bayo Canyon Site, Los Alamos, New Mexico) to Arthur Whitman, Division of Nuclear Energy, NE-24, Division of Remedial Action, U.S. Department of Energy, December 7.

8.0 Berkeley, California, Site

8.1 Site Conditions

The State of California owns the Berkeley, California, Site, which consists of Gilman Hall, a 4-story building with a sub-basement floor on the campus of the University of California at Berkeley (Figure 8-1).

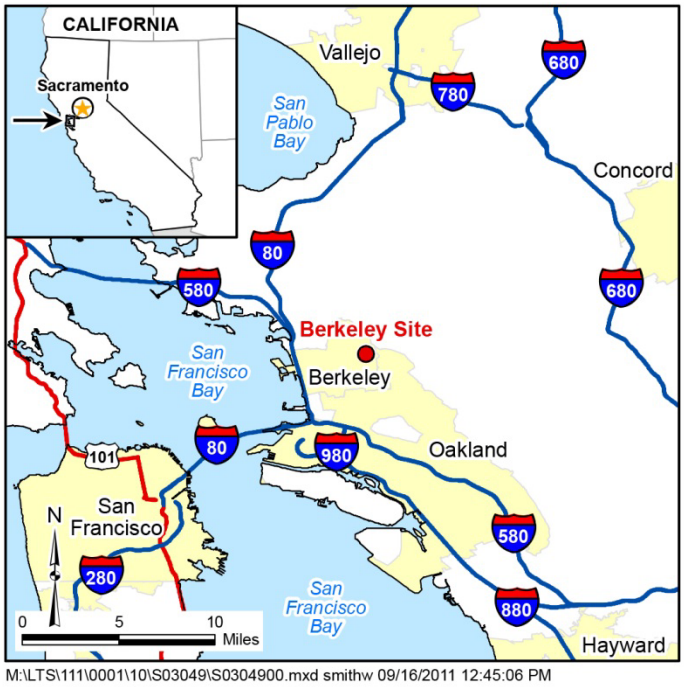


Figure 8-1. Location of the Berkeley, California, Site

Gilman Hall (third floor and basement areas) was used in support of MED and AEC during the 1940s. Research involved the production of minute quantities of plutonium by bombarding uranium with cyclotron-produced neutrons. Other work included verification of plutonium's existence and chemical properties and demonstrating the feasibility of chemically separating plutonium produced in the first chain-reacting pile at the University of Chicago.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were uranium, $^{239}Pu/^{240}Pu$, ^{137}Cs, and ^{241}Am.

8.2 Remedial Action

FUSRAP Eligibility Determination

In 1979, DOE determined the Berkeley site was eligible for FUSRAP.

Cleanup Criteria

Residual contamination was remediated to conditions that were acceptable under the University of California's State General License 1333-62.

Remedial Action

In 1976, DOE identified and surveyed select rooms in Gilman Hall as part of a FUSRAP evaluation. At that time, low-level alpha emitter contamination was detected under the asphalt-tile flooring in two rooms on the third floor. Low-level ^{137}Cs contamination was detected in an unused sewer line under the ground floor. Since the levels were low and there was no removable contamination, no remedial action was taken at that time. The campus's radioactive materials license covered the materials present, and controls were in place to monitor any renovations of the areas that might affect the residual radioactive materials.

In 1981, a more detailed characterization survey identified contamination in 12 rooms, three hallways, and six exterior alcoves of the building, along with isolated areas of removable contamination. Most of the contamination involved spilled uranium compounds on floors and walls. Remedial actions included the removal of radioactive material from the contaminated floors and walls and removal and replacement of contaminated walls, lab benches, baseboards, and sills; contamination on the remaining floor areas was shielded, sealed, or fixed. From 1981 through February 1983, Lawrence Berkeley Laboratory performed remedial action of the contaminated areas under an agreement with DOE and the University of California. The Berkeley site was remediated to a condition that would pose no unacceptable risk to occupants, in accordance with the University of California's state radioactive materials license.

Release Survey

DOE concluded that the Berkeley site is radiologically acceptable under the controls provided by the University of California's State General License 1333-62.

Independent Verification

None performed.

Use Restrictions

Use is restricted by the controls of the University of California's State General License 1333-62.

Assessment of Risk

There was no site-specific risk assessment performed.

Certification and Regulator Concurrence

DOE certified that the condition of Gilman Hall is radiologically acceptable for restricted use under the controls of the University of California's State General License 1333-62 provided the University's Office of Environmental Health and Safety continues to survey Gilman Hall and monitor whenever remodeling or renovation takes place.

DOE certification occurred on March 26, 1985 (date partially illegible) (DOE 1985); documentation of publication in the *Federal Register* was not found in project files.

Agreements and Permits

The University of California's State General License 1333-62 controls acceptable use of the site. The University of California retains responsibility for managing the remaining contamination in accordance with appropriate standards prior to terminating its California general license. The university performs health physics monitoring under the state of California radioactive materials license. The contract between the University of California and DOE stipulates that DOE will restore all areas to conditions that existed before activities were conducted by DOE and its predecessor agencies.

8.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Berkeley site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Berkeley site.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at https://www.energy.gov/lm/articles/berkeley-california-site-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to the Berkeley site.

Monitoring

The University's Office of Environmental Health and Safety conducts monitoring in accordance with State General License 1333-62.

Field Operations

No field operations are required at the Berkeley site.

Regulatory Interfaces

No regulatory interfaces are required at the Berkeley site.

8.4 References

DOE (U.S. Department of Energy), 1985. *CA.03-6 – Certification Docket for Gilman Hall, University of California, Berkeley, California*, Office of Nuclear Energy, Office of Terminal Waste Disposal and Remedial Action, Division of Remedial Action Projects.

9.0 Beverly, Massachusetts, Site

9.1 Site Conditions

The Beverly, Massachusetts, Site is on Massachusetts Bay at the confluence of the Bass and Danvers Rivers; the city of Beverly is approximately 15 miles northeast of Boston (Figure 9-1). The 3-acre (1.2-hectare) site, formerly a chemical manufacturing plant and research and development facility, is bordered on the north by Congress Street, on the east by the Boston and Maine Railroad, on the west by the Bass River, and on the south by the Danvers River. Surrounding land use is residential and commercial/industrial. The property has been developed into multiunit residential housing.

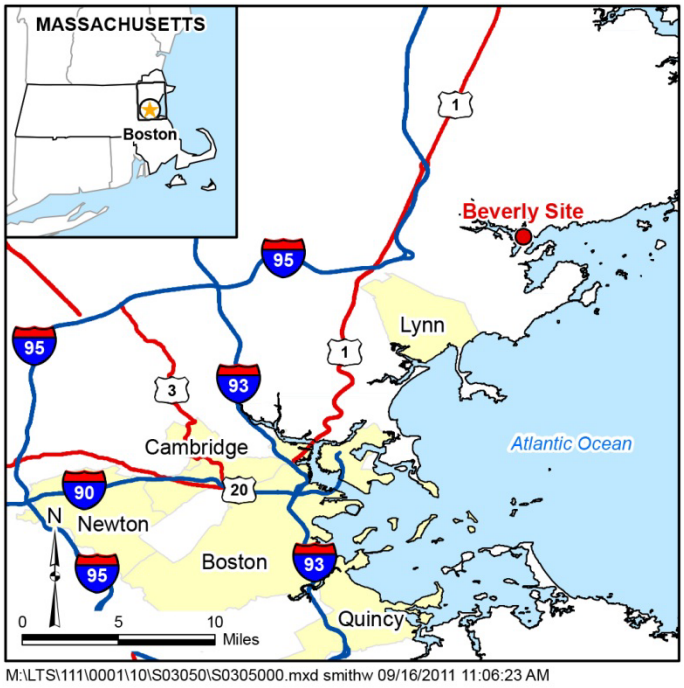


Figure 9-1. Location of the Beverly, Massachusetts, Site

From 1942 to 1948, the Metal Hydrides Corporation conducted uranium-processing operations under contract to MED and AEC. MED and AEC contract operations involved converting uranium oxide to uranium metal powder using calcium hydroxide. A process used later involved reacting uranium oxide with hydrogen fluoride to produce uranium tetrafluoride, which was mixed with magnesium and heated to produce uranium metal. MED and AEC contract work at the site involved only natural uranium; no depleted or enriched uranium was processed. Other operations at the site involved the recovery of uranium from scrap and turnings received from a fuel fabrication plant in Hanford, Washington. Uranium-238 was identified as the primary contaminant of concern (COC) associated with MED and AEC activities.

Two of the original buildings, which housed foundry facilities at the site, were demolished between 1948 and 1950 (after completion of AEC surveying and decommissioning), and two other buildings (Buildings B and F) were erected at these locations; the remaining original

buildings (Buildings A and A-1) contained furnaces, leaching facilities, a mixing room, a drying room, and analytical laboratories. The Alfa Building was used in later, non–MED-related operations that involved purification of thorium compounds. The primary contaminants resulting from this work were ^{232}Th and, to a lesser extent, ^{226}Ra. Beneath Building A, radium was mixed with ACM. The thorium and radium contamination resulted from private operations that did not involve work for the federal government. Figure 9-2 and Figure 9-3 show photographs of the site.

In 1965, Metal Hydrides Corporation became the Ventron Corporation, which was acquired by the Thiokol Corporation in late 1976. In 1980, Ventron became a division of Morton Thiokol Inc. (renamed Morton International in 1990). The site was designated for remedial action under FUSRAP in 1986. Morton International production activity at the site ceased in 1994. In 1996, DOE and Morton International finalized a memorandum of agreement regarding the allocation of cleanup responsibilities between the parties at the site.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminant was uranium. Thorium-232 (^{232}Th) and ^{226}Ra contamination was present as a result of thorium purification operations (not related to MED) that were conducted privately after MED operations ceased.

9.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined the Beverly site's eligibility for FUSRAP in December 1985.

Cleanup Criteria

Standards and criteria governing release of properties for radiologically unrestricted use are based on DOE Order 5400.5 (archived) and related guidance applicable to FUSRAP sites. Guidelines specified in DOE Order 5400.5 (archived) are comparable to criteria then in use by EPA and NRC.

Cleanup criteria for residual radioactive material in soil were based on application of the ALARA principle to site-specific guidance developed by ANL. Site-specific guidelines for total uranium in soil averaged over the remediated area were dose-based criteria derived by ANL based on the most probable future use of the site. Site-specific criteria for soil were 15 pCi/g for ^{232}Th and ^{226}Ra and 100 pCi/g for total uranium (50 pCi/g for ^{238}U) regardless of depth. Criteria for building decontamination were DOE Order 5400.5 (archived) surface criteria for unrestricted use. The guidelines are summarized in Table 9-1.

Table 9-1. Archived DOE Order 5400.5 Surface Contamination Limits

Natural Uranium, ^{235}U, ^{238}U, and Associated Decay Products on Structural Surfaces	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2
Surface Contamination Limit for Beta/Gamma Emitters	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2

Note:
Where surface contamination by both alpha and beta/gamma-emitting nuclides exists, the limits established for alpha and beta/gamma-emitting nuclides should apply independently.

Asbestos was the only nonradioactive constituent mingled with residual radioactive materials at concentrations requiring remedial action. The ACM was contaminated with ^{226}Ra at concentrations greater than 5 pCi/g. All ACM residual radioactive materials were removed from the site and transported to Envirocare of Utah, a facility licensed for the disposal of radioactively contaminated waste.

Figure 9-2. Beverly, Massachusetts, Site Looking West from a Railroad Bridge, August 2010

Figure 9-3. Beverly, Massachusetts, Site Looking South, August 2010

Remedial Action

DOE performed remedial action of the site in two phases: in September 1995 and from May 1996 to March 1997. Supplemental sampling of the site to verify the adequacy of radiological remediation occurred in July 1997.

In September 1995, remediation began with excavation and cleanup of contamination from portions of the harbor adjacent to the seawall. Residual contamination within the seawall could not be remediated because of stability and safety concerns. Morton International demolished 10 buildings, and uncontaminated rubble from the buildings was used as backfill along the seawall. The Alfa Building was also demolished to provide access to underlying contaminated soil. Only two buildings (the Biocides Building and Building E) were left standing at the site.

Rubble meeting DOE guidelines in DOE Order 5400.5 (archived) was stockpiled and used as backfill along the seawall. Building slabs were surveyed and either decontaminated and left in place or removed and disposed of with other contaminated material.

Excavation of contaminated materials was the primary remedial action technique used at the site. Eleven discrete areas of the site were excavated and verified for compliance with radiological cleanup criteria. Excavations occurred beneath demolished buildings in the northwest corner of the site, in the harbor area. Approximately 9500 yd^3 of radioactively contaminated soil, including ACM, were removed and shipped to a licensed disposal facility in Clive, Utah.

Release Survey

Analytical results of the postremedial action surveys indicate that the levels of radioactivity in the remediated areas comply with applicable cleanup guidelines for radioactive contamination.

Independent Verification

The independent verification survey concluded that the site satisfies the DOE requirements for release for unrestricted use.

Use Restrictions

The site was released for unrestricted use; DOE certified that reasonable, foreseeable future use of the property will result in no radiological exposure above current guidelines established to protect members of the general public, as well as occupants of the site.

Assessment of Risk

ANL performed a risk analysis using the resident subsistence farmer as a most conservative scenario and concluded that the site-specific criteria for total uranium of 100 pCi/g is equivalent to an exposure of 36 mrem/yr, which is less than the 100 mrem/yr DOE dose guideline.

Certification and Regulator Concurrence

A notice of cleanup certification for the site was published in the *Federal Register* on October 21, 2003 (68 FR 60097–60098). The notice states that any residual contamination remaining onsite at the time remedial actions were completed falls within DOE radiological decontamination criteria and standards for use of the property without radiological restrictions. This certification provides assurance that reasonably foreseeable future use of the site will result in no radiological exposure above DOE radiological criteria and standards for protecting members of the general public and occupants of the property. A certification docket was prepared in March 2003 (DOE 2003).

Agreements and Permits

There are no agreements or permits.

9.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Beverly site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Beverly site. Materials to which supplemental limits were applied have been removed from the site. There is no need for restrictions on future use and no further LM waste management responsibility.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at https://www.energy.gov/articles/beverly-massachusetts-site-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to the Beverly site.

Monitoring

No monitoring is required at the Beverly site.

Field Operations

There are no field operations required at the Beverly site.

Regulatory Interfaces

No regulatory interfaces are required at the Beverly site.

9.4 References

68 FR 60097–60098. U.S. Department of Energy, "Certification of the Radiological Condition of the Ventron Site in Beverly, MA," *Federal Register*, October 21, 2003.

DOE (U.S. Department of Energy), 2003. *MA.04-6 – Certification Docket for the Remedial Action Performed at the Ventron Site, Beverly, Massachusetts*, Office of Assistant Manager for Environmental Management, Oak Ridge Operations, March.

DOE Order 458.1 Chg 4 (LtdChg), *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, September 15, 2020.

10.0 Buffalo, New York, Site

10.1 Site Conditions

The Buffalo, New York, Site (formerly the Bliss & Laughlin Steel Site) is at 110 Hopkins Street in southern Buffalo, New York (Figure 10-1).

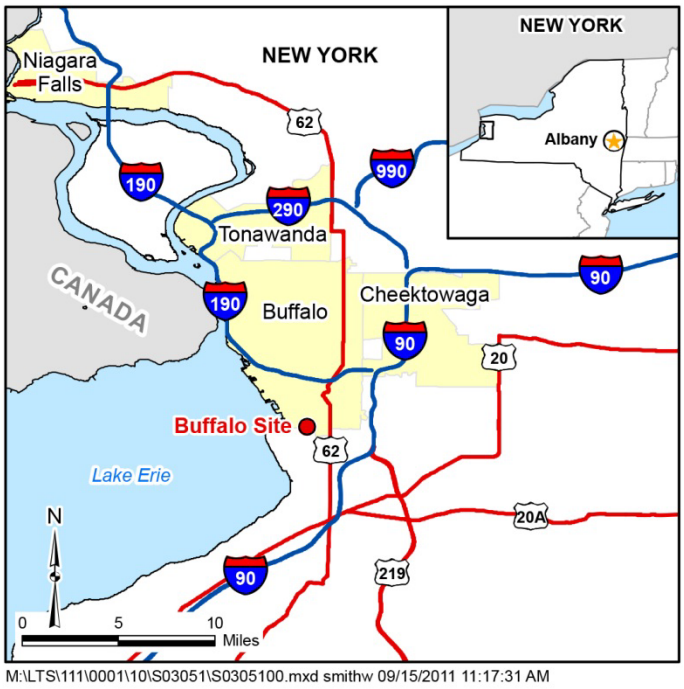


Figure 10-1. Location of the Buffalo, New York, Site

The Bliss & Laughlin Steel Company processed cold-drawn steel, and, in fall 1952, the company performed machining and straightening operations on uranium rods. Although contracts or purchase orders have not been located, AEC records from the New York Operations Office suggest that the work was performed by National Lead of Ohio (NLO), an AEC prime contractor operating AEC's Feed Materials Production Center at Fernald, Ohio. Rods were shipped from Lake Ontario Ordnance Works (LOOW) to Bliss & Laughlin, machined onsite, and then shipped directly to Fernald. Turnings from the operation were picked up by AEC trucks and returned to LOOW for packaging under oil and subsequent shipment to Fernald.

Machining operations were conducted on Saturdays, possibly for security reasons or to avoid disrupting Bliss & Laughlin's operations during normal business hours. The exact quantity of uranium and the duration of operations are not known. AEC's New York Operations Office records indicate machining occurred in September and October 1952, and 53 drums of turnings collected from Bliss & Laughlin were shipped from LOOW to Fernald in November 1952. There is no evidence of any operations after this date.

Bliss & Laughlin is referenced also in an October 1951 AEC letter as having accumulated four drums of uranium oxide. The nature of this earlier work is unknown. There is no evidence that the site was decontaminated at the time of that work. Ramco Steel Inc. purchased the facility in 1972.

The facility consists of a single building (approximately 129,600 ft^2) surrounded by approximately 161,460 ft^2 of grounds. In March 1992, DOE surveyed the site and found that Niagara Cold Drawn Corporation owned and occupied the site. During the survey, the occupants indicated that the main structure had undergone only minor changes since the uranium operations in the 1950s. Equipment inside the building has been rearranged or replaced to varying degrees.

The uranium machining operations were in the Special Finishing Area, but work was no longer performed there. The Special Finishing Area occupied about 3300 ft^2 of floor space. The floor was concrete and contained several shallow utility (water, electricity, lubricant, and pneumatic) trenches; there were no drains in the area. Floor surfaces were generally rough and pitted and covered with a thin layer of oil-absorbent material and dried oil and grease. Machining equipment and material storage racks prevented access to some floor surface areas at that time. Ceilings were approximately 40 ft high and supported by a framework of trusses. The machining area of the building was open (without inside walls or partitions). The 2009 DOE survey found that the processing area had not changed much, although the machining equipment had been replaced. The disposition of the old equipment is not known, but the equipment may have been returned or traded to the Medart Company in St. Louis, Missouri.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminant was natural uranium.

10.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined the Buffalo site's eligibility for FUSRAP in 1992.

Cleanup Criteria

Cleanup criteria were as follows:

- Release criterion: TEDE of 25 mrem/year (criteria from 10 CFR 20, Subpart E)
- Site-specific derived concentration guideline for surface contamination: 2000 dpm/100 cm^2 (based on TEDE of 25 mrem/yr)
- Site-specific derived concentration guideline for uranium in soil: 100 pCi/g (based on TEDE of 25 mrem/yr)

Remedial Action

USACE performed remediation of the Buffalo site from December 1998 to March 1999. Trusses were remediated by scraping them and wiping them off and then removing the residual dust with a high-efficiency vacuum. Scabbling (a process that breaks up and removes the surface of

concrete) and jackhammers were used to remove surface contamination from the floor and from the concrete over the trench west of the Special Finishing Area. The second trench and a pit area contained uranium metal shavings and debris, which were removed manually. The concrete pad covering this trench was jackhammered, and the trench walls and floors were scabbled, jackhammered, and sandblasted. Approximately 60 yd^3 of construction debris was generated during the decontamination of the trusses, floors, and trenches. This debris was handled as radiologically contaminated waste and shipped to a licensed facility in Clive, Utah, for disposal.

A postremediation survey indicated that the remaining radiological contaminants were below the levels required to meet the dose specified in the ROD.

Release Survey

A postremediation report survey indicated that the remaining radiological contaminants were below the levels required to meet the 25 mrem/yr dose specified in the ARARs in the ROD.

Independent Verification

None.

Use Restrictions

Postremedial survey results indicate that the radiological condition of the site is in compliance with the standards established in the ROD, and USACE released the site for unrestricted use.

Assessment of Risk

Because the site was remediated to the conservative dose-based standards, there was no site-specific risk assessment performed.

Certification and Regulator Concurrence

A declaration of remedial action completion and issuance of the closure report for the site concludes that as a result of remedial action, no radioactive material remains onsite above the cleanup level in the ROD, and no further action will be required at the site (NYSDEC 1999).

Agreements and Permits

There are no agreements or permits.

10.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS the Buffalo site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Buffalo site.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at
https://www.energy.gov/articles/buffalo-new-york-site-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to the Buffalo site.

Monitoring

No monitoring is required at the Buffalo site.

Field Operations

There are no field operations required at the Buffalo site.

Regulatory Interfaces

No regulatory interfaces are required at the Buffalo site.

10.4 References

NYSDEC (New York State Department of Environmental Conservation), 1999. *Closure Report: Decontamination of the Former Bliss and Laughlin Facility*, Buffalo, New York, USACE Contract No. DACA31-96-D-0026.

11.0 Chicago North, Illinois, Site

11.1 Site Conditions

The Chicago North, Illinois, Site (formerly the National Guard Armory) is at East 52nd Street and Cottage Grove Avenue in Chicago, Illinois, approximately 6 miles south of the downtown business district (Figure 11-1).

Figure 11-1. Location of the Chicago North, Illinois, Site

The 290,000 ft^2 concrete and stone facility consists of an arena with bleachers at the center of the building and classrooms, offices, storage areas, and garages at the north and south ends. MED leased the armory from the State of Illinois 124th Field Artillery during World War II. Beginning in 1942, the MED Metallurgical Laboratory and the University of Chicago jointly used the building in support of federal programs involving nuclear materials. The building was needed to alleviate space shortages at the University of Chicago and the Metallurgical Laboratory. In 1943, the building was the central procurement and shipping location for the Metallurgical Laboratory, and records indicate that uranium metal stock was received and temporarily stored in the shipping and receiving room.

Various types of uranium processing activities were conducted in the armory in support of nuclear activities. The arena was probably used for chemical processing and metal casting of uranium; the bleachers area surrounding the arena was used for storage of radioactive materials.

The armory storeroom (believed to be Room 1) was apparently used to store uranium shavings and grinding wastes because at least one of several fires in the armory was reported to have occurred in the northeast corner of that room. That particular fire contaminated both the

receiving room and storeroom. A second fire also contaminated both the receiving area and the storeroom.

After MED terminated its use of the facility, contaminated soil from the arena was removed and disposed of. However, no records of this operation could be located. Later, more soil was removed, and a concrete slab was poured over the dirt floor to facilitate use of the arena for maintenance of military vehicles. Interviews with facility staff indicated that attempts were made in the past to decontaminate bleachers in the arena; however, no records of radiological surveys or decontamination efforts conducted at the facility upon termination of MED and AEC activities could be found.

When use of this facility in support of nuclear programs was terminated in 1951, the property was returned to the State of Illinois for use by the National Guard. In the 1970s and the 1980s, the Illinois National Guard occupied the armory, which housed the 1st Battalion of the 178th Infantry and the 2nd Battalion of the 122nd Field Artillery. The facility was used for offices, classrooms, storage, and garage areas.

Because of the uncertainties involving decontamination efforts by MED and AEC at the armory, ERDA, predecessor to DOE from 1975 to 1977, conducted a comprehensive radiological survey to determine whether any contamination remained at the site.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminant was uranium (from natural uranium metal and dry uranium oxide).

11.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined the Chicago North site's eligibility for FUSRAP in 1985.

Cleanup Criteria

The Chicago North site was remediated to criteria in the *U.S. Department of Energy Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Site*s (DOE 1985).

A guideline of 150 pCi/g was derived for ^{238}U in soil with ^{234}U and ^{235}U present in naturally occurring concentrations, on the basis of a scenario in which a person would live in the armory, drink water from a shallow onsite well, and raise 10% of his or her plant-based diet in an onsite garden.

Remedial Action

ERDA and then DOE conducted radiological surveys between September 1977 and October 1978 at the site. Results of the surveys indicated that residual contamination at the site exceeded guidelines in effect at that time and that uranium was the primary contaminant. Based on these results, DOE designated the Chicago North site for remedial action under FUSRAP.

Remedial action consisted of the removal of radioactive contamination from the contaminated areas. A total of 20 yd^3 of waste was generated during remedial action. This material was disposed of as low specific activity waste at the DOE Hanford Site in Washington. Figures showing the areas in which remedial action was performed are provided in Exhibit III of the certification docket.

Remediation activities were (1) vacuuming or wiping surface areas; (2) sanding, grinding, or scabbling the areas where necessary; (3) shoveling out sludge in six catch basins, high-pressure water cleaning of pipes from each catch basin, and sandblasting walls; and (4) removing contaminated soil from the area outside the armory building and from the area between catch basins where a main pipe was removed. Figure 11-2 and Figure 11-3 show photographs of remediation activities.

Wastes removed from the National Guard Armory during remedial action were placed in 55-gallon steel drums for disposal. The sludges from the catch basins contained mixed wastes that were treated to elevate the flash point and were solidified for disposal offsite. All wastewater generated from remedial action activities was placed in drums and temporarily stored onsite.

Remediation was completed in 1987.

Figure 11-2. Removing Sludge and Placing It in Drums at the Chicago North Site (DOE Digital Archive)

Figure 11-3. Scabbling Concrete at the Chicago North Site (DOE Digital Archive)

Release Survey

All the measurements taken after the removal of radioactive materials indicated that no areas of radioactive contamination remain in which concentrations exceed DOE guidelines.

Independent Verification

The results of the independent verification survey demonstrate that the remedial actions were successful in meeting DOE guidelines.

Use Restrictions

The site was released for unrestricted use.

Assessment of Risk

There was no site-specific risk assessment performed.

Certification and Regulator Concurrence

A certification docket was prepared in February 1989 (DOE 1989) and contains the notice of cleanup certification for the site, which was published on February 17, 1989.

Agreements and Permits

There are no agreements or permits.

11.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Chicago North site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Chicago North site.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at
https://www.energy.gov/lm/articles/chicago-north-illinois-site-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to the Chicago North site.

Monitoring

No monitoring is required at the Chicago North site.

Field Operations

There are no field operations required at the Chicago North site.

Regulatory Interfaces

No regulatory interfaces are required at the Chicago North site.

11.4 References

DOE (U.S. Department of Energy), 1985. *U.S. Department of Energy Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites*, Rev. 1, July.

DOE (U.S. Department of Energy), 1989. *IL.05-7 – Certification Docket for the Remedial Action Performed at the National Guard Armory, Chicago, Illinois, from April 1987 to June 1987*, DOE/OR/20722-179, Technical Services Division, Oak Ridge Operations Office, February.

12.0 Chicago South, Illinois, Site

12.1 Site Conditions

The Chicago South, Illinois, Site is at the University of Chicago at 5801 South Ellis Avenue, Chicago, Illinois (Ryerson Physical Laboratory, 1100-14 East 58th Street; Eckhart Hall, 1118-32 East 58th Street; George Herbert Jones Chemical Laboratory, 5747 South Ellis Avenue; and Kent Chemistry Laboratory, 1020-24 East 58th Street), approximately 7 miles south of the downtown business district in Chicago (Figure 12-1).

Figure 12-1. Location of the Chicago South, Illinois, Site

The University of Chicago was one of the focal points for supporting activities conducted by MED and AEC. Activities included handling radioactive material associated with the development of the atomic bomb during World War II. The primary focus of research conducted at the university under contract to MED was the production and purification of plutonium, which involved handling and processing uranium compounds.

In 1941, the National Defense Research Committee contracted the University of Chicago to construct a uranium and graphite pile (a small mass of uranium rods embedded in a larger mass of graphite to produce a controlled atomic fission reaction) to investigate the probability of producing plutonium to be used in developing an atomic bomb. Physicist Enrico Fermi oversaw construction of the first pile, and, the following year beneath the west stands of Stagg Field on the university campus, Fermi produced the world's first sustained nuclear fission reaction.

That same year, all work on the development was transferred to the Metallurgical Laboratory, where research continued until 1946, when AEC was created. Work under the AEC contract

continued through 1952. Research conducted included the development of a process for producing high-purity uranium compounds, testing of uranium metal, research associated with operation of the pile, and plutonium separation. Work occurred in the New Chemistry Laboratory and Annex, West Stands, Ryerson Physical Laboratory, Eckhart Hall, Kent Chemical Laboratory, G.H. Jones Chemical Laboratory, and Ricketts Laboratory. During the early 1950s, after transfer of nuclear activities to ANL's new site in DuPage County, the Chicago South site was decontaminated using suitable techniques for that time.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were natural uranium and daughters, ^{232}Th and daughters, fission products, and ^{239}Pu.

12.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined the Chicago South site's eligibility for FUSRAP in 1983.

Cleanup Criteria

The Chicago South site was remediated to criteria in the *U.S. Department of Energy Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites* (DOE 1985). The remedial action guideline for ^{238}U in soil at the University of Chicago is the 150 pCi/g limit derived for the Illinois National Guard Armory. Remedial action guidelines for surface contamination at the University of Chicago are 100 alpha dpm/100 cm^2, average, and 300 alpha dpm/100 cm^2, maximum; 0.2 millirad per hour beta-gamma, average, and 1.0 millirad per hour beta-gamma, maximum; and 20 alpha dpm/100 cm^2 for removable contamination.

Remedial Action

In 1976 and 1977, AEC directed ANL to conduct surveys to determine whether any contamination remained above then-current guidelines. Although only minimal uranium contamination was found, some remediation was deemed necessary to meet these guidelines.

In 1977, as part of a facilities renovation program, the University of Chicago decontaminated Kent Chemical Laboratory at 23 locations in 14 rooms or areas, including the removal of contaminated sewers and some soil beneath the building. The New Chemistry Laboratory and Annex, West Stands, and Ricketts Laboratory were torn down. ANL performed removal and decontamination of walls, floors, ceilings, roofing tiles, and ductwork in the Ryerson Physical Laboratory, Eckhart Hall, and G.H. Jones Chemical Laboratory.

Work under FUSRAP in 1984 included decontamination of the G.H. Jones Chemical Laboratory at 46 locations in 17 rooms or areas, Ryerson Physical Laboratory at 40 locations in 26 rooms or areas, and Eckhart Hall at 13 locations in 9 rooms or areas.

Cleanup included removing and replacing ductwork and cabinets; removing concrete, bricks, tile, wood, insulation, and soil; scabbling concrete; and applying solvents to metals. Some piping and

a significant amount of floor and wall material (which was visibly contaminated from deposits of yellow uranium salts) were removed from the fourth-floor attic of the G.H. Jones Chemical Laboratory. A total of 600 cubic feet (ft^3) of radioactively contaminated solid waste from all four facilities and three 55-gallon drums of liquid waste were removed, packaged in bins, and shipped to approved waste sites for disposal.

Remediation of the Chicago South site was completed in 1987. The remaining contaminated material volume is currently unknown, but residual contamination is potentially located in sewer lines associated with the Ryerson Physical Laboratory, Eckhart Hall, Kent Chemical Laboratory, and G.H. Jones Chemical Laboratory. This contamination does not pose an immediate hazard and supplemental limits were not applied. Appropriate safeguards should be taken into consideration whenever the sewers are intruded upon or removed. Figure 12-2 shows the affected areas.

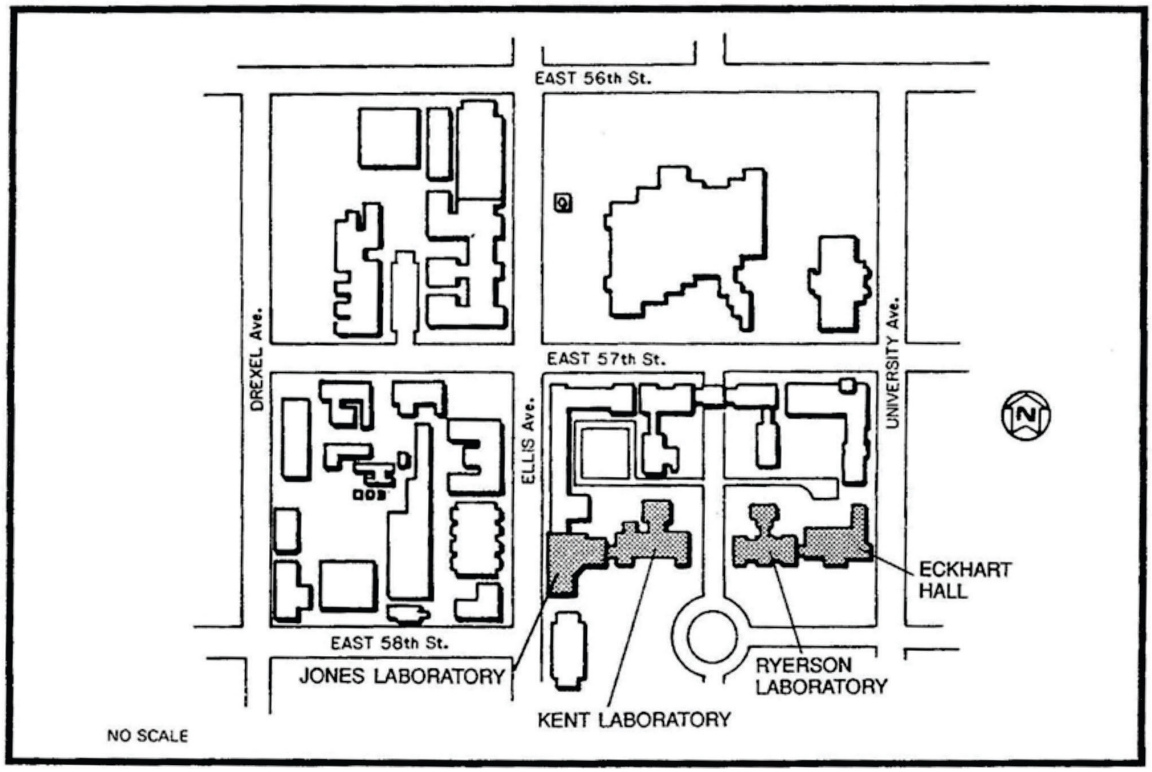


Figure 12-2. Affected Areas at the Chicago South, Illinois, Site (University of Chicago)

Release Survey

The data collected showed that the remedial action activities performed were successful and that the radiological conditions of the G.H. Jones Laboratory, Kent Laboratory, Ryerson Laboratory, and Eckhart Hall are in compliance with all applicable DOE radiological guidelines established for release for unrestricted use (DOE 1983).

Independent Verification

The results of the independent verification survey demonstrate that radiological conditions at the site are in compliance with DOE decontamination criteria and standards and that the future use of the property will result in no radiological exposure above applicable radiological guidelines established to protect members of the general public or site occupants.

Use Restrictions

The site has no use restrictions. It was remediated to unrestricted use.

Assessment of Risk

There was no site-specific risk assessment performed. No additional protective measures by DOE are warranted following the 2017 technical workshop review of site conditions and risk.

Certification and Regulator Concurrence

A draft certification docket was prepared in December 1989 (DOE 1989).

Agreements and Permits

There are no agreements or permits.

12.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Chicago South site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Chicago South site.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at
https://www.energy.gov/articles/chicago-south-illinois-site-fact-sheet.

Desktop Assessment

The desktop assessment is applicable to the Chicago South site. For sites that were released for unrestricted use and that contain supplemental limits areas, DOE will conduct annual data verification to ensure that land usage is consistent with the site certification land use in accordance with the remedy and determine if a site visit is necessary.

Although no supplemental limits were formally applied to the inaccessible contamination, the desktop assessment allows for monitoring of site conditions to ensure that the sewers are not removed. The latest desktop assessment was conducted in February 2023.

Monitoring

No monitoring is required at the Chicago South site.

Field Operations

There are no field operations required at the Chicago South site.

Regulatory Interfaces

No regulatory interfaces are required at the Chicago South site.

12.4 References

DOE (U.S. Department of Energy), 1983. *Formerly Utilized MED/AEC Sites Remedial Action Program, Post-Remedial-Action Radiological Survey of Kent Chemical Laboratory, The University of Chicago, Chicago, Illinois*, May.

DOE (U.S. Department of Energy), 1985. *U.S. Department of Energy Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites*, Rev. 1, July.

DOE (U.S. Department of Energy), 1989. *Draft Certification Docket for the Remedial Action Performed at the University of Chicago, Chicago, Illinois, from December 1982 to October 1987*, December.

13.0 Chupadera Mesa, New Mexico, Site

13.1 Site Conditions

The Chupadera Mesa, New Mexico, Site is in central New Mexico (Figure 13-1), 28 miles northeast of the Trinity test site. Trinity was the first atomic bomb test and was conducted on the Alamogordo Bombing and Gunnery Range, currently known as the White Sands Missile Range. The Trinity test exploded a 21-kiloton plutonium weapon above ground on July 16, 1945. The fallout cloud was carried to the northeast by prevailing winds (Figure 13-2). Chupadera Mesa was in the nuclear fallout zone of the test and received higher levels of fallout due to a precipitation event that occurred as the fallout cloud moved over the mesa (EPA 1978).

The Chupadera Mesa is a geologic feature that rises approximately 400 ft above the neighboring region and encompasses an area of approximately 50 square miles. Windblown fallout from the Trinity test drifted northeast over the bombing range, Chupadera Mesa, and other ranching areas. The site was studied and sampled to evaluate the presence of residual radioactive contamination from the Trinity test in 1945. Radiation measurements began the same day as the test, and, since then, surveys and studies have been performed in the area by the University of California (in 1948, 1950, and 1951), EPA (in 1973 and 1974), and LANL (from 1972 to 1979). DOE evaluated radiological conditions at the Chupadera Mesa site in 1985 under FUSRAP.

Figure 13-1. Location of the Chupadera Mesa, New Mexico, Site

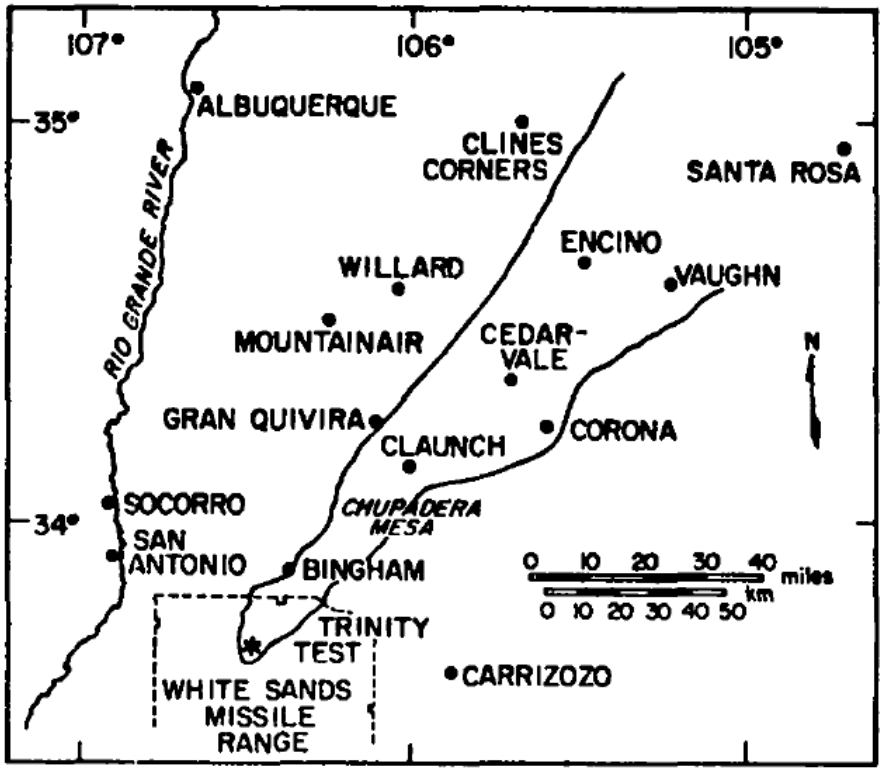


Figure 13-2. Illustration of the Fallout Zone, Circa 1945

Radioactive decay since the Trinity test has resulted in substantial reduction in levels of fallout-related radionuclides at the Chupadera Mesa site. Primarily, only the longer-lived radioactive materials remain, including ^{137}Cs, ^{90}Sr, ^{239}Pu, cobalt-60 (^{60}Co), and europium-155 (^{155}Eu) (LANL 1985).

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were ^{137}Cs, ^{90}Sr, ^{239}Pu, ^{60}Co, and traces of ^{155}Eu.

13.2 Remedial Action

FUSRAP Eligibility Determination

The Chupadera Mesa site was designated as eligible for FUSRAP in November 1985 (DOE 1985).

Cleanup Criteria

At the time of the 1978 EPA survey, the EPA screening level for ^{239}Pu/^{240}Pu was 200 nanocuries per m^2 in the top 5 cm of soil (EPA 1978). Assuming standard soil density and water content, the EPA action level for ^{239}Pu/^{240}Pu was converted to 15 pCi/g in the top 1 cm layer of soil (LANL 1985; Chanin and Murfin 1996).

Concentrations of the eligible contaminants were below screening levels; therefore, DOE determined that no remedial action would be required at the Chupadera Mesa site (DOE 1985).

Remedial Action

No remedial action was required.

Release Survey

There was no need for a release survey at the site because a remedial action was not conducted.

Independent Verification

No independent verification survey was conducted.

Use Restrictions

The site remains available for unrestricted use and unlimited exposure.

Assessment of Risk

Because site concentrations of contaminants were below the dose-based standards of DOE Order 5400.5 (archived), there was no site-specific risk assessment performed.

Certification of Regulator Concurrence

Regulator concurrence was not sought regarding the DOE decision that radiological conditions at the site do not warrant remedial action. The 1978 EPA study of the site came to similar conclusions. The report stated:

> The values reported from this study are for the top 5 cm of soil, and consequently are higher than the value for the top 1 cm. While higher plutonium levels could no doubt be found by additional sampling, the sampling density on the Chupadera Mesa makes it unlikely that grossly higher values are present in this area. (EPA 1978)

Agreements and Permits

There are no agreements or permits.

13.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Chupadera Mesa site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Chupadera Mesa site.

Site Fact Sheets

The LM site fact sheet and LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at https://www.energy.gov/articles/chupadera-mesa-new-mexico-site-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to the Chupadera Mesa site.

Monitoring

No monitoring is required at the Chupadera Mesa site.

Field Operations

There are no field operations required at the Chupadera Mesa site.

Regulatory Interfaces

No regulatory interfaces are required at the Chupadera Mesa site.

13.4 References

Chanin, D.I., and W.B. Murfin, 1996. *Site Restoration: Estimation of Attributable Costs from Plutonium-Dispersal Accidents*. Report No. SAND96-0957, Sandia National Laboratory, Albuquerque, New Mexico.

DOE (U.S. Department of Energy), 1985. *Chupadera Mesa and Near-By Areas Summary Review to Support the DOE Designation/Elimination Decision*, NM.4-2, November.

DOE Order 458.1 Chg 4 (LtdChg), *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, September 15, 2020.

EPA (Environmental Protection Agency), 1978. *Levels and Distribution of Environmental Plutonium Around the Trinity Site*, ORP/LV-78-3, NM.4-4, October.

LANL (Los Alamos National Laboratory), 1985. *Radiological Survey and Evaluation of the Fallout Area from the Trinity Test: Chupadera Mesa and White Sands Missile Range, New Mexico*, LA-10256-MS, NM.4-3.

14.0 Columbus East, Ohio, Site

14.1 Site Conditions

The Columbus East, Ohio, Site—formerly known as the B&T Metals Site—is at 435 West Town Street, Columbus, Ohio (Figure 14-1). From March through August 1943, B&T Metals extruded uranium fuel rods from natural uranium metal billets under contract with E.I. du Pont de Nemours and Company (DuPont). The rods were manufactured in support of MED operations and were destined for use as feedstock in the DOE Hanford Site, Washington, nuclear reactor. According to estimates, more than 50 tons of uranium were extruded during the process.

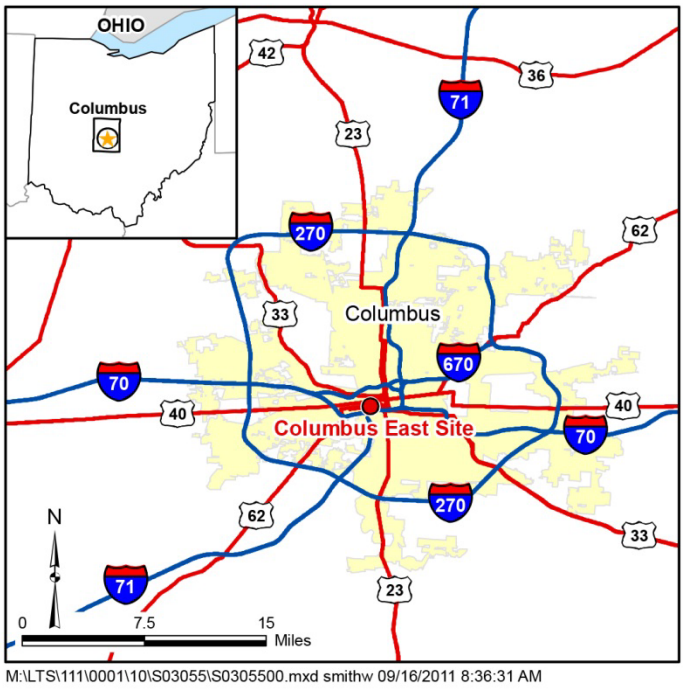


Figure 14-1. Location of the Columbus East, Ohio, Site

The extrusion work occurred in the northwest corner of the main building, the largest of the three site structures. Reportedly, shavings from the operations were dumped outside in what was a parking area west of the main office building. Machinery used for processing uranium was likely sold or removed from the site, since no records indicating final disposition of the equipment were found.

Records indicated that part of the extrusion and machining process involved blowing out the heating cylinders on the extrusion press. This process resulted in large quantities of uranium-bearing material being blown into the extrusion building. Measurements taken in March and April 1943 indicated significant amounts of airborne material found near the rolling table, extrusion trough, and furnace. Appropriate recommendations were made to B&T Metals that this practice be discontinued, and the extrusion process was modified to reduce airborne debris. Upon completion of the extrusion project, representatives of MED and DuPont visually inspected the site to verify that all sweepings, turnings, solid scrap, and other remnants of the operation had been shipped offsite.

ORNL in Oak Ridge, Tennessee, conducted screening surveys to evaluate the radiological conditions at the site in 1988 and 1989. Radiological assessments of soil and dust samples from B&T Metals in Columbus, Ohio, demonstrated background concentrations of ^{226}Ra and ^{232}Th. Concentrations of ^{238}U ranged from 3.5 to 1700 pCi/g in the eight soil and dust samples analyzed. Areas containing residual radioactive material included the following:

- Three floor locations in the main office
- The drain system beneath the floor of the main office building
- The support beams in the main office building, where the source of the residual radioactive material appears to be dust from the former uranium extrusion process
- One area outdoors (east of the storage building), where shavings from the former MED operations were reportedly dumped (ORNL 1990)

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were the isotopes of natural uranium (ORNL 1990).

14.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined the Columbus East site's eligibility for FUSRAP in 1992 (DOE 1992a; DOE 1992b).

Cleanup Criteria

The residual contamination guidelines for fixed and transferable radioactive contamination listed in DOE Order 5400.5 (archived) were utilized for cleanup of the site. The guidelines are summarized in Table 14-1.

Table 14-1. Archived DOE Order 5400.5 Surface Contamination Limits

Natural Uranium, ^{235}U, ^{238}U, and Associated Decay Products on Structural Surfaces	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2
Surface Contamination Limit for Beta/Gamma Emitters	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2

Note:
Where surface contamination by both alpha and beta/gamma-emitting nuclides exists, the limits established for alpha and beta/gamma-emitting nuclides should apply independently.

Site-specific criteria for total uranium concentrations in soil were developed by ANL based on the most probable future use of the site. The site-specific criterion for total uranium was 35 pCi/g averaged over an area less than or equal to 100 m^2 (ANL 1996; DOE 2001).

Remedial Action

Remedial action at the B&T Metals site in Columbus, Ohio, was conducted from March to June 1996. The impacted areas, shown in Figure 14-2, were isolated from the remainder of the building with high-density plastic sheeting. The impacted areas were then decontaminated by proceeding down from the overhead fixtures, down the walls, and along the floors, followed by removal of contaminated soil beneath the floor slabs. Rain gutters on the roof were remediated, as well as several manholes. Soil contamination in a 4 yd^2 area along the southern side of the substation west of the main building was excavated (DOE 2001).

Most of the main building was subsequently demolished. The northwest corner of the building where the remediation took place was still standing but was observed to be derelict during the 2010 site visit.

Release Survey

Release surveys were conducted by the remedial contractor BNI immediately following site cleanup in 1996 (BNI 1996).

Independent Verification

An independent verification survey conducted after the completion of remedial action detected no residual radioactivity at the site that exceeded current guidelines (ORNL 1997). DOE released the site for unrestricted use (DOE 2001).

Use Restrictions

The site was released for unrestricted use and unlimited exposure.

Assessment of Risk

Because the site was remediated to the conservative dose-based standards of DOE Order 5400.5 (archived), there was no site-specific risk assessment performed.

Certification of Regulator Concurrence

A certification docket was prepared in June 2001, and a notice of cleanup certification for the site was published on June 26, 2001 (66 FR 33954).

Agreements and Permits

The property owner entered into an agreement with DOE in late 1995 and early 1996 to allow for the characterization and remediation of the site (DOE 2001).

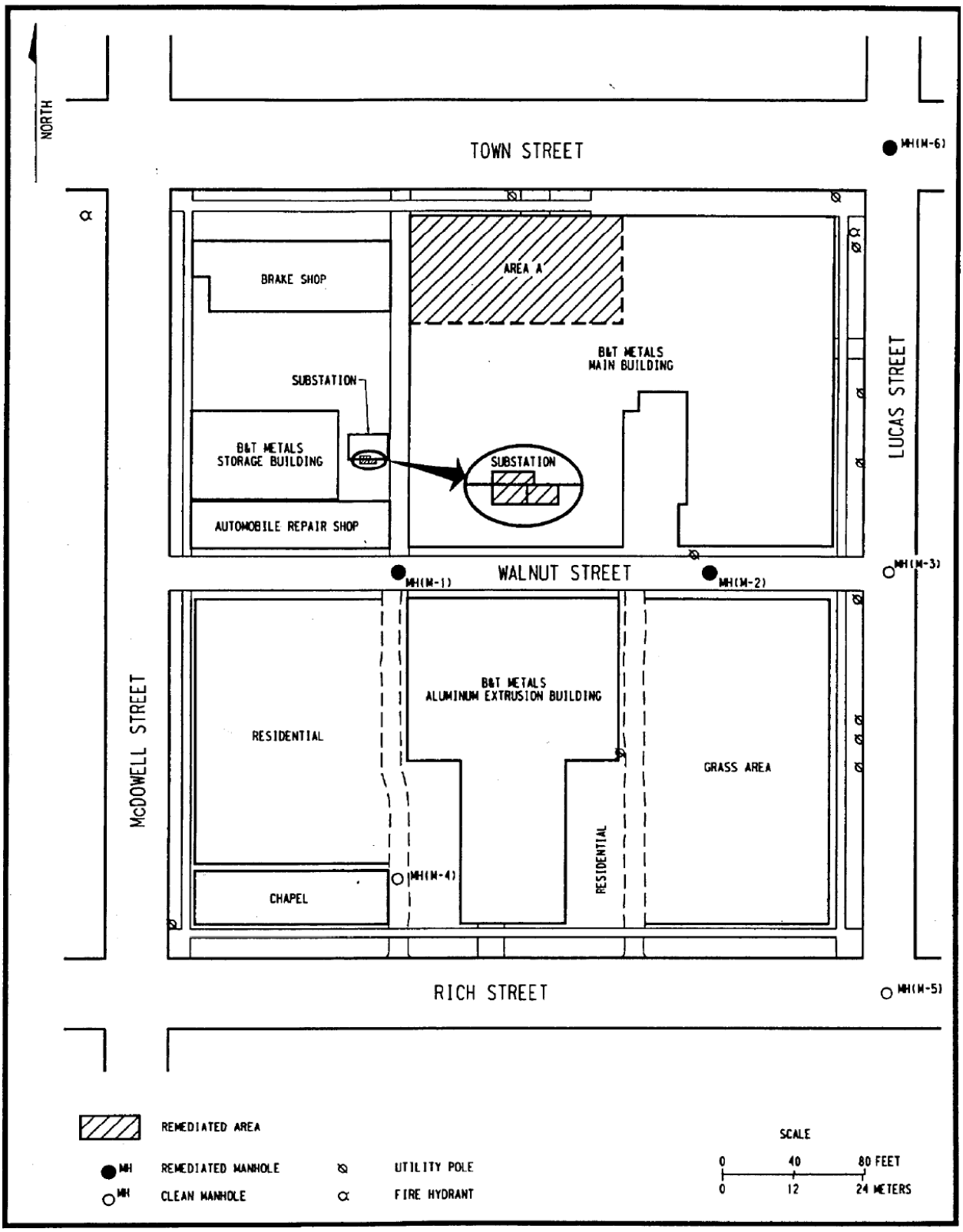


Figure 14-2. Remediated Areas of the Columbus East Site

BNI determined that the work was not subject to Ohio radiation protection regulations. The scoping notice indicated that local construction permits would be obtained in support of the cleanup actions (DOE 1996). BNI also consulted with regulators and historic preservation officials and determined that no protected resources would be adversely affected by cleanup actions (DOE 2001).

14.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Columbus East site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Columbus East site.

Site Fact Sheets

The LM site fact sheet and LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at
https://www.energy.gov/articles/columbus-east-ohio-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to the Columbus East site.

Monitoring

No monitoring is required at the Columbus East site.

Field Operations

There are no field operations required at the Columbus East site.

Regulatory Interfaces

No regulatory interfaces are required at the Columbus East site.

14.4 References

66 FR 33954. U.S. Department of Energy, "Certification of the Radiological Condition of the B&T Metals Site in Columbus, Ohio," *Federal Register*, June 26, 1996.

ANL (Argonne National Laboratory), 1996. *Derivation of Guidelines for Uranium Residual Radioactive Material in Soil at the B&T Metals Company Site, Columbus, Ohio*, ANL/EAD/TM-51, January.

BNI (Bechtel National Inc.), 1996. *Post-Remedial Action Report for the B&T Metals Site, Columbus, Ohio*, DOE/OR/21949-406, October.

DOE (U.S. Department of Energy), 1992a. *Authority Determination—B&T Metals in Columbus, Ohio*, memorandum by Designation and Certification Manager W. Alexander Williams, Off-Site Branch, Division of Eastern Area Programs, Office of Environmental Restoration, February 21.

DOE (U.S. Department of Energy), 1992b. *Authorization for Remedial Action at B&T Metals in Columbus, Ohio*, memorandum by Director James W. Wagoner II, Division of Eastern Area Programs, Office of Environmental Restoration, September 25.

DOE (U.S. Department of Energy), 1996. *Post-Remedial Action Report for the B&T Metals Site, Columbus, Ohio*, October.

DOE (U.S. Department of Energy), 2001. *Certification Docket for the Remedial Action Performed at the B&T Metals Site in Columbus, Ohio*, June.

DOE Order 458.1 Chg 4 (LtdChg), *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, September 15, 2020.

ORNL (Oak Ridge National Laboratory), 1990. *Results of the Preliminary Radiological Survey at B&T Metals, 425 West Town Street, Columbus, Ohio (C0001)*, October.

ORNL (Oak Ridge National Laboratory), 1997. *Results of the Independent Radiological Survey at B&T Metals, 425 West Town Street, Columbus, Ohio (C0001)*, June.

15.0 Fairfield, Ohio, Site

15.1 Site Conditions

The Fairfield, Ohio, Site is at 3660 Dixie Highway, approximately 15 miles northwest of Cincinnati, Ohio (Figure 15-1).

Figure 15-1. Location of the Fairfield, Ohio, Site

In 1956, AEC and NLO contracted with Associate Aircraft Tool and Manufacturing Company (Associate Aircraft), a Cincinnati-area machine shop, to machine hollow slugs from natural uranium (i.e., neither depleted nor enriched) from February to September for the Hanford and Savannah River reactors. The primary activities included machining, hollow drilling, reaming, and turning slugs to a final outside diameter. Records show that approximately 95,000 slugs were machined during the 8-month contract period; during the last 3 months of the contract, Associate Aircraft machined approximately 10,000 to 15,000 slugs per month (ORNL 1993).

From October through November 12, 1956, the site was decontaminated to levels considered acceptable under the regulations in effect at that time. The decontamination was performed by Associate Aircraft with NLO supervision and health physics support. The final contract amendment required Associate Aircraft "to decontaminate its plant and equipment as required by the contractor's representative . . ." and to return all machining equipment to NLO (ORNL 1993).

ORNL conducted a radiological survey under FUSRAP in 1992. The survey comprised (1) a surface gamma radiation scan over a defined outdoor area, (2) collection and radionuclide

analysis of systematic and biased soil samples, (3) measurement of direct radiation levels on accessible floor surfaces inside the building, (4) collection and analysis of debris and dust samples from indoor drains and overhead beams, and (5) collection of smear samples from selected indoor locations to determine removable alpha and beta-gamma emitter surface activity levels (ORNL 1993).

The results of the radiological survey identified soil concentrations and surface contamination in excess of previously applied DOE limits in numerous locations inside the building and in isolated spots outdoors. Concentrations of ^{238}U in outdoor soil and in indoor samples of debris, concrete, and dust from within drains and from overhead surfaces exceeded guidelines. Directly measured radiation levels in many areas of the building also exceeded guidelines.

In the areas surveyed outdoors, contamination was found in two small areas near the building. These were in the parking lot north of the building and near the southwest corner of the building. The collection of ^{238}U contaminated samples of soil from near the southwest corner of the building effectively remediated those spots (ORNL 1993).

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were the isotopes of natural uranium (ORNL 1993).

15.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined the Fairfield site to be eligible for FUSRAP in 1993 (DOE 1993a; DOE 1993b).

Cleanup Criteria

The residual contamination guidelines for fixed and transferable radioactive contamination listed in DOE Order 5400.5 (archived) were utilized for cleanup of the site. The guidelines are summarized in Table 15-1.

Table 15-1. Archived DOE Order 5400.5 Surface Contamination Limits

Natural Uranium, ^{235}U, ^{238}U, and Associated Decay Products on Structural Surfaces	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2
Surface Contamination Limit for Beta/Gamma Emitters	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2

Note:
Where surface contamination by both alpha and beta/gamma-emitting nuclides exists, the limits established for alpha and beta/gamma-emitting nuclides should apply independently.

Site-specific criteria for total uranium concentrations in soil were designated by DOE at this site using the ALARA principle. The site-specific criterion for total uranium concentration in solids was 35 pCi/g averaged over an area less than or equal to 100 m^2 (DOE 1996). This criterion was well below the derived concentrations of 280 pCi/g total uranium (for residential use) and 970 pCi/g total uranium (for industrial use) that could result in an exposure rate of 30 mrem/yr as derived by ANL (ANL 1995).

Remedial Action

All residual radioactive materials exceeding the site-specific guidelines were removed from the Associate Aircraft site and disposed of as low-activity radiological waste at Envirocare of Utah, except for a 200 yd^2 (167 m^2) area beneath the building slab in the area shown in Figure 15-2 and Figure 15-3. The depth of burial (4 ft [1.2 meter] subslab) and low concentration of uranium, predicted future use, and costs of remediation (i.e., relocation of equipment, lost productivity for Force Control Inc., volume for shipping, labor) were evaluated by performing a hazard assessment. Sample results indicated that the maximum total uranium contamination in soil is 134 pCi/g. This level exceeds the ALARA-based site-specific soil criterion of 35 pCi/g total uranium but not the concentration guidelines derived by ANL for this site (280 [residential] and 970 [industrial] pCi/g) (ANL 1995) that would limit the public dose to less than 100 mrem/yr. Therefore, a hazard assessment was conducted and approved by DOE (BNI 1995; DOE 1996); the assessment describes the effects of this localized area of residual radioactive material under reasonable future use scenarios. The findings of the hazard assessment were that a total uranium concentration of 134 pCi/g is equal to a potential dose of 4.15 mrem/yr to a future industrial worker and 17.42 mrem/yr to a future subsistence farmer. The results of the hazard assessment and the cost of any additional action justified the conclusion that no further characterization or remediation is necessary in this area.

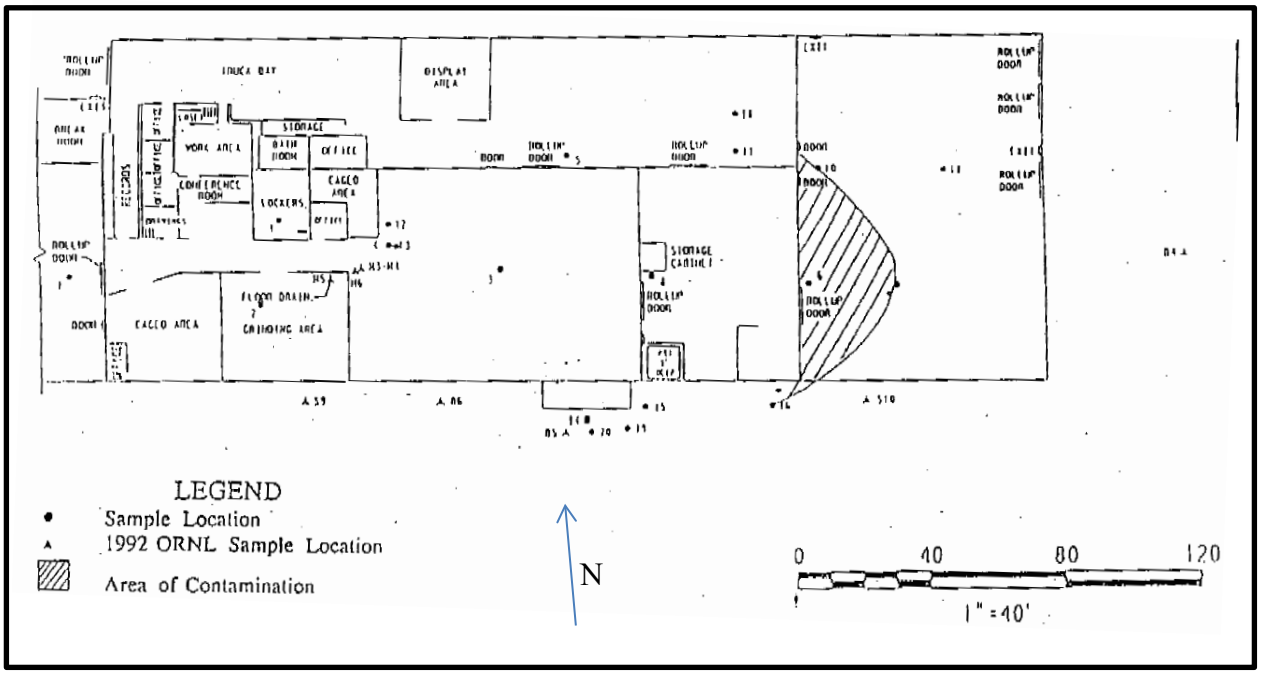


Figure 15-2. Location of Impacted Soil from the Fairfield Site, Diagram

Figure 15-3. Location of Impacted Soil from the Fairfield Site, Aerial Photo

Release Survey

Release surveys were conducted by the remedial contractor BNI immediately following site cleanup in 1996 (BNI 1996).

Independent Verification

An independent verification survey conducted by ORNL after the completion of remedial action detected no residual radioactivity at the site that exceeded guidelines (ORNL 1996). DOE released the site for unrestricted use (DOE 1996).

Use Restrictions

The site was released for unrestricted use and unlimited exposure (DOE 1996).

Assessment of Risk

Because the site was remediated to the conservative dose-based standards of DOE Order 5400.5 (archived), there was no site-specific assessment of residual risk performed. No additional protective measures by DOE are warranted following the 2017 technical workshop review of site conditions and risk.

Certification of Regulator Concurrence

A certification docket was prepared in October 1996 (DOE 1996). A notice of cleanup certification for the site was published in on September 16, 1996 (61 FR 48667–48668).

Agreements and Permits

The property owner entered an agreement with DOE in late 1995 and early 1996 to allow for the characterization and remediation of the site (DOE 1996).

BNI obtained a hazardous waste generator ID number for disposal of lead-bearing wastes from the Ohio Environmental Protection Agency (DOE 1996). BNI also consulted with regulators and historic preservation officials and determined that no protected resources would be adversely affected by cleanup actions (DOE 1996).

15.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Fairfield site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Fairfield site.

Site Fact Sheets

The LM site fact sheet and LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at https://www.energy.gov/lm/articles/fairfield-ohio-site-fact-sheet.

Desktop Assessment

Although the annual desktop assessment is not applicable to the Fairfield site, an assessment will be conducted at 5-year intervals to review site conditions. The first 5-year desktop assessment was conducted in 2023.

Monitoring

No monitoring is required at the Fairfield site.

Field Operations

There are no field operations required at the Fairfield site.

Regulatory Interfaces

No regulatory interfaces are required at the Fairfield site.

15.4 References

61 FR 48667–48668. U.S. Department of Energy, "Certification of the Radiological Condition of the Associate Aircraft Site in Fairfield, Ohio," *Federal Register*, September 16, 1996.

ANL (Argonne National Laboratory), 1995. *Derivation of Guidelines for Uranium Residual Radioactive Material in Soil at the Former Associate Aircraft Tool and Manufacturing Company Site, Fairfield, Ohio*, January.

BNI (Bechtel National Inc.), 1995. *Associate Aircraft Site Hazard Assessment for Identified Soil Contamination*, May.

BNI (Bechtel National Inc.), 1996. *Post-Remedial Action Report for the Associate Aircraft Site, Fairfield, Ohio*, July.

DOE (U.S. Department of Energy), 1993a. *Authorization for Remedial Action at the Former Associated Aircraft Site, Fairfield, Ohio*, memorandum by Director James W. Wagoner II, Division of Off-Site Programs, Office of Eastern Area Programs, Office of Environmental Restoration, April 29.

DOE (U.S. Department of Energy), 1993b. *Authorization for Remedial Action at the Former Associate Aircraft Site in Fairfield, Ohio*, memorandum by Director James W. Wagoner II, Division of Off-Site Programs, Office of Eastern Area Programs, Office of Environmental Restoration, April 15.

DOE (U.S. Department of Energy), 1996. *Certification Docket for the Remedial Action Performed at the Associate Aircraft Site, Fairfield, Ohio, 1994–1995*, January.

DOE Order 458.1 Chg 4 (LtdChg), *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, September 15, 2020.

ORNL (Oak Ridge National Laboratory), 1993. *Results of the Radiological Survey at the Former Associate Aircraft Tool and Manufacturing Company Site, Fairfield, Ohio*, March.

ORNL (Oak Ridge National Laboratory), 1996. *Results of the Independent Radiological Verification Survey at the Former Associate Aircraft Tool and Manufacturing Company Site, Fairfield, Ohio (FOH001)*, January.

16.0 Granite City, Illinois, Site

16.1 Site Conditions

The Granite City, Illinois, Site is at 1417 State Street in Granite City, Illinois (Figure 16-1). During the late 1950s and early 1960s, the General Steel Casting Corporation performed nondestructive testing uranium ingots for AEC under purchase orders issued by Mallinckrodt Chemical Company. Two facilities were used for this purpose: the Old Betatron Building and the New Betatron Building. General Steel Casting Corporation X-rayed natural uranium ingots and "dingots" to detect metallurgical flaws. Contamination occurred in the Old Betatron Building by abrasion of oxidized uranium surfaces during handling.

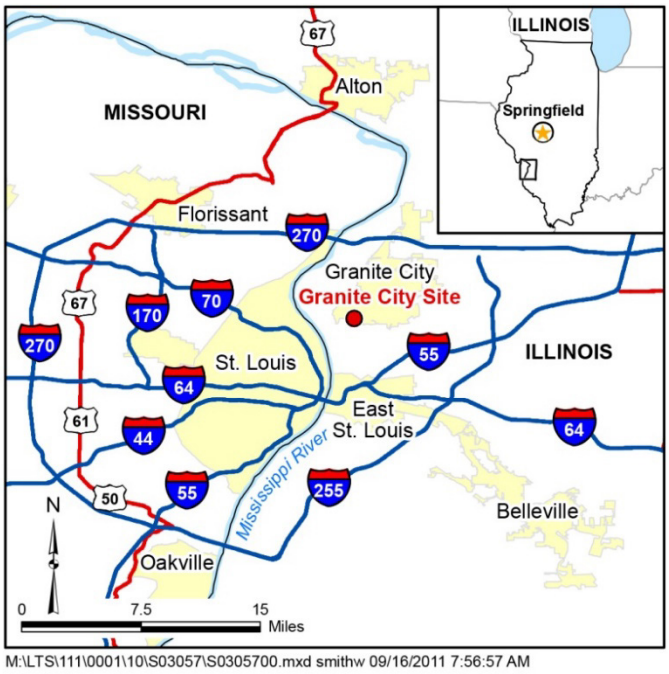


Figure 16-1. Location of the Granite City, Illinois, Site

The work was performed from 1958 to 1966, after which the facility was decontaminated to then-current standards. ORNL conducted a radiological survey of the Old Betatron Building and nearby exterior areas in March 1989. The survey comprised (1) gamma radiation scanning of the ground surface outdoors near the building, (2) gamma radiation scanning at floor and wall surfaces throughout the building and on the roof, (3) collection and radionuclide analysis of outdoor soil samples and indoor dust and debris, and (4) the determination of direct and transferable beta-gamma and alpha emitter activity levels on indoor surfaces and on the roof.

Survey results showed that a small amount of residual radioactivity remained in discrete locations in the Old Betatron Building, as indicated in Figure 16-2. Uranium-238 was found in elevated concentrations in debris from an industrial vacuum cleaner, on the ventilation duct above the vacuum cleaner, and in dust and debris in scattered locations throughout the interior of the building. The roof of the building and the soil surrounding the outside of the building were found to be unimpacted by FUSRAP contaminants (ORNL 1990).

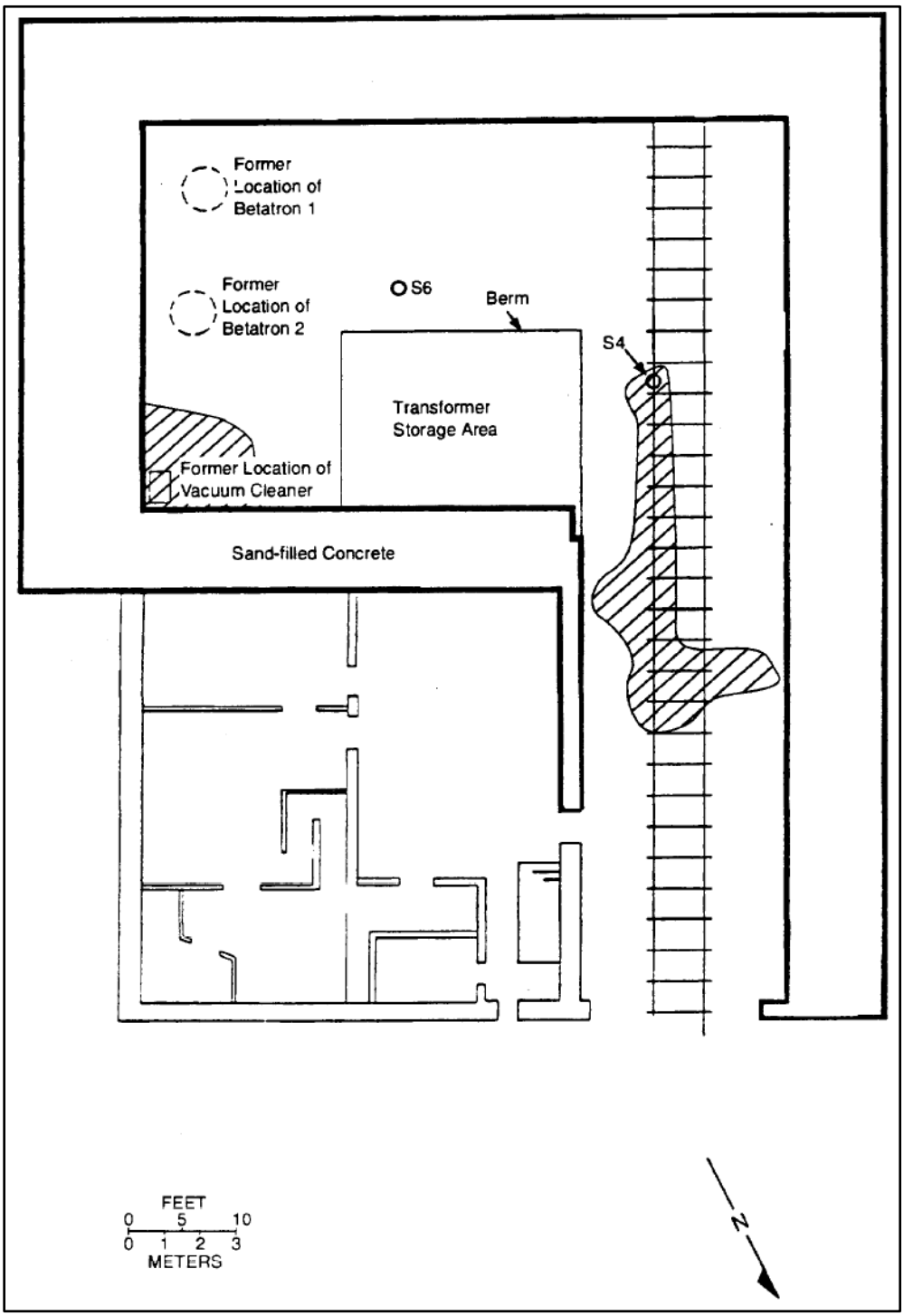


Figure 16-2. Impacted Areas of the Old Betatron Building

ORNL conducted a survey of the New Betatron Building in August 1991. The scope of work for this survey was the same as that performed for the Old Betatron Building. The New Betatron Building and the surrounding area were found to be unimpacted by FUSRAP contamination (ORNL 1992).

Based on a review of satellite photographs, both Betatron buildings were demolished sometime between April 2008 and August 2009.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were the isotopes of natural uranium (ORNL 1990).

16.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined the Granite City site to be eligible for FUSRAP in September 1992 (DOE 1992).

Cleanup Criteria

The residual contamination guidelines for fixed and transferable radioactive contamination listed in DOE Order 5400.5 (archived) were utilized for cleanup of the site. The guidelines are summarized in Table 16-1.

Table 16-1. Archived DOE Order 5400.5 Surface Contamination Limits

Natural Uranium, ^{235}U, ^{238}U, and Associated Decay Products on Structural Surfaces	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2
Surface Contamination Limit for Beta/Gamma Emitters	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2

Note:
Where surface contamination by both alpha and beta/gamma-emitting nuclides exists, the limits established for alpha and beta/gamma-emitting nuclides should apply independently.

Remedial Action

Decontamination included packaging the contaminated vacuum cleaner and its contents in a 55-gallon galvanized steel drum and then vacuuming the floor where the vacuum cleaner had been stored using a HEPA-filtered exhaust vacuum cleaner.

The area of contamination on the floor was approximately 107 ft^2 (10 m^2). Where fixed contamination remained after vacuuming, an Alconox/water mixture and stiff-bristled brush were used to further decontaminate the floor. Washing and light abrasive techniques were found to be generally effective; however, two locations (approximately 1 ft^2 [0.1 m^2] each) required scabbling, a more aggressive, destructive technique, to remove the contaminated portion of the surface. The areas were scabbled to depths not greater than 0.25 inch (0.6 cm) (DOE 1994).

Release Survey

Release surveys were conducted by the remedial contractor BNI immediately following site cleanup (DOE 1994).

Independent Verification

An independent verification survey conducted after the completion of remedial action detected no residual radioactivity at the site that exceeded guidelines (ORNL 1994).

Use Restrictions

The site was released for unrestricted use and unlimited exposure (Adler 1993).

Assessment of Risk

Because the site was remediated to the conservative dose-based standards of DOE Order 5400.5 (archived), there was no site-specific risk assessment performed.

Certification of Regulator Concurrence

A certification docket was prepared in June 1993 (DOE 1994). A notice of cleanup certification for the site was published on June 14, 1994 (59 FR 30573).

Agreements and Permits

The property owner entered an agreement with DOE in 1988 to allow for the characterization and remediation of the site.

BNI authored a scoping notice in 1994 to identify federal or state regulations that would be applicable to the remedial action. DOE determined that no correspondence with the state, county, or local governments was required for the remedial action (Adler 1993; DOE 1994).

16.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Granite City site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Granite City site.

Site Fact Sheet

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at https://www.energy.gov/lm/articles/granite-city-illinois-site-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to the Granite City site.

Monitoring

No monitoring is required at the Granite City site.

Field Operations

There are no field operations required at the Granite City site.

Regulatory Interfaces

No regulatory interfaces are required at the Granite City site.

16.4 References

59 FR 30573. U.S. Department of Energy, "Certification of the Radiological Condition of the Granite City Site, Granite City, Illinois," *Federal Register*, June 14, 1994.

Adler, 1993. Dave Adler, Granite City site manager, Oak Ridge Operations, U.S. Department of Energy, letter (about Betatron Building – Completion of Decontamination – Transmittal of Preliminary Verification) to Thomas Mahl, environmental specialist, National Steel Corporation, September 22.

DOE (U.S. Department of Energy), 1987. *U.S. Department of Energy Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites*, Rev. 2, March.

DOE (U.S. Department of Energy), 1992. *Designation for Remedial Action at the Granite City Steel Site in Madison, Illinois*; memorandum by Director James W. Wagoner II, Division of Off-Site Programs, Office of Eastern Area Programs, Office of Environmental Restoration, September 25.

DOE (U.S. Department of Energy), 1994. *Certification Docket for the Remedial Action Performed at the Granite City Site in Granite City, Illinois*, *June. 1993*, September 1994.

DOE Order 458.1 Chg 4 (LtdChg), *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, September 15, 2020.

ORNL (Oak Ridge National Laboratory), 1990. *Results of the Radiological Survey at the Granite City Steel Facility, Granite City, Illinois*, July.

ORNL (Oak Ridge National Laboratory), 1992. *Results of the Radiological Survey at the New Betatron Building, Granite City Steel Facility, Granite City, Illinois*, January.

ORNL (Oak Ridge National Laboratory), 1994. *Results of the Independent Verification Survey at the Old Betatron Building, Granite City, Illinois*, July.

17.0 Hamilton, Ohio, Site

17.1 Site Conditions

The Hamilton, Ohio, Site (formerly referred to as the Herring-Hall-Marvin Safe [HHMS] Company) is at 1550 Grand Boulevard in Hamilton, Ohio (Figure 17-1). The 3-story HHMS building was roughly rectangular and had an approximate area of 300,000 ft^2.

From the 1940s to the early 1950s, the HHMS Company machined and shaped natural uranium metal under subcontract for the USACE MED (Nickson 1943). Uranium was machined on lathes in a large machine room on the first floor and also on the third floor in the southeastern corner of the building (AEC 1951).

Figure 17-1. Location of the Hamilton, Ohio, Site

Radiological surveys were conducted in 1989 of the first floor of the building and revealed no radionuclide concentrations in excess of the applicable DOE criteria. The limits of the surveys were determined by information supplied by the site owner that described the area used for uranium machining operations performed in 1943 (ORNL 1990). Consequently, the site was eliminated from consideration under FUSRAP.

Later interviews revealed that uranium machining operations for AEC occurred on the third floor of the building in 1951 (Figure 17-2). The radiological surveys that were performed in 1988 and 1989 did not include that area of the building because it had not been previously identified as an area where uranium operations had taken place. A subsequent radiological survey identified uranium contamination in excess of standards in portions of the floor and walls on the third floor of the building (ORNL 1994).

Figure 17-2. Former HHMS Company Building (circa 2006) Showing the Third Floor, Where FUSRAP Remediation Occurred

Remedial activities were conducted on the contaminated areas of the third floor in 1994 and 1995 (DOE 1996). After remediation, alpha and beta radiation surface activities were less than the release criteria for surface contamination. Gamma radiation exposure rates were at background levels. No exterior contamination was found (ORNL 1995).

DOE personnel visited the site most recently in July 2010 to assess property use. The area still had light industrial use, but recent commercial development had occurred on the adjacent property, and residential use was nearby. The entire building where the uranium operations took place was demolished in 2013 (Figure 17-3). A service station has been constructed in the southwest quarter of the property.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were the isotopes of natural uranium (ORNL 1994).

Figure 17-3. Redevelopment on the Otherwise Vacant Original Site

17.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined the Hamilton site to be eligible for FUSRAP in March 1994 (DOE 1994).

Cleanup Criteria

The residual contamination guidelines for fixed and transferable radioactive contamination listed in DOE Order 5400.5 (archived) were utilized for cleanup of the site. The guidelines are summarized in Table 17-1.

Table 17-1. Archived DOE Order 5400.5 Surface Contamination Limits

Natural Uranium, ^{235}U, ^{238}U, and Associated Decay Products on Structural Surfaces	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2
Surface Contamination Limit for Beta/Gamma Emitters	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2

Note:
Where surface contamination by both alpha and beta/gamma-emitting nuclides exists, the limits established for alpha and beta/gamma-emitting nuclides should apply independently.

The basic limit for the annual radiation dose (excluding radon) received by an individual member of the general public is 100 mrem/yr. The maximum exposure rate for a habitable building or structure is limited to 20 microroentgens per hour (μR/h) above background.

Remedial Action

Decontamination techniques used on the site included using HEPA-filtered vacuums and mechanical shot blasting, coring, and washing. Wastes generated from the decontamination efforts were containerized and shipped to a licensed disposal facility in Clive, Utah, for permanent disposal (DOE 1996).

Release Survey

Release surveys were conducted by the remedial contractor BNI immediately following site cleanup in 1996 (DOE 1996).

Independent Verification

An independent verification survey conducted after the completion of remedial action detected no residual radioactivity at the site that exceeded guidelines (ORNL 1995). DOE released the site for unrestricted use (DOE 1995).

Use Restrictions

The site was released for unrestricted use and unlimited exposure.

Assessment of Risk

Because the site was remediated to the conservative dose-based standards of DOE Order 5400.5 (archived), there was no site-specific risk assessment performed.

Certification of Regulator Concurrence

A notice of cleanup certification for the site was published on December 3, 1996 (61 FR 64072–64073).

Agreements and Permits

The property owner entered into an agreement with DOE in 1988 to allow for the characterization and remediation of the site (Wallo 1988).

BNI authored a scoping notice in 1994 to identify applicable federal or state regulations that would be applicable to the remedial action. BNI determined that the work was not subject to Ohio radiation protection regulations. The scoping notice indicated that local construction permits would be obtained (DOE 1996).

17.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Hamilton site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Hamilton site.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at
https://www.energy.gov/lm/articles/hamilton-ohio-site-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to the Hamilton site.

Field Operations

There are no field operations required at the Hamilton site.

Regulatory Interfaces

No regulatory interfaces are required at the Hamilton site.

17.4 References

61 FR 64072–64073. U.S. Department of Energy, "Certification of the Radiological Condition of the Herring-Hall-Marvin Safe Company in Hamilton, Ohio," *Federal Register*, December 3, 1996.

AEC (U.S. Atomic Energy Commission), 1951. Herring-Hall-Marvin Safe Company, Hamilton, Ohio, memorandum, unsigned, June 20.

DOE (U.S. Department of Energy), 1994. *Authority Determination—Former Herring-Hall-Marvin Safe Co., Hamilton, Ohio*, memorandum by Designation and Certification Manager James W. Wagoner II, Office of Eastern Area Programs, Office of Environmental Restoration, March 8.

DOE (U.S. Department of Energy), 1995. *Results of Radiological Verification Survey at the Former Herring-Hall-Marvin Safe Company, 1550 Grand Boulevard, Hamilton, Ohio*, November.

DOE (U.S. Department of Energy), 1996. *Certification Docket for the Remedial Action Performed at the Former Herring-Hall-Marvin Safe Company Site in Hamilton, Ohio*, December.

DOE Order 458.1 Chg 4 (LtdChg), *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, September 15, 2020.

Nickson, 1943. J.J. Nickson, MD, Metallurgical Laboratory, letter (about Metallurgical Processes) to J.B. Miles, H.H.M Safe Company, April 19.

ORNL (Oak Ridge National Laboratory), 1990. *Results of the Radiological Survey at Diebold Safe Company, 1550 Grand Boulevard, Hamilton, Ohio*, February.

ORNL (Oak Ridge National Laboratory), 1994. *Results of the Radiological Survey at the Former Herring-Hall-Marvin Safe Company (3rd Floor), 1550 Grand Boulevard, Hamilton, Ohio*, March.

ORNL (Oak Ridge National Laboratory), 1995. *Results of the Radiological Verification Survey at the Former Herring-Hall-Marvin Safe Company, 1550 Grand Boulevard, Hamilton, Ohio*, November.

Wallo, 1988. Andrew Wallo III, Designation and Certification manager, Division of Facility and Site Decommissioning Projects, Office of Nuclear Energy, letter (about Property Access Consent Form) to Roy J. Villella, assistant secretary, Diebold Inc., June 11.

18.0 Indian Orchard, Massachusetts, Site

18.1 Site Conditions

The Indian Orchard, Massachusetts, Site is on Pinevale Street in Indian Orchard, Massachusetts (Figure 18-1).

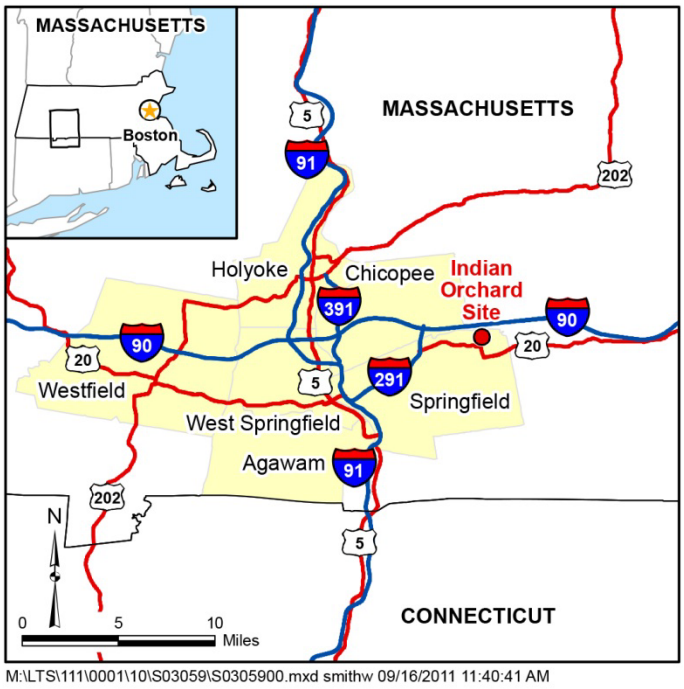


Figure 18-1. Location of the Indian Orchard, Massachusetts, Site

Chapman Valve Manufacturing Company used the western one-third of Building 23 (shown in Figure 18-2) to machine uranium rods under a contract with the AEC's Brookhaven National Laboratory from January through November 1948. When uranium operations terminated on November 8, 1948, Chapman Valve Manufacturing Company had generated more than 27,000 pounds of contaminated metal scrap, metal oxides, and sweepings. This material was removed from the site several months after the contract work ended. The Crane Company took over ownership of the site in 1981. The company disconnected all utilities and vacated Building 23 in 1987.

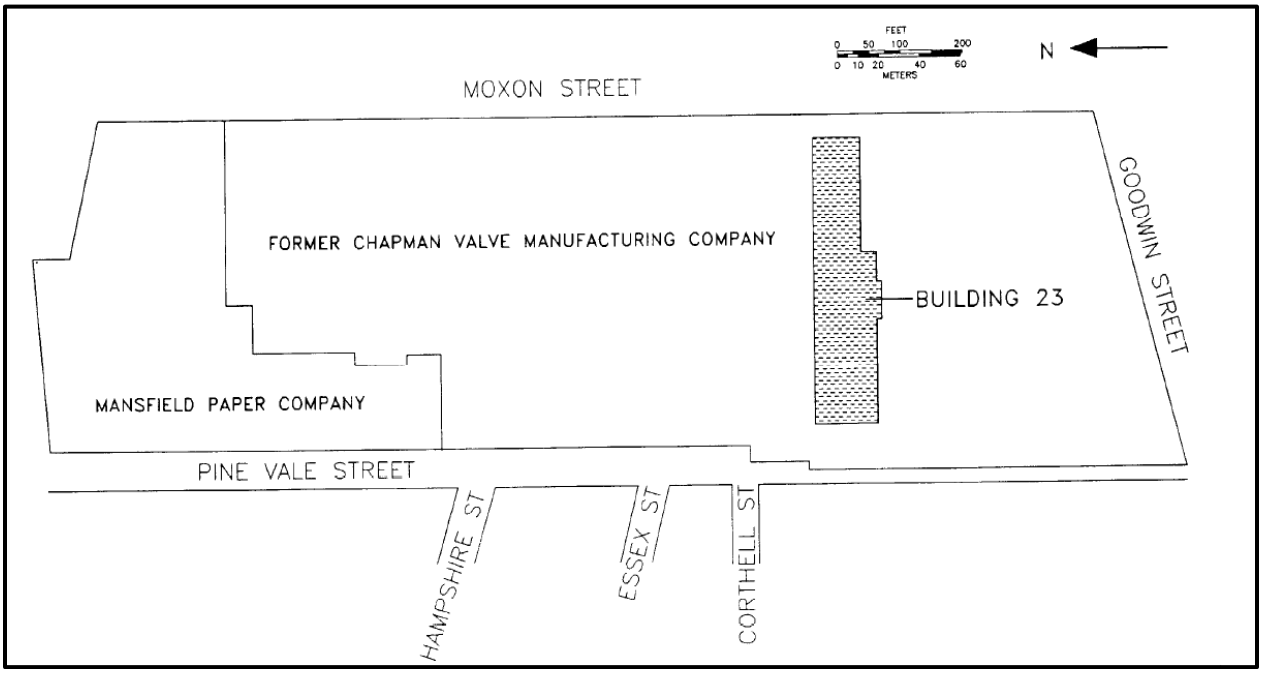


Figure 18-2. Indian Orchard Site Layout, Showing Location of Building 23

A radiological survey of the then-vacant Building 23 was conducted by ORNL in 1991 (ORNL 1992). The scope of the survey consisted of (1) a surface gamma radiation scan of the floor and walls in all accessible areas inside the building and a gamma radiation scan of the ground surface in selected areas outdoors, (2) measurement of surface and l-meter gamma radiation exposure rates, (3) a beta-gamma radiation scan of dose rates in accessible areas of the floors and walls inside the building, (4) measurement of alpha activity levels at selected locations, (5) collection and radionuclide analysis of 26 dust and debris samples from overhead beams, (6) measurement of direct and removable alpha and beta-gamma emitter levels, and (7) collection and radionuclide analysis of two soil samples outside the building. It was judged unsafe to conduct a survey of the deteriorating roof. Additional radiological surveys were performed in November and December 1994 to supplement and refine existing survey information. Characterization confirmed the results of the earlier survey (BNI 1995b).

Radionuclide analysis of soil, dust, debris, and smear samples collected at Building 23 indicated that residual ^{238}U attributable to former AEC-supported operations was present. Elevated levels of radioactivity were particularly evident on the floors and walls in the western part of the central area of the building (Figure 18-3). Concentrations of ^{238}U in dust samples collected from most of the overhead beams exceeded DOE guidelines. Dust on a movable overhead crane was well above the guidelines, probably because the crane had at some time been located farther west. There were no elevated ^{238}U concentrations in soil samples.

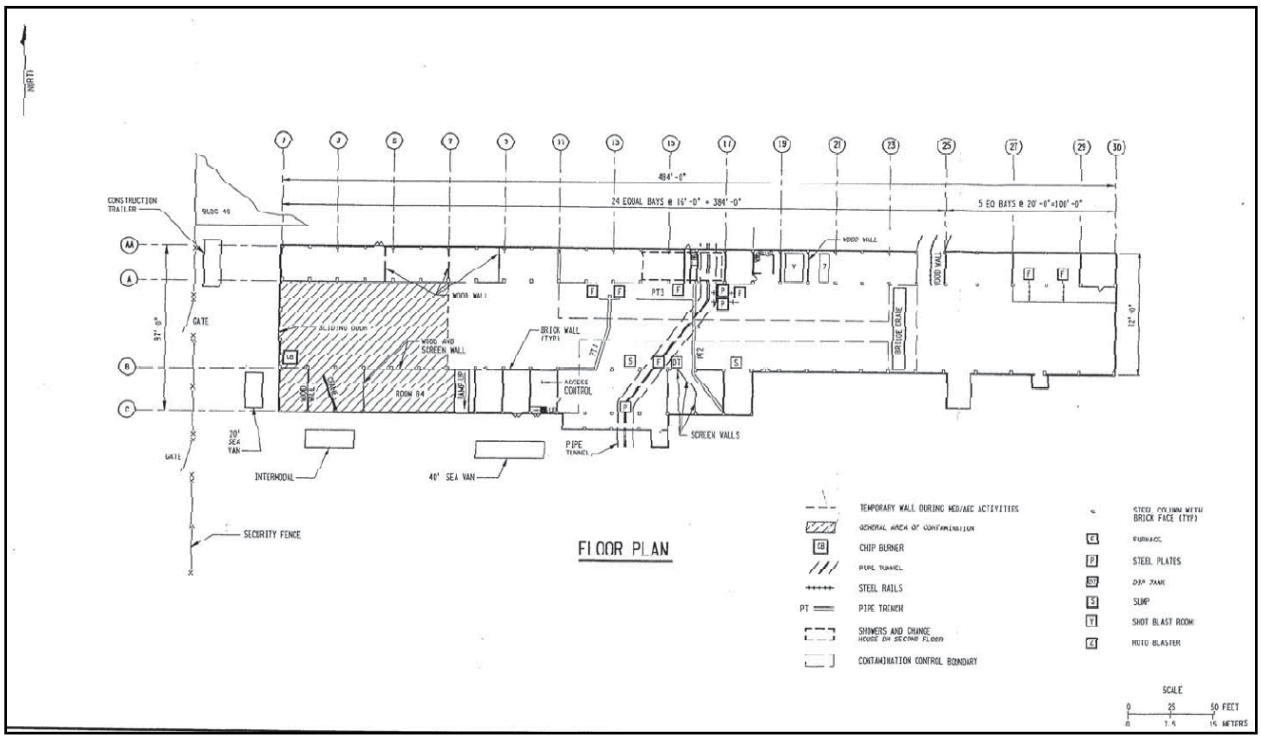


Figure 18-3. Floor Plan of Building 23 at the Indian Orchard Site

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminant was natural uranium (ORNL 1992).

18.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined the Indian Orchard site to be eligible for FUSRAP in December 1992 (DOE 1992).

Cleanup Criteria

DOE residual contamination guidelines stated in DOE Order 5400.5 (archived) for release of formerly contaminated properties for use without radiological restrictions were applied to the crane, floor, and drain lines. The guidelines are summarized in Table 18-1.

Table 18-1. Archived DOE Order 5400.5 Surface Contamination Limits

Natural Uranium, ^{235}U, ^{238}U, and Associated Decay Products on Structural Surfaces	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2
Surface Contamination Limit for Beta/Gamma Emitters	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2

Note:
Where surface contamination by both alpha and beta/gamma-emitting nuclides exists, the limits established for alpha and beta/gamma-emitting nuclides should apply independently.

Supplemental guidelines were developed for the roof trusses based on information contained in a technical study and preliminary hazard assessment (BNI 1995a; BNI 1995b). The supplemental guideline for the surfaces was to meet an average surface level activity of no more than 15,000 dpm/100 cm^2 of uranium activity for the entire truss.

Remedial Action

Remedial activities lasted approximately 8 weeks, from July to September 1995. All decontamination efforts were confined to the interior of Building 23. HEPA-filtered vacuum cleaners were used to remove loose contamination and dust. During the survey of the floor, it was determined that part of the ramp at the west equipment door of Building 23 needed to be removed to provide access to contamination under the ramp. Conventional jackhammers were used on small areas to remove anchor bolts from the concrete slab. Skid steer loaders equipped with hoe-ram attachments were used to remove the wooden blocks from the floor and to break up the concrete pads to expose the base slab. A ductile iron drain line discovered in Room B4 after removal of the wooden blocks was determined to be radioactively contaminated above criteria. In all, 145 ft of 4-inch drain line was removed and shipped to the disposal facility. The lead seals were surveyed, released, and taken to a local lead recycling company. Contaminated soil from the west ramp and the pipe excavation was removed with shovels. Small areas on the overhead trusses requiring rework were wire-brushed to remove contamination. Contamination was scraped from the surface of the 10-ton crane and the wooden planks were removed from the crane deck.

At some point between the 1995 verification survey and 2001, the property owner demolished Building 23 and removed all demolition debris from the property. Because of the demolition and removal of Building 23, a second verification survey was performed to verify that the demolition activities did not redistribute any of the structural contamination. This survey was performed in May 2003. After completion of survey activities, ORNL prepared a verification report and submitted it to DOE (Murray 2003). Satellite imagery from December 2015 shows that the property was vacant.

Release Survey

Release surveys were conducted by the remedial contractor BNI immediately following site cleanup (BNI 1996).

Independent Verification

An independent verification survey conducted after the completion of remedial action detected no residual radioactivity at the site that exceeded guidelines (ORNL 1997).

Use Restrictions

The site was released for unrestricted use and unlimited exposure (DOE 2003).

Assessment of Risk

Because the site was remediated to the conservative dose-based standards of DOE Order 5400.5 (archived), there was no site-specific risk assessment performed.

Certification of Regulator Concurrence

A notice of cleanup certification for the site was published on January 21, 2004 (69 FR 2908).

MassDEP reviewed the investigation report and work plan for remedial action and approved them in a letter dated June 15, 1995. The Massachusetts Department of Public Health Radiation Control Program also reviewed and approved the remedial action plan in a letter dated June 14, 1995 (DOE 2003).

Agreements and Permits

The property owner entered into an agreement with DOE in 1988 to allow for the characterization and remediation of the site (Kates 1995).

18.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Indian Orchard site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Indian Orchard site. Materials to which supplemental limits were applied have been removed from the site. No need for restrictions on future use and no further LM waste management responsibility.

Site Fact Sheet

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at https://www.energy.gov/lm/articles/indian-orchard-massachusetts-site-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to the Indian Orchard site.

Monitoring

No monitoring is required at the Indian Orchard site.

Field Operations

There are no field operations required at the Indian Orchard site.

Regulatory Interfaces

No regulatory interfaces are required at the Indian Orchard site.

18.4 References

69 FR 2908. U.S. Department of Energy, "Certification of the Radiological Condition of the Chapman Valve Site, Indian Orchard, Massachusetts," *Federal Register*, January 21, 2004.

BNI (Bechtel National Inc.), 1995a. *Hazard Assessment for Chapman Valve*, Rev. 2, Calculation Number 133-CV-001.

BNI (Bechtel National Inc.), 1995b. *Technical Study for the Remedial Action at the Chapman Valve Site, Indian Orchard, Massachusetts*, May.

BNI (Bechtel National Inc.), 1996. *Post-Remedial Action Report for the Chapman Valve Site, Indian Orchard, Massachusetts*, November.

DOE (U.S. Department of Energy), 1992. *Authorization for Remedial Action at the Former Chapman Valve Manufacturing Company Facility, Indian Orchard, Massachusetts*, memorandum by Director James W. Wagoner II, Division of Off-Site Programs, Office of Eastern Area Programs, Office of Environmental Restoration, December 15.

DOE (U.S. Department of Energy), 2003. *Certification Docket for the Remedial Action Performed at the Chapman Valve Site Indian Orchard, Massachusetts, MA*, August.

DOE Order 458.1 Chg 4 (LtdChg), *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, September 15, 2020.

Kates, 1995. Katy Kates, realty officer, U.S. Department of Energy, letter (about Real Estate License REORDOER-7-95-0139, Chapman Valve Mfg. Co.) to Anthony D. Pantaleoni, vice president, Crane Company, June 6.

Murray, 2003. M. Murray, Oak Ridge National Laboratory, U.S. Department of Energy, letter (about Final Radiological Verification Survey at the Chapman Valve Site, Indian Orchard, Massachusetts), July l.

ORNL (Oak Ridge National Laboratory), 1992. *Results of the Radiological Survey at the Former Chapman Valve Manufacturing Company, Indian Orchard, Massachusetts (CIO001)*, July.

ORNL (Oak Ridge National Laboratory), 1997. *Results of the Independent Radiological Verification Survey at the Former Chapman Valve Manufacturing Company, Indian Orchard, Massachusetts (CIO001V)*, May.

19.0 Jersey City, New Jersey, Site

19.1 Site Conditions

The Jersey City, New Jersey, Site is in an industrial park at the northwest corner of New Jersey Route 440 and Kellogg Street in Jersey City, New Jersey (Figure 19-1 and Figure 19-2).

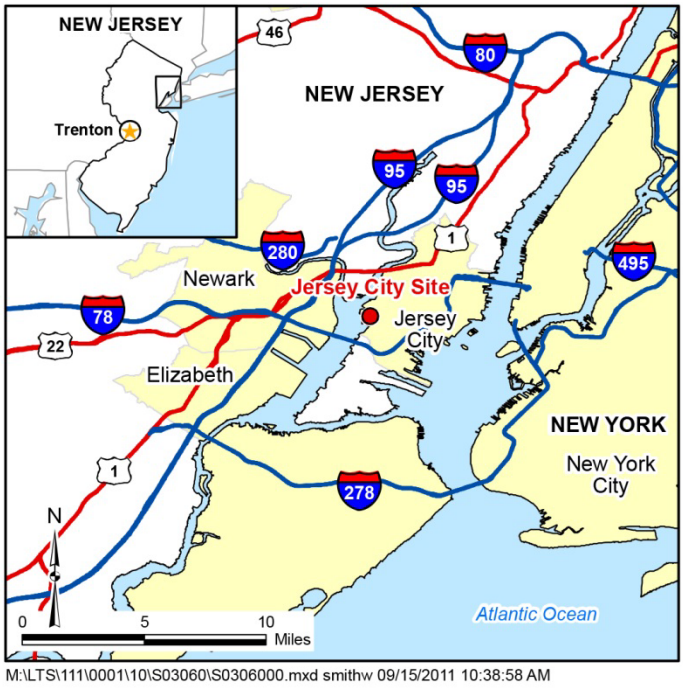


Figure 19-1. Location of the Jersey City, New Jersey, Site

The site originally consisted of more than 20 buildings on approximately 43 acres of land. Operations for MED and AEC took place in the former Building 11 and in Building A, which housed the Kellex Laboratory (ORNL 1982). Building 11 consisted of laboratories, offices, weighing facilities, toilets, changing rooms, and a shielded counting room. Kellex was contracted in 1943 by MED to design the first gaseous diffusion uranium enrichment plant. The laboratory operated until July 1952, developing various solvent extraction methods under contract to AEC. In 1953, Building 11 was demolished, leaving only the concrete pad. All of the original buildings have since been demolished, and some of the Building 11 concrete pad has been covered with fill dirt. The disposal site for the rubble from the demolished buildings is uncertain. The site has been divided into several privately owned parcels. A shopping center has been constructed on part of the site along with townhomes on another portion of the site.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were natural uranium, ^{226}Ra, and ^{232}Th (ORNL 1982).

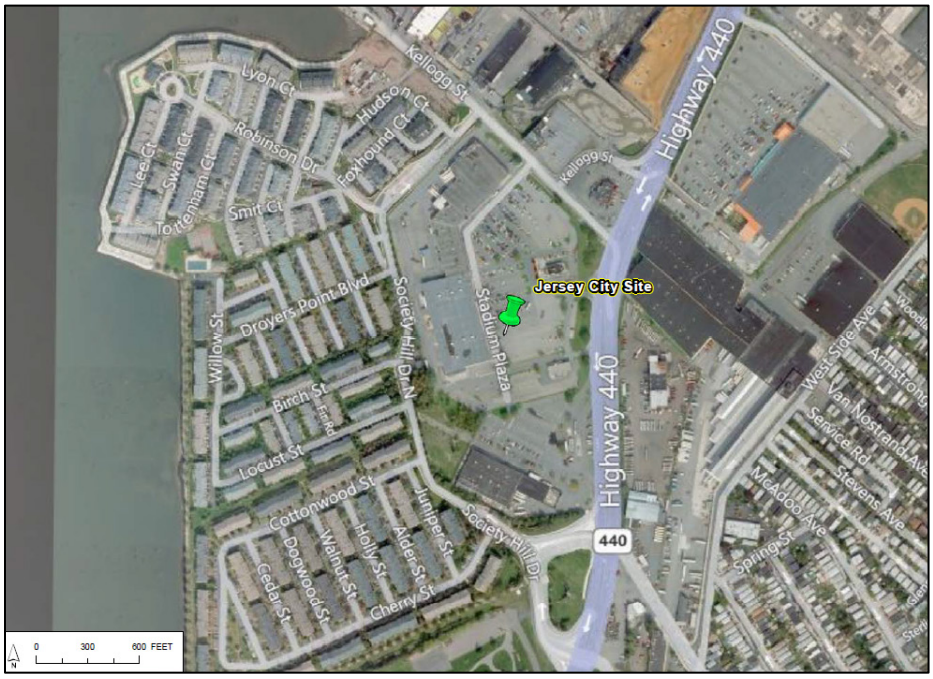


Figure 19-2. Aerial Photograph of the Jersey City Site

19.2 Remedial Action

FUSRAP Eligibility Determination

Preliminary surveys began in 1976. This site was one of 73 sites known to have been involved in MED or early AEC research and development activities and was included in an initial survey program conducted between 1974 and 1978. A formal eligibility determination has not been located in project files (Tyler 1979).

Cleanup Criteria

The 1979 survey and a subsequent 1982 survey resulted in nine areas of interest being identified (ORNL 1982). The upper limit for radionuclides such as ^{232}Th and ^{226}Ra in soil was assumed to be 5 pCi/g in any 1-pound (450-gram) sample chosen at random or in a composite sample averaged over the decontaminated zone (ORNL 1979). A site-specific dose assessment was performed and set a residual limit of 40 pCi/g of ^{238}U averaged over 400 m^2 in the top 20 cm of soil, based on a residential future-use scenario. However, based on the ALARA concept, the remedial action contractors were directed to excavate soils to the detection limit of their field instruments, which was estimated to represent 20 pCi/g ^{238}U (DOE 1983). Of the 36 soil samples collected during the 1979 survey, maximum radionuclide concentrations observed for ^{238}U, ^{226}Ra, and ^{232}Th were 2100, 340, and 4300 pCi/g, respectively. Of the 31 soil samples collected during the 1982 survey, the ^{226}Ra concentration averaged 1.2 pCi/g, with a range of 0.29 to 2.4 pCi/g. The concentration of ^{232}Th averaged 1.2 pCi/g, with a range of 0.50 to 2.3 pCi/g, and the ^{238}U concentration averaged 1.2 pCi/g, with a range of 0.34 to 3.3 pCi/g.

Groundwater sampling from four boreholes yielded radionuclide concentrations that were comparable to background conditions (ORNL 1982).

Remedial Action

The nine areas containing higher-than-background concentrations of radioactive material constituted a total area of approximately 0.83 acre (3350 m^2). ORNL remediated three areas associated with the Building 11 foundation in 1979. The total surface area remediated was 5058 ft^2 (ORNL 1979). A total of about 1000 barrels of contaminated soil and debris were removed from the site and disposed of at Barnwell, South Carolina. The remaining impacted areas were remediated by DOE in 1983 (DOE 1983).

Release Survey

Release surveys were conducted by ORNL immediately following site cleanup. All of the surveyed areas were released for unrestricted use (DOE 1983).

Independent Verification

An independent verification of soil samples conducted by the New Jersey Department of Environmental Protection (NJDEP) after the completion of remedial action detected no residual radioactivity at the site that exceeded guidelines (DOE 1983).

Use Restrictions

The site was released for unrestricted use and unlimited exposure (DOE 1983).

Assessment of Risk

A site-specific dose assessment was used to determine the derived concentration cleanup levels (DOE 1983).

Certification of Regulator Concurrence

NJDEP reviewed the remedial action reports and FSSs and certified that remediation was complete in a letter dated May 23, 1983 (Kuhrtz 1983).

Agreements and Permits

The property owner entered into an agreement with DOE in 1979 to allow for the characterization and remediation of the site (DOE 1983).

19.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Jersey City site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Jersey City site.

Site Fact Sheet

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at https://www.energy.gov/lm/articles/jersey-city-new-jersey-site-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to the Jersey City site.

Monitoring

No monitoring is required at the Jersey City site.

Field Operations

There are no field operations required at the Jersey City site.

Regulatory Interfaces

No regulatory interfaces are required at the Jersey City site.

19.4 References

DOE (U.S. Department of Energy), 1983. *NJ.07-5 – Certification Docket for the Former Kellex Corporation, Jersey City, New Jersey*, Office of Nuclear Energy, Office of Terminal Waste Disposal and Remedial Action, Division of Remedial Action Projects.

Kuhrtz, 1983. Steven G. Kuhrtz, director, Division of Environmental Quality, New Jersey Department of Environmental Protection, letter (about Review of Radiological Survey Reports and Postremedial Action Reports), May 23.

ORNL (Oak Ridge National Laboratory), 1979. *Post-Decontamination Radiological Survey of the Former Kellex Laboratory Site, Jersey City, New Jersey*, NJ.07-7.

ORNL (Oak Ridge National Laboratory), 1982. *Radiological Survey of the Former Kellex Research Facility, Jersey City, New Jersey*, February.

Tyler, 1979. George J. Tyler, director, New Jersey Department of Environmental Protection, letter (about Decontamination Criteria for Real Property Contaminated with Radium), February 6.

20.0 Madison, Illinois, Site

20.1 Site Conditions

The Madison, Illinois, Site is at the intersection of College and Weaver Streets in Madison, Illinois. The site is northeast of and across the Mississippi River from St. Louis, Missouri (Figure 20-1 and Figure 20-2). During the late 1950s and early 1960s, the Dow Metal Products Division of Dow Chemical Company machined and shaped uranium metal and straightened uranium rods for AEC. This work was conducted at the Madison site under subcontract to the Uranium Division of Mallinckrodt Chemical Works (AEC 1957).

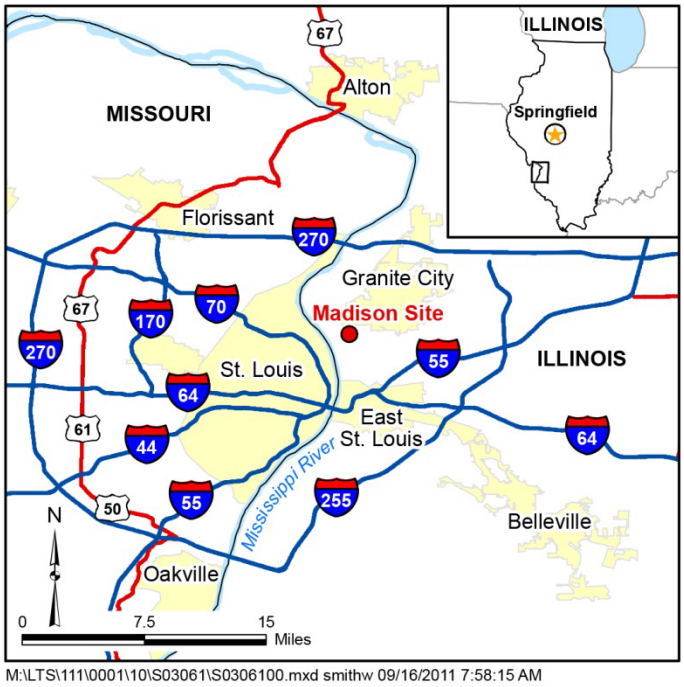


Figure 20-1. Location of the Madison, Illinois, Site

Work at the Madison site included researching the properties of various die metals, the die cavities, and lubricants to apply to the process. This operation resulted in residual radiological contamination in dust on overhead steel beams in the building (ORNL 1990).

The site consists of a large, multisectional complex of 10 interconnecting buildings with a total underroof area of about 1.4 million ft^2. AEC production work occurred in Building 6, which is about 270 ft wide by 1000 ft long. The walls are concrete block with some brick veneer, and the floors are concrete with rough and pitted surfaces. Much of the floor near the extrusion press was covered with a thin layer of oily dirt and fine metal debris. The adjoining Building 4 was used for material transfers. There are no physical barriers between these two buildings.

Figure 20-2. Aerial View of the Madison Site

A preliminary radiological survey performed in 1990 found elevated concentrations of ^{238}U and ^{232}Th in dust sampled from overhead beams at the south end of Building 6. The survey noted that beam dust samples containing ^{232}Th and thorium-containing magnesium-alloy objects (e.g., grinding wheels, shims) were not FUSRAP-eligible because they were the result of a separate, licensed process of the current owner (ORNL 1990).

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminant was natural uranium (ORNL 1990).

20.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined the Madison site to be eligible for FUSRAP in September 1992 (DOE 1992).

Cleanup Criteria

The remedial action objective was to prevent direct exposure to uranium that would result in a dose greater than 25 mrem/yr. The remediation goal, based on exposure to a utility worker, was 6000 dpm/100 cm^2 for surficial contamination and 20 pCi/g for volumetric contamination. A separate remediation goal of 300 pCi/g was calculated for the difficult-to-access areas based on the 25 mrem/yr limit and conditions specific to those areas (USACE 2000b).

Remedial Action

Between June and July 2000, USACE removed contaminated dust and debris from overhead surfaces in Buildings 4 and 6, including window ledges, utility conduits, trusses, and cross-member beams. Areas designated as "difficult-to-access" were assigned supplemental limits and included above window ledges, steel beams, and utilities in the upper portions of the structure (45–60 ft above the floor).

After remediation, the maximum value in each survey unit met cleanup criteria. The maximum surface activity overall was 2720 dpm/100 cm^2, and the maximum uranium concentration in dust remaining on inaccessible areas (on interior window ledges and structural members at the roof level) was 112 pCi/g. The dose to the maximally exposed individual was estimated to be 8.3 mrem/yr for a utility worker working in the existing structure (USACE 2001).

Release Survey

Release surveys were conducted in accordance with the *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)* guidance (NRC et al. 2000) immediately following site cleanup (USACE 2001).

Independent Verification

An independent verification survey was not conducted (USACE 2001).

Use Restrictions

The site was released for unrestricted use and unlimited exposure as specified in 10 CFR 20.1402 (USACE 2001).

Assessment of Risk

USACE calculated the dose that would be received to a maximally exposed individual due to exposure to the residual contamination. The maximum exposure to a utility worker was calculated to be 19.8 mrem/yr if he or she was exposed only to the survey unit with the highest residual concentrations. A utility worker would receive a maximum dose of 8.3 mrem/yr if work time was split between Buildings 4 and 6. All 36 survey units met the guidelines (USACE 2001). No additional protective measures by DOE are warranted following the 2017 technical workshop review of site conditions and risk. The site remains an industrial facility in a condition acceptable to the owner.

Certification of Regulator Concurrence

USACE issued a declaration of remedial action completion, which was included in the Closeout Report (USACE 2001).

Agreements and Permits

USACE acted as lead agency conducting remediation under CERCLA standards pursuant to PL 106-60. Under CERCLA, neither permits nor state agreements are required for cleanup

activities that occur wholly onsite. USACE delivered copies of the Remedial Investigation Report and Feasibility Study (USACE 2000a) and the ROD for the Madison site to state regulators (USACE 2000b).

20.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Madison site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Madison site.

Site Fact Sheet

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at https://www.energy.gov/lm/articles/madison-illinois-site-fact-sheet.

Desktop Assessment

The desktop assessment is applicable to the Madison site. For sites that were released for unrestricted use and that contain supplemental limits areas, DOE will conduct annual data verification to ensure that land usage is consistent with the site certification land use according to the remedy and determine if a site visit is necessary. The latest desktop assessment was conducted in February 2023.

Monitoring

No monitoring is required at the Madison site.

Field Operations

There are no field operations required at the Madison site.

Regulatory Interfaces

No regulatory interfaces are required at the Madison site.

20.4 References

10 CFR 20.1402. U.S. Nuclear Regulatory Commission, “Radiological Criteria for Unrestricted Use,” *Code of Federal Regulations.*

AEC (U.S. Atomic Energy Commission), 1957. *Agreement Between Mallinckrodt Chemical Works and Dow Chemical Company for Experimental Extrusion Work*, memorandum by Area Manager F.H. Belcher, St. Louis Area Office, January 4.

DOE (U.S. Department of Energy), 1992. *Authorization for Remedial Action at the Former Dow Chemical Company Facility in Madison, Illinois*, memorandum by Director James W. Wagoner II, Division of Off-Site Programs, Office of Eastern Area Programs, Office of Environmental Restoration, September 25.

MARSSIM:NRC (U.S. Nuclear Regulatory Commission), EPA (U.S. Environmental Protection Agency), and DOE (U.S. Department of Energy), 2000. *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, Rev. 1, NUREG-1575, EPA 402-R-97-016, DOE/EH-0624, August.

ORNL (Oak Ridge National Laboratory), 1990. *Preliminary Results of the Radiological Survey at the Former Dow Chemical Company Site, Madison, Illinois,* December.

PL 106-60. "Energy and Water Development Appropriations Act of 2000," Public Law.

USACE (U.S. Army Corps of Engineers), 2000a. *Final Remedial Investigation Report and Feasibility Study for the Madison Site*, January.

USACE (U.S. Army Corps of Engineers), 2000b. *Record of Decision for the Madison Site, Madison, Illinois*, May.

USACE (U.S. Army Corps of Engineers), 2001. *Closeout Report for the Formerly Utilized Sites Remedial Action Program (FUSRAP) –Madison Site. Madison, Illinois*, September.

21.0 New Brunswick, New Jersey, Site

21.1 Site Conditions

The New Brunswick, New Jersey, Site is at 986 Jersey Avenue, approximately 1.6 miles from downtown New Brunswick, New Jersey (Figure 21-1).

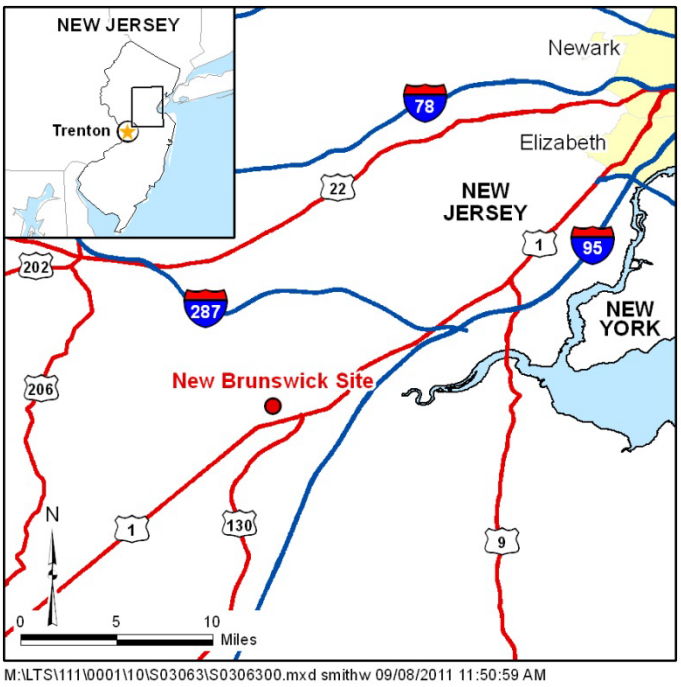


Figure 21-1. Location of the New Brunswick, New Jersey, Site

Operations at the New Brunswick Laboratory included nuclear material assay; spectral-chemical analysis of lithium, magnesium, beryllium, zirconium, and other materials used in the nuclear fuel cycle; a small-scale boron recovery pilot-plant operation; operation of a thorium extraction pilot plant; development of a continuous production system for uranium tetrafluoride; and preparation of high-purity plutonium sulfate. In addition, 18,000 ft^3 of Belgian Congo pitchblende was transferred to the site in 1960 from the Middlesex Municipal Landfill and mixed with 93,600 ft^3 of clean soil. The pitchblende and soil mixture was used as backfill on an abandoned railroad spur on the site. Figure 21-2 shows the excavated area.

The 5.6-acre site was transferred to a private owner in late 2009 and has been redeveloped into a 72,000 ft^2 waste transfer facility.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminant was natural uranium (DOE 1997a).

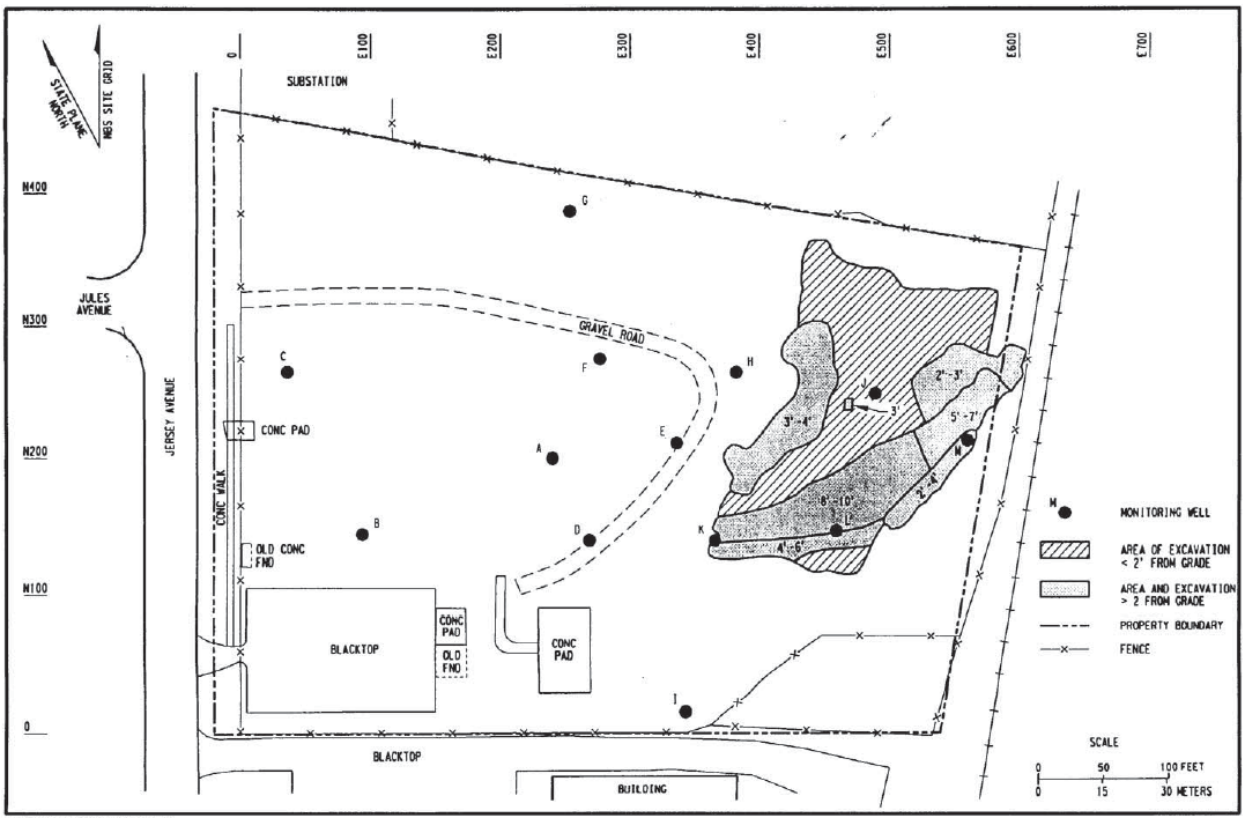


Figure 21-2. New Brunswick Site Excavated Area

21.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined the New Brunswick site to be eligible for FUSRAP in August 1990 (DOE 1990).

Cleanup Criteria

The New Brunswick site was remediated to criteria in DOE Order 5400.5 (archived). The guidelines are summarized in Table 21-1.

Table 21-1. Archived DOE Order 5400.5 Surface Contamination Limits

Natural Uranium, ^{235}U, ^{238}U, and Associated Decay Products on Structural Surfaces	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2
Surface Contamination Limit for Beta/Gamma Emitters	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2

Note:
Where surface contamination by both alpha and beta/gamma-emitting nuclides exists, the limits established for alpha and beta/gamma-emitting nuclides should apply independently.

A site-specific standard was developed for total uranium, which was 100 pCi/g (DOE 1995; DOE 1996).

Remedial Action

Before its transfer to FUSRAP, the site was partially remediated in two phases between 1978 and 1983. Phase I consisted of removing contaminated accessible plumbing; equipment; and portions of floors, walls, and ceilings. Phase II included removal of all aboveground structures, including contaminated concrete foundations and onsite drain lines, and radioactively contaminated soil on the front two-thirds of the property. In 1996, additional contaminated soil was remediated from a location along the south fence line and beneath a railroad spur that was backfilled with a contaminated soil mixture (included both clean soil and pitchblende received from the Middlesex Municipal Landfill).

Soil samples from an area that was backfilled with clean soil had arsenic and thallium at levels exceeding state standards. However, USACE determined that the soil samples had come from the bottom of the excavation rather than the backfill soil. In 2005, USACE investigated the backfill soil and presented the results to NJDEP in a Technical Memorandum. The investigation concluded that the backfill soil did not contain arsenic and thallium in concentrations that exceeded the New Jersey Residential Direct Contact Soil Cleanup Criteria. The Technical Memorandum recommended establishing an institutional control (deed notice) and an engineering control (soil cap composed of the backfill soil).

NJDEP requested additional groundwater sampling at the site. USACE conducted groundwater and soil sampling to demonstrate that groundwater met applicable standards. USACE removed the monitoring wells in 2006.

NJDEP also requested additional radiological data on a drop inlet and drain lines entering a sanitary sewer in the public right-of-way at the property frontage. DOE completed the radiological survey of these structures in 2009 and found no indication of above-background radioactivity.

Release Survey

Postremedial action survey data indicated that the radiological condition of the site complies with DOE standards and guidelines for cleanup of residual radioactive contamination (DOE 1997a; DOE 1997b).

Independent Verification

An independent verification survey conducted after the completion of remedial action detected no residual radioactivity at the site that exceeded guidelines (ORISE 2001).

Use Restrictions

Excavation is restricted in the northeast portion of the site where soils containing arsenic are covered by a layer of clean soil. The owner inspects this restricted area every other year and submits a certification of protectiveness to the NJDEP. This restriction is addressed by a deed notice described under the "Institutional Controls" subsection.

Assessment of Risk

Because the site was remediated to the conservative dose-based standards of DOE Order 5400.5 (archived), there was no site-specific risk assessment performed.

Certification of Regulator Concurrence

A notice of cleanup certification for the site was published on September 21, 2001 (66 FR 48863).

NJDEP issued a decision that no further action was required in 2001 (Gaffigan 2011).

Agreements and Permits

NJDEP approved a deed notice in 2011 (Gaffigan 2008; Gaffigan 2011) restricting excavation at the site.

21.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the New Brunswick site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

A regulator-imposed institutional control at the site is the deed notice in accordance with NJDEP regulations in *New Jersey Administrative Code* 7:26E (NJAC 7:26E). The deed notice issued by DOE restricts excavation through the clean soil cover in the northeast corner of the site into soil containing elevated levels of arsenic and thallium. The property owner inspects the site and submits a biennial remedial action protection certification to NJDEP.

Site Fact Sheet

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at https://www.energy.gov/lm/articles/new-brunswick-new-jersey-site-fact-sheet.

Desktop Assessment

The desktop assessment is applicable to the New Brunswick site. For sites that were released for unrestricted use and contain supplemental limits areas, DOE will conduct annual data verification to ensure that land usage is consistent with the site certification land use in accordance with the remedy and determine if a site visit is necessary.

Although the New Brunswick site does not contain supplemental limits, a desktop assessment is conducted to verify that a deed notice restricting excavation in the northeast corner of the site remains in place.

Every 5 years after March 31, 2017, LM will perform a site assessment summary for the New Brunswick site. The assessment summary will compile the results of the previous 5 years of annual desktop assessments. This assessment is designed to meet the intent of oversight on a CERCLA site (EPA 2001). The latest site assessment summary was prepared in February 2022.

Monitoring

No monitoring is required at the New Brunswick site.

Field Operations

There are no field operations required at the New Brunswick site.

Regulatory Interfaces

NJDEP is the regulatory interface required at the New Brunswick site.

21.4 References

66 FR 48863. U.S. Department of Energy, "Certification of the Radiological Condition of the New Brunswick Site, New Brunswick, New Jersey," *Federal Register*, September 24, 2001.

DOE (U.S. Department of Energy), 1990. *Addition of Sites to FUSRAP*, memorandum by Director James W. Wagoner II, Division of Off-Site Programs, Office of Eastern Area Programs, Office of Environmental Restoration, August 2.

DOE (U.S. Department of Energy), 1995. *Uranium Guideline for the New Brunswick Site, New Brunswick, New Jersey*, memorandum by Director James W. Wagoner II, Division of Off-Site Programs, Office of Eastern Area Programs, Office of Environmental Restoration, December 19.

DOE (U.S. Department of Energy), 1996. *Derivation of Guidelines for Uranium Residual Radioactive Material in Soil at the New Brunswick Site, Middlesex County, New Jersey*, February.

DOE (U.S. Department of Energy), 1997a. *Post-Remedial Action Report for the Remedial Action at the New Brunswick Laboratory Site, New Brunswick, New Jersey*, July.

DOE (U.S. Department of Energy), 1997b. *Technical Memorandum—Post-Remedial Action Groundwater Quality Summary for the New Brunswick Site*, No. 144-97-013, Rev. 0, September.

DOE Order 458.1 Chg 4 (LtdChg), *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, September 15, 2020.

Gaffigan, 2008. D. Gaffigan, New Jersey Department of Environmental Protection, letter (about Conditional No-Further-Action Letter and Covenant Not to Sue with Requirements for Biennial Certification), October 14.

Gaffigan, 2011. D. Gaffigan, New Jersey Department of Environmental Protection, letter (about No-Further-Action Letter, Remedial Action Type: Unrestricted Use for Areas of Concern [Manhole 26 and Site-Wide Groundwater], ERDA New Brunswick Laboratory), March 21.

NJAC 7:26E. "Technical Requirements for Site Remediation," *New Jersey Administrative Code*.

ORISE (Oak Ridge Institute for Science and Education), 2001. *Verification Survey of the New Brunswick Laboratory Site, New Brunswick, New Jersey*, ORISE 01-0987, July.

22.0 New York, New York, Site

22.1 Site Conditions

During the 1940s, the Baker and Williams Company owned three adjacent warehouses at 513-519, 521-527, and 529-535 West 20th Street in New York (Manhattan), New York (Figure 22-1). These warehouse locations are collectively known as the New York, New York, Site.

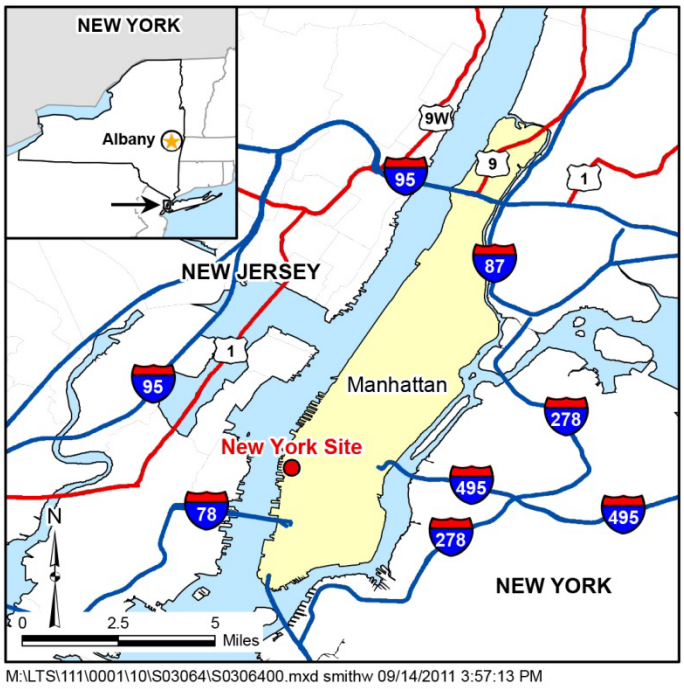


Figure 22-1. Location of the New York, New York, Site

MED used the New York site for short-term storage of uranium concentrates produced in Port Hope, Canada. Historical shipping documents indicate that MED shipments of uranium concentrates were delivered to the shipping and receiving office at Building 529-535 (Figure 22-2). However, shipments may have been received, unloaded, or stored at either of the adjacent warehouse buildings. Adjoining doorways between 521-527 and 529-535 allowed convenient access between the two buildings.

Figure 22-2. Baker and Williams Warehouses, 1990 (DOE Digital Archive)

According to historical information, approximately 219,000 pounds of orange and yellow sodium uranate were delivered to the warehouses in 1942 for storage. In 1943, deliveries to the warehouses included 86,000 pounds of orange and yellow sodium uranate, 22,000 pounds of sodium uranyl carbonate, and 20,000 pounds of black uranium oxide. The uranium was distributed to other federal government facilities.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were processed uranium, uranium ores, and oxides (i.e., orange and yellow sodium uranate, sodium uranyl carbonate, and black uranium oxide).

22.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined the New York site to be eligible for FUSRAP in August 1990 (DOE 1990).

Cleanup Criteria

The New York site was remediated to criteria in DOE Order 5400.5 (archived). The guidelines are summarized in Table 22-1.

Table 22-1. Archived DOE Order 5400.5 Surface Contamination Limits

Natural Uranium, ^{235}U, ^{238}U, and Associated Decay Products on Structural Surfaces	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2
Surface Contamination Limit for Beta/Gamma Emitters	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2

Note:
Where surface contamination by both alpha and beta/gamma-emitting nuclides exists, the limits established for alpha and beta/gamma-emitting nuclides should apply independently.

Remedial Action

In 1991, DOE identified surface contamination in Building 513-519 exceeding guideline levels at four locations in the basement east bay, 21 locations on the first floor east bay, one location on the third floor west bay, and two locations on the elevator pit east bay. In Building 521-527, surface contamination exceeded guideline levels in the basement east and west bays and on the first floor. No residual contamination above guideline levels was found in Building 529-535.

DOE conducted remedial action in Building 521-527 in 1991. Decontamination methods included a nonhazardous, nontoxic, biodegradable chemical agent with a self-propelled floor scarifier (a machine that breaks apart the surfaces of concrete and asphalt), a HEPA-filtered vacuum, and a chipping hammer to remove contamination. The cleanup generated 12 drums of radioactive waste that were shipped to the DOE Hanford Site in Washington for disposal.

DOE conducted remedial action in Building 513-519 in 1993. Decontamination methods included a steel shot-blasting machine, a HEPA-filtered vacuum, and chipping hammers to remove contamination. The 1993 cleanup generated 38 drums of radioactive waste that were shipped to a licensed radioactive waste disposal facility in Clive, Utah.

After remediation, no removable contamination was found that exceeded DOE guidelines in any building. Of 1200 beta-gamma emitter activity direct measurements collected after remediation, 20 exceeded the guideline for fixed surface activity but were less than the maximum allowable activity. The maximum removable alpha activity was 45 dpm/100 cm^2, and the maximum removable beta activity was 54 dpm/100 cm^2. Gamma radiation exposure rates ranged from 10 to 14 μR/h. No exterior contamination was found.

Release Survey

As documented in the *Post-Remedial Action Report for Buildings 521–527, Baker & Williams Warehouses Site, New York, New York* (DOE 1992) and the *Post-Remedial Action Report for Buildings 513–519, Baker & Williams Site, New York, New York* (DOE 1994), the postremedial action survey data indicated that the radiological condition of the site was in compliance with applicable DOE standards and guidelines for cleanup of residual radioactive contamination.

Independent Verification

The results of the independent verification survey of the site demonstrated that all contaminated areas have been remediated to radionuclide concentrations and activity levels below the applicable guidelines set by DOE and were documented by ORNL in two separate reports: *Verification Survey of the Baker and Williams Warehouses Building 521–527, New York, New York* (ORISE 1992) and *Verification Survey of the Baker and Williams Warehouses—Buildings 513–519, New York, New York* (ORISE 1994).

Use Restrictions

There are no use restrictions at the New York site. The site was released for unrestricted use.

Assessment of Risk

DOE received risk assessment results and confirmed that residential use on the site did not pose an unacceptable risk.

Certification of Regulator Concurrence

A notice of cleanup certification was published in the *Federal Register* on October 16, 1995 (60 FR 53588).

Agreements and Permits

There are no agreements or permits.

22.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the New York site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the New York site.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at https://www.energy.gov/lm/articles/new-york-new-york-site-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to the New York site.

Monitoring

No monitoring is required at the New York site.

Field Operations

There are no field operations required at the New York site.

Regulatory Interfaces

No regulatory interfaces are required at the New York site.

22.4 References

60 FR 53588. U.S. Department of Energy, "Notice of Certification of the Radiological Condition of the Baker and Williams Warehouses Site, New York, NY, 1991–1993," *Federal Register*, October 16, 1995.

DOE (U.S. Department of Energy), 1990. *Authorization for Remedial Action at the Former Baker and Williams Warehouses on West 20th Street in New York, New York, under FUSRAP*, memorandum by James Fiore, U.S. Department of Energy Headquarters, August 1.

DOE (U.S. Department of Energy), 1992. *Post-Remedial Action Report for Buildings 521–527, Baker & Williams Warehouses Site, New York, New York*, DOE/OR/21949-301, February.

DOE (U.S. Department of Energy), 1994. *Post-Remedial Action Report for Buildings 513–519, Baker & Williams Site, New York, New York*, DOE/OR/21949-381, May.

DOE Order 458.1 Chg 4 (LtdChg), *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, September 15, 2020.

ORISE (Oak Ridge Institute for Science and Education), 1992. *Verification Survey of the Baker and Williams Warehouses Buildings 521–527, New York, New York*, May.

ORISE (Oak Ridge Institute for Science and Education), 1994. *Verification Survey of the Baker and Williams Warehouses—Buildings 513–519, New York, New York*, June.

23.0 Niagara Falls Storage Site Vicinity Properties, New York, Site

23.1 Site Conditions

The Niagara Falls Storage Site Vicinity Properties, New York, Site is in Lewiston, New York, approximately 10 miles north of the city of Niagara Falls, New York (Figure 23-1). The site consists of 25 properties sold to private owners; previously, the properties were part of the LOOW. Another portion of the former ordnance works was transferred to AEC and became the Niagara Falls Storage Site. There are also three anomaly properties in the town of Lewiston, the town of Niagara Falls, and the city of Niagara Falls.

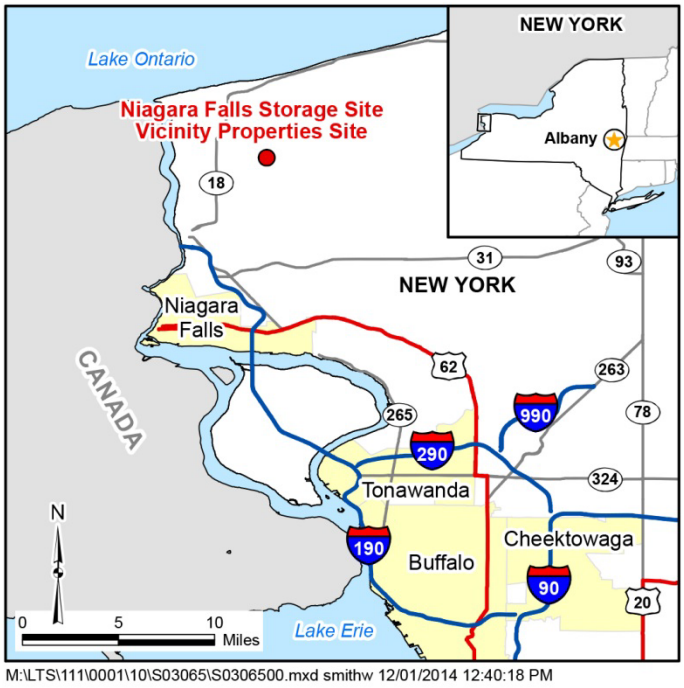
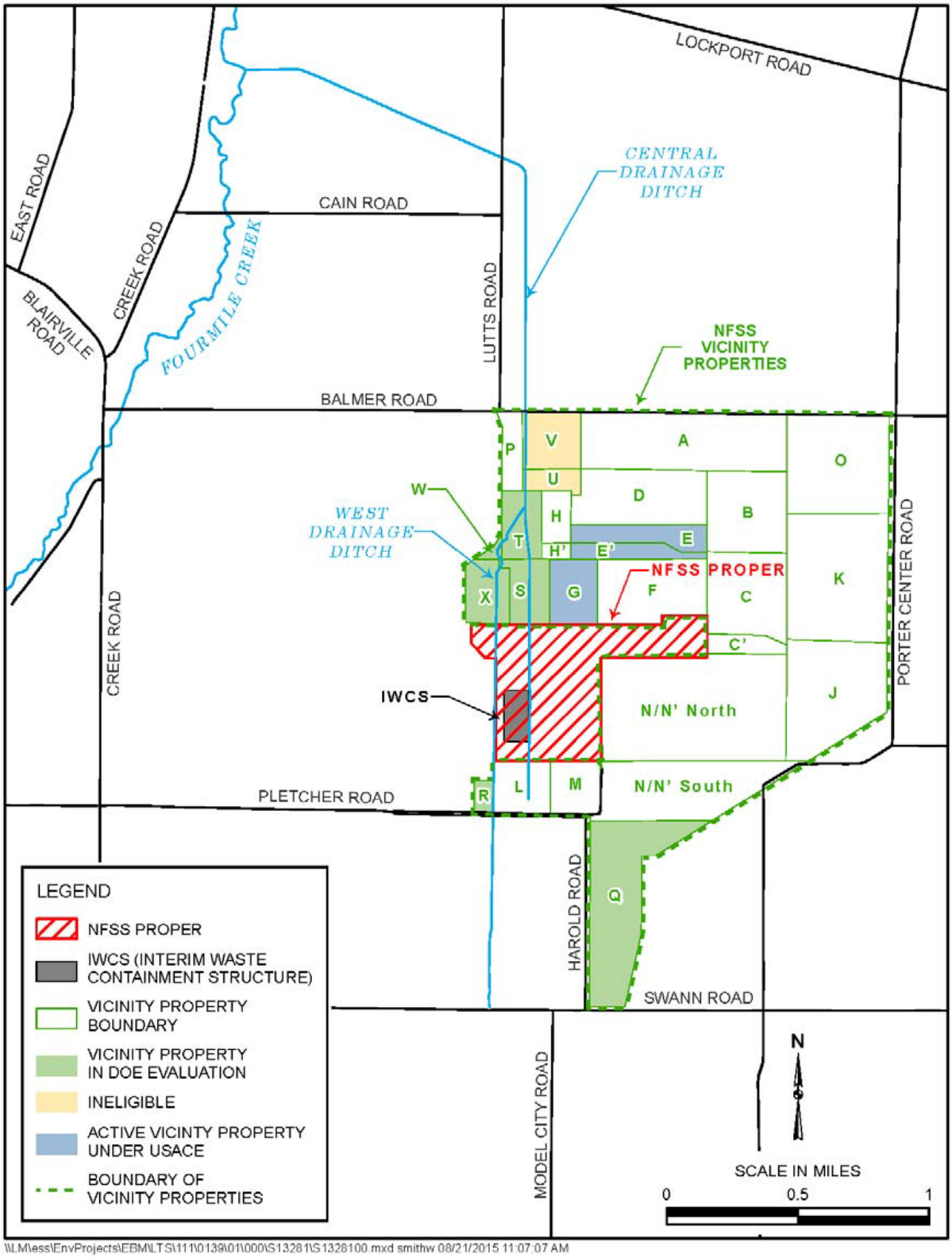


Figure 23-1. Location of the Niagara Falls Storage Site Vicinity Properties, New York, Site

Beginning in 1944, MED stored uranium-processing residues, uranium metal, and radiological waste at the former LOOW. Radiological surveys conducted between 1970 and 1980 indicated that residual contamination that exceeded FUSRAP guidelines remained on the vicinity properties (VPs). The VPs were sold in 1971.

The VPs were designated as A, B, C', D, F, H', L, M, N/N' North, N/N' South, P, Q, R, S, T, U, V, W, X, West and Central Drainage Ditches, and areas along Pletcher Road. There were three anomaly properties designated Anomaly AA (in the town of Lewiston), Anomaly BB (in the town of Niagara Falls), and Anomaly CC (in the city of Niagara Falls) (Figure 23-2).

Much of the area that comprises the VPs is occupied by a municipal waste landfill and a hazardous waste landfill; access to these properties is restricted. Other portions of the VPs are occupied by municipal or commercial interests.



Abbreviation: NFSS = Niagara Falls Storage Site

Figure 23-2. Vicinity Property Designations at the Niagara Falls Storage Site

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were natural uranium, radium, and thorium in soil and sediments.

23.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined the Niagara Falls Storage Site VPs site to be eligible for FUSRAP in June 1983.

Cleanup Criteria

The Niagara Falls Storage Site VPs were remediated to criteria in *U.S. Department of Energy Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites* (DOE 1985). The guidelines are summarized in Table 23-1.

Table 23-1. DOE Guidelines for Remediation

Constituent	DOE Guideline (pCi/g) (averaged over 100 m^2)	
	Surface[a]	Subsurface
^{226}Ra	5	15
^{228}Ra	5	15
^{230}Th	5	15
^{232}Th	5	15
Total U	75	75

Note:
[a] Upper 15 cm (6 inches) of soil below ground surface.
Abbreviation: U = uranium

The site-specific limit for total uranium was later established as 90 pCi/g, and 5 pCi/g ^{226}Ra in surface soil.

Supplemental limits of 20 pCi/g ^{226}Ra were applied along the Central Drainage Ditch from 500 ft west of Lutts Road to the confluence with Fourmile Creek (DOE 1986a).

Remedial Action

Radiological surveys of the VPs conducted from October 1970 to June 1971 indicated that approximately 6.5 acres had residual radioactive material that exceeded AEC guidelines. As a result, between 15,000 and 20,000 yd^3 of contaminated soil were removed.

Between 1983 and 1986, DOE remediated 23 of the 25VPs eligible for remediation under FUSRAP to authorized limits. Remedial action included excavating soil and rubble along with the restoration of offsite drainage ditches. Approximately 50,000 yd^3 of radiological material were removed, placed in watertight dump trucks, and transported to an interim waste containment structure constructed on the Niagara Falls Storage Site. The Central Drainage

Ditch was remediated to authorized limits except where supplemental limits (for ^{226}Ra) were applied along the ditch from 500 ft west of Lutts Road to the confluence with Fourmile Creek (DOE 1986b; DOE 1989).

DOE did not complete investigations on three VPs (E, E', and G) because the properties were either in use or portions were inaccessible. USACE will complete investigation of these properties once the areas are accessible. VPs H' and X had been identified as eligible for FUSRAP and are currently under investigation by USACE (USACE 2023).

Release Survey

Postremedial action survey data indicate that the radiological condition of the site is in compliance with applicable DOE standards and guidelines for cleanup of residual radioactive contamination. Contamination in the supplemental limits area of the Central Drainage Ditch is below the risk-based standard established for that area.

Independent Verification

The results of the independent verification survey of the site demonstrate that all contaminated areas have been remediated to radionuclide concentrations and activity levels below the applicable guidelines set by DOE and were documented by ORNL in two separate reports: *Verification of 1983 and 1984 Remedial Actions, Niagara Falls Storage Site Vicinity Properties, Lewiston, New York* (ORAU 1989) and *Verification of 1985 and 1986 Remedial Actions, Niagara Falls Storage Site Vicinity Properties, Lewiston, New York* (ORAU 1990).

Use Restrictions

The New York State Department of Health imposed use restrictions in 1972, before the last episode of remediation occurred. These land use restrictions are still in effect. DOE released the individual VPs for unrestricted use.

Assessment of Risk

After remediation, radionuclide concentrations did not exceed authorized limits except where supplemental limits were applied to residual ^{226}Ra in soil in the Central Drainage Ditch.

Results of dose modeling indicated that residual ^{226}Ra concentrations in the ditch do not pose unacceptable risk to residents. The dose modeling assumed that the soil would be removed from the ditch and used as fill material for a residential foundation and that the ^{226}Ra concentrations would be diluted to one-fourth of the original concentration through excavation and handling. The modeling concluded that ^{226}Ra concentrations as high as 20 pCi/g would not result in unacceptable risk under this residential-use scenario. The maximum ^{226}Ra concentration in the unexcavated portion of the ditch where supplemental limits were applied was 11.5 pCi/g.

No additional protective measures by DOE are warranted following the 2017 technical workshop review of site conditions and risk.

Certification of Regulator Concurrence

A notice of cleanup certification for the site was published in the *Federal Register* on October 25, 1991 (56 FR 55292–55293).

Agreements and Permits

There are no agreements or permits.

23.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Niagara Falls Storage Site VPs site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Niagara Falls Storage Site VPs site.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at https://www.energy.gov/lm/articles/niagara-falls-storage-site-vicinity-properties-new-york-site-fact-sheet.

Desktop Assessment

Although the annual desktop assessment is not applicable to the Niagara Falls Storage Site VPs site, an assessment will be conducted at 5-year intervals to review site conditions. The first 5-year desktop assessment was conducted in February 2023.

Monitoring

No monitoring is required at the Niagara Falls Storage Site VPs site.

Field Operations

There are no field operations required at the Niagara Falls Storage Site VPs site.

Regulatory Interfaces

No regulatory interfaces are required at the Niagara Falls Storage Site VPs site.

23.4 References

56 FR 55292–55293. U.S. Department of Energy, "Certification of the Radiological Condition of Certain Niagara Falls Storage Site Vicinity Properties in Lewiston, New York Following Cleanup Activities from 1983 Through 1986," *Federal Register,* October 25, 1991.

DOE (U.S. Department of Energy), 1985. *U.S. Department of Energy Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites*, Rev. 1, July.

DOE (U.S. Department of Energy), 1986a. *Development of a Supplemental Residual Contamination Guideline for the NFSS Central Drainage Ditch*, December.

DOE (U.S. Department of Energy), 1986b. *Post-Remedial Action Report for the Niagara Falls Storage Site Vicinity Properties-1983 and 1984*, DOE/OR/20722-84, prepared by Bechtel National Inc., December.

DOE (U.S. Department of Energy), 1989. *Post-Remedial Action Report for the Niagara Falls Storage Site Vicinity Properties-1985 and 1986*, DOE/OR/20722-133, prepared by Bechtel National Inc., January.

ORAU (Oak Ridge Associated Universities), 1989. *Verification of 1983 and 1984 Remedial Actions, Niagara Falls Storage Site Vicinity Properties, Lewiston, New York*, ORAU 89/J-178, prepared for the U.S. Department of Energy, December.

ORAU (Oak Ridge Associated Universities), 1990. *Verification of 1985 and 1986 Remedial Actions, Niagara Falls Storage Site Vicinity Properties, Lewiston, New York*, prepared for the U.S. Department of Energy, July.

USACE (U.S. Army Corps of Engineers), 2023. *Formerly Utilized Sites Remedial Action Program Update, Fiscal Year 2022*, January.

24.0 Oak Ridge, Tennessee, Warehouses Site

24.1 Site Conditions

The Oak Ridge, Tennessee, Warehouses Site (formerly the Elza Gate site) is north of Meco Lane (formerly Antwerp Lane) in the eastern portion of Oak Ridge, Tennessee, in what is now known as Melton Lake Industrial Park (Figure 24-1). Access to the 17.3-acre site is off Melton Lake Drive near its intersection with the Oak Ridge Turnpike.

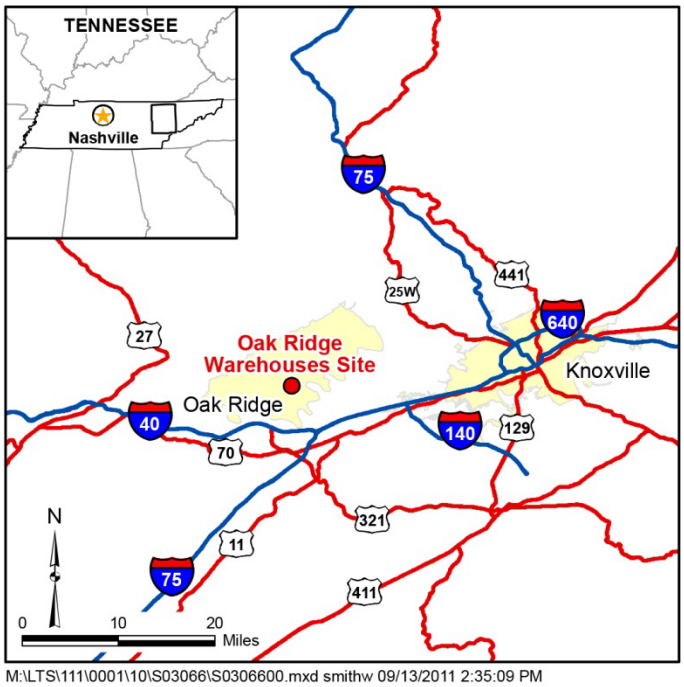


Figure 24-1. Location of the Oak Ridge, Tennessee, Warehouses Site

In the early 1940s, the site consisted of five warehouses and other smaller structures used by MED to store pitchblende (high-grade uranium ore); radium-bearing sludges; and other radioactive materials such as tailings, oxide residues, and slag for the Manhattan Project. The site is divided into nine parcels, and MED warehouses were in parcels 1 through 4, which are divided from parcels 5 through 9 by Meco Lane, a dead-end asphalt road. In 1946, AEC took ownership of the site. The date when the warehouses were no longer used for storage of the pitchblende and residues is unknown.

DOE deemed the site acceptable for use with no radiological restrictions after conducting a survey and decontamination activities in 1972. In 1987, various surveys conducted at the site found radiological contamination that exceeded newer, stricter DOE cleanup guidelines. As a result, the site was designated for inclusion in FUSRAP on November 30, 1988. At this time, none of the original structures remained, but the concrete pads were still in place (Figure 24-2). After site remediation, several new structures were built as the area was redeveloped for commercial and light industrial use.

Figure 24-2. Oak Ridge Warehouses Site Before Remediation, January 1990 (DOE Digital Archives)

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were high-grade uranium ore (pitchblende), uranium oxide residues, slag, and tailings. PCBs and lead contamination were present from post-DOE private plating operations.

24.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined the Oak Ridge Warehouses site to be eligible for FUSRAP in November 1988 (DOE 1988).

Cleanup Criteria

The Oak Ridge Warehouses site was remediated to criteria in the *U.S. Department of Energy Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites* (DOE 1985), with site-specific soil standards for total uranium of 35 pCi/g, lead of 1000 milligrams per kilogram (mg/kg), and PCBs of 50 mg/kg.

Remedial Action

Additional radiological and chemical characterization of the site in 1989 and 1990 identified ^{238}U, ^{226}Ra, lead, and PCBs in site soils, as well as uranium contamination on the surfaces of the

concrete pads. Remedial action at the site began in 1991 and was completed in 1992. The first phase of remediation (March–May 1991) consisted of concrete pad and soil removal at five locations.

During the second phase of remediation (October 1991–January 1992), concrete pads and soils on other parcels at the site were removed (Figure 24-3).

Figure 24-3. Oak Ridge Warehouses Site After Phase 2 Remediation, December 1992 (DOE Digital Archives)

In all, 6700 yd^3 of waste material from both phases was transported in 818 truckloads to the Oak Ridge Reservation for disposal. In addition, 294 ft^3 of PCB-contaminated soil were containerized in 40 drums and transported to a licensed commercial facility for disposal.

After remediation, concentrations of ^{226}Ra and ^{230}Th were less than 2 pCi/g. Uranium-238 concentrations were less than the site-specific guideline of 35 pCi/g; most results were less than 20 pCi/g. Gamma radiation exposure rates were within the range of background. The dose rate modeled for a residential farmer scenario based on a ^{238}U concentration of 35 pCi/g was around 15 mrem/yr. Lead (EPA 1989) and PCB (EPA 1990) contamination was remediated to less than 100 and 25 mg/kg, respectively, which are less than the approved limits.

Release Survey

In accordance with the *Post-Remedial Action Report for the Elza Gate Site, Oak Ridge, Tennessee* (DOE 1992), the post-remedial action survey data indicated that the radiological condition of the site is in compliance with applicable DOE standards and guidelines for cleanup of residual radioactive contamination.

Independent Verification

The results of the independent verification survey of the site demonstrate that all contaminated areas have been remediated to radionuclide concentrations and activity levels below the applicable guidelines set by DOE and were documented by ORNL in the *Verification Survey of the Elza Gate Site* (ORISE 1992).

Use Restrictions

There are no use restrictions at the Oak Ridge Warehouses site. The site was released for unrestricted use.

Assessment of Risk

DOE received risk assessment results and confirmed that residential use on the site did not pose an unacceptable risk.

Certification of Regulator Concurrence

A notice of cleanup certification for the site was published in the *Federal Register* on November 5, 1993 (58 FR 59020).

Agreements and Permits

There are no agreements or permits.

24.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Oak Ridge Warehouses site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Oak Ridge Warehouses site.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at https://www.energy.gov/lm/articles/oak-ridge-tennessee-warehouses-site-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to the Oak Ridge Warehouses site.

Monitoring

No monitoring is required at the Oak Ridge Warehouses site.

Field Operations

There are no field operations required at the Oak Ridge Warehouses site.

Regulatory Interfaces

No regulatory interfaces are required at the Oak Ridge Warehouses site.

24.4 References

58 FR 59020. U.S. Department of Energy, "Certification of the Radiological and Chemical Condition of Remediation at Oak Ridge, Tennessee," *Federal Register*, November 5, 1993.

DOE (U.S. Department of Energy), 1985. *U.S. Department of Energy Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites*, Rev. 1, July.

DOE (U.S. Department of Energy), 1988. *Authorization for Remedial Action at the Melton Lake Industrial Park (Former Elza Gate Area Warehouses), Oak Ridge, Tennessee*, memorandum by J. Fiore, November 30.

DOE (U.S. Department of Energy), 1992. *Post-Remedial Action Report for the Elza Gate Site, Oak Ridge, Tennessee*, DOE/OR/21949-352, prepared by Bechtel National Inc., October.

EPA (U.S. Environmental Protection Agency), 1989. *Interim Guidance on Establishing Lead Cleanup Levels at Superfund Sites*, OSWER 9355.4-02, September.

EPA (U.S. Environmental Protection Agency), 1990. *Guidance on Remedial Action for Superfund Sites with PCB Contamination*, EPN540/G-90/007, August.

ORISE (Oak Ridge Institute for Science and Education), 1992. *Verification Survey of the Elza Gate Site*, ORISE 92/L-30, prepared for the U.S. Department of Energy, December.

25.0 Oxford, Ohio, Site

25.1 Site Conditions

The Oxford, Ohio, Site is approximately 35 miles northwest of Cincinnati, Ohio. The site comprises the former Alba Craft Laboratory property at 10-14 West Rose Avenue and VPs at 525 South West Main Street, 9 West Rose Avenue, 550 South Main Street, and West Rose Avenue adjacent to the former Alba Craft Laboratory Inc. building (Figure 25-1).

Figure 25-1. Location of the Oxford, Ohio, Site

Alba Craft Laboratory, under a subcontract to NLO, a primary contractor for AEC from October 1952 to February 1957, provided a variety of machine-shop services on natural uranium (i.e., uranium metal that was neither enriched nor depleted but contained uranium isotopes in natural abundance). Operations at the site consisted of hollow drilling and turning of uranium metal slugs. Production operations ceased in 1957 after several hundred tons of uranium metal were machined. Alba Craft Laboratory personnel decontaminated the building and equipment in accordance with NLO Industrial Hygiene Department specifications after the operations ended.

In 1992, ORNL performed a radiological survey in and around the Alba Craft Laboratory building and adjacent properties suspected of being contaminated from activities conducted at the laboratory. The survey identified radioactive contamination exceeding DOE guidelines for unrestricted release at the Alba Craft Laboratory building and three VPs. DOE designated the building and the three VPs for remedial action under FUSRAP.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminant was natural uranium metal.

25.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined the Oxford site to be eligible for FUSRAP in September 1992 (DOE 1992; DOE 1993; DOE 1994b).

Cleanup Criteria

The Oxford site was remediated to criteria in DOE Order 5400.5 (archived), with a site-specific total uranium-in-soil standard of 35 pCi/g. The guidelines are summarized in Table 25-1.

Table 25-1. Archived DOE Order 5400.5 Surface Contamination Limits

Natural Uranium, ^{235}U, ^{238}U, and Associated Decay Products on Structural Surfaces	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2
Surface Contamination Limit for Beta/Gamma Emitters	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2

Note:
Where surface contamination by both alpha and beta/gamma-emitting nuclides exists, the limits established for alpha and beta/gamma-emitting nuclides should apply independently.

Remedial Action

Between August 1994 and January 1995, remedial actions performed on the Alba Craft Laboratory (Figure 25-2) building included decontamination of the building structure and dismantlement of the roof and walls (Figure 25-3). The remaining concrete floor and foundation were excavated. The concrete building debris was crushed for shipping using a size-reduction device. Underlying and surrounding soil was excavated as necessary to meet cleanup criteria. A manhole in the parking lot was decontaminated, and 65 ft of pipe was excavated and removed from the site. Radioactively contaminated soil was excavated on the three VPs. Following the remedial action and verification that the remediation was completed, the excavated areas were restored to the original grade and seeded. The remedial action generated approximately 2800 yd^3 of low-level radioactive soil and building debris, which was shipped to a licensed facility in Clive, Utah, for disposal.

After remediation (Figure 25-4), ^{226}Ra and ^{232}Th concentrations were less than 2.2 pCi/g. Concentrations of ^{238}U ranged as high as 73 pCi/g, exceeding the site-specific guideline of 35 pCi/g. However, when averaged over an area of 100 m^2, concentrations were below the guideline. Final modeled dose rates are 11 mrem/yr for residential farming use and 4 mrem/yr for residential use (DOE 1994a; DOE 1994c).

Figure 25-2. The Alba Craft Laboratory Building Before Remediation (DOE Digital Archive)

Figure 25-3. Demolition of the Alba Craft Laboratory Building, October 1994 (DOE Digital Archive)

Figure 25-4. Vacant Land with Duplex on Right Side of Photo, Oxford, Ohio, Site, June 2006

Release Survey

Postremedial action survey data indicate that the radiological condition of the Oxford site complies with applicable DOE standards and guidelines for cleanup of residual radioactive contamination. DOE released the site for unrestricted use. The site has been restored to a condition acceptable to the owner (DOE 1995).

Independent Verification

The results of the independent verification survey of the site demonstrate that all contaminated areas have been remediated to radionuclide concentrations and activity levels below the applicable guidelines set by DOE and were documented by ORNL in two separate reports: the *Results of the Independent Radiological Verification Survey of the Remedial Action Performed at the Former Alba Craft Laboratory Site, Oxford, OH* (DOE 1996b) and *Results of the Independent Radiological Verification Survey of the Remedial Action Performed at 525 S. Main Street, Oxford, Ohio (OX0002)* (DOE 1996a).

Use Restrictions

There are no use restrictions at the Oxford site. The site was released for unrestricted use.

Assessment of Risk

Because the site was remediated to the conservative dose-based standards of DOE Order 5400.5 (archived), there was no site-specific risk assessment performed.

Certification of Regulator Concurrence

A notice of cleanup certification for the site was published in the *Federal Register* on November 26, 1996 (61 FR 60097).

Agreements and Permits

There are no agreements or permits.

25.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Oxford site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Oxford site.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at https://www.energy.gov/lm/articles/oxford-ohio-site-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to the Oxford site.

Monitoring

No monitoring is required at the Oxford site.

Field Operations

There are no field operations required at the Oxford site.

Regulatory Interfaces

No regulatory interfaces are required at the Oxford site.

25.4 References

61 FR 60097, U.S. Department of Energy, "Certification of the Radiological Condition of the Alba Craft Site in Oxford, Ohio," *Federal Register*, November 26, 1996.

DOE (U.S. Department of Energy), 1992. *Authorization for Remedial Action at Alba Craft Laboratory in Oxford, Ohio*, memorandum by Director James W. Wagoner II, Division of Eastern Area Programs, Office of Environmental Restoration, September 25.

DOE (U.S. Department of Energy), 1993. *Designation of 525 South Main Street, Oxford, Ohio*, memorandum by W.A. Williams, October 18 (vicinity property).

DOE (U.S. Department of Energy), 1994a. *Derivation of Uranium Residual Radioactive Material Guidelines for the Former Alba Craft Laboratory Site*, *Oxford, Ohio*, ANL/EAD/TM-9, prepared by Argonne National Laboratory, January.

DOE (U.S. Department of Energy), 1994b. *Designation of Vicinity Properties in Oxford, Ohio*, memorandum by W.A. Williams, June 3.

DOE (U.S. Department of Energy), 1994c. *Uranium Guidelines for the Alba Craft Site, Oxford, Ohio*, memorandum by W.A. Williams, July 15.

DOE (U.S. Department of Energy), 1995. *Post Remedial Action Report for the Former Alba Craft Laboratory and Vicinity Properties*, DOE/OR/21949-387, August.

DOE (U.S. Department of Energy), 1996a. *Results of the Independent Radiological Verification Survey of the Remedial Action Performed at 525 S. Main Street, Oxford, Ohio (OX0002)*, ORNL/RASA-95/2, prepared by Oak Ridge National Laboratory, April.

DOE (U.S. Department of Energy), 1996b. *Results of the Independent Radiological Verification Survey of the Remedial Action Performed at the Former Alba Craft Laboratory Site, Oxford, OH*, ORNL/TM-12968, prepared by Oak Ridge National Laboratory, April.

DOE Order 458.1 Chg 4 (LtdChg), *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, September 15, 2020.

26.0 Painesville, Ohio, Site

26.1 Site Conditions

The Painesville site (formerly the Diamond Magnesium site) is at 720 Fairport Nursery Road in Painesville, Ohio (Figure 26-1). The site is in Lake County in northeastern Ohio, about 22 miles northeast of Cleveland.

Figure 26-1. Location of the Painesville, Ohio, Site

From mid-1942 to late 1953, the Diamond Magnesium Company operated a magnesium production facility at the site. There is no historical evidence that Diamond Magnesium processed or produced radioactive materials at the Painesville site.

Between late 1951 and mid-1953, approximately 1650 tons of scrap metal from the Lake Ontario Storage Area, now the Niagara Falls Storage Area, was shipped to the Diamond Magnesium Company facility. The scrap metal was either used to scrub chlorine gas or stored on the ground with no cover. The scrap metal included empty metal drums that had been used to ship and store residues from the processing of pitchblende ores; these drums contained observable residues of pitchblende ores. The scrap metal that was stored on the ground was moved around the site on skids or sleds, pulled by a tractor.

There is no known history of processing or production of radioactive materials at the site. The radioactivity present at the site resulted from the use of scrap ferrous metal to scrub chlorine gas released during the magnesium production process.

By 2017, aboveground structures on the site (buildings, storage tanks, and railroad spurs) were demolished including the vacant office building (formerly called Building 400) that was used by Uniroyal Chemical Company. The concrete foundations of many of the buildings still remain. Some remediated areas have been backfilled with gravel (Figure 26-2.), and other remediated areas have been backfilled with soil (Figure 26-3.). There are privately owned groundwater monitoring wells on the site.

Figure 26-2. Gravel Backfill in Remediation Area C Along the Eastern Boundary of the Painesville Site, Adjacent to Hardy Industrial Technologies, May 2013

Figure 26-3. View from Top of Adjacent Landfill Northeast of Painesville Site Looking Southeast to Building 400, Across Remediation Areas A and G and to Hardy Industrial Technologies to the East, May 2013

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were ^{226}Ra, ^{230}Th, ^{232}Th, and uranium isotopes ^{234}U, ^{235}U, and ^{238}U, as well as their decay products.

26.2 Remedial Action

FUSRAP Eligibility Determination

The Painesville site was designated for remedial action under FUSRAP in 1992 (DOE 1992).

Cleanup Criteria

The Painesville site was remediated to cleanup criteria outlined in the Painesville ROD (USACE 2006) for ^{226}Ra, ^{230}Th, ^{232}Th, and total uranium. Soil cleanup was based on the derived concentration guideline levels (DCGLs) for the construction worker scenario (Table 26-1), which comply with the 25 mrem/yr standard found in *Ohio Administrative Code* 3701:1-38-22(B) (OAC 3701:1-38-22[B]), "Decommissioning"

Table 26-1. Painesville Site COCs and Soil Remediation Goals

Constituent of Concern	Average Site Background Concentrations (pCi/g)	Construction Worker Scenario $DCGL_w$ (pCi/g)	Construction Worker Scenario $DCGL_{emc}$ (pCi/g)
^{226}Ra	0.95	9	12
^{230}Th	1.45	25	34
^{232}Th	1.07	6	8
Total U	2.72	482	810

Note:
The DCGLs are used as the remediation goals for comparison with soil sampling data.

Abbreviations:
$DCGL_{emc}$ = DCGL elevated measurement comparison; derived based on a contaminated area of 100 m^2
$DCGL_w$ = DCGL wide-area average; derived based on a contaminated area of 10,000 m^2
U = uranium

Remedial Action

Detailed radiological surveys were conducted in 1991 and 1996 by the ORNL, BNI, Science Applications International Corporation, and ANL. In 1997, USACE was assigned responsibility for FUSRAP remediation. An Engineering Evaluation/Cost Analysis was then developed support a removal action at the site. The nontime critical removal action for excavation and offsite disposal of impacted soil was conducted in 1998.

Results of the 1998 removal action and the cessation of Uniroyal Chemical Company site operations resulted in a reevaluation of site conditions and a remedial investigation/feasibility study was implemented to address residual radionuclides in the soil. The selected remedy in the subsequent ROD (USACE 2006) was for excavation and offsite disposal of impacted soil. Remediation took place between 2007–2008 and 2010–2011.

During the 2007–2008 remediation, 15,168 tons of impacted soil were excavated from eight areas of concern (AOCs) and transported to US Ecology Idaho, a treatment plant and landfill in Grand View, Idaho, for disposal.

Between 2010–2011, a mechanical segregation system was used to survey and sort excavated soils that met a selected size criteria. The sorting process delineated soils that exceeded the ROD cleanup criteria from soils that were below cleanup criteria. Of the 47,950 tons of soil that were sent through the system, 46,932 tons of soil met the cleanup criteria and were returned as backfill, and the remaining soil was sent offsite for disposal.

An additional 1854 tons of contaminated material was dispositioned during 2010–2011. This material, including 1728 tons of contaminated soil and 126 tons of contaminated debris that did not meet free release criteria, was shipped to the US Ecology Idaho facility for disposal.

Release Survey

Following the final remediation, a postremediation report survey showed that the remaining radiological contaminants did not exceed the 25 mrem/yr dose limit specified in the ARARs in the ROD.

Independent Verification

As documented in the *Site Closeout Report for the Painesville Site, Painesville, Ohio* (USACE 2014), ANL performed an independent review of the site gamma radiation survey data and all FSS data. No FSS samples exceeded the ROD cleanup criteria. Furthermore, the FSS results indicated that all Multi-Agency Radiation Survey and Site Investigation Manual, otherwise called MARSSIM, Class 1 and Class 2 survey units met the requirements of the ROD (USACE 2014).

Use Restrictions

Postremedial action survey results indicate that the radiological condition of the site is in compliance with the standards established in the ROD.

Assessment of Risk

Based on the results of RESRAD computer modeling, residual concentrations were estimated to be protective (at the 10^{-4} risk level) for a construction worker and an industrial worker in all survey units. Therefore, as long as the site maintains its current use designation as industrial land use, it meets the ROD criteria.

One round of groundwater sampling was performed in spring of 2001 using the eight preexisting wells. These wells were analyzed for ^{226}Ra, isotopic thorium, and isotopic uranium. It was determined, based on the modeling results, that the groundwater was not impacted and was protected from migration of radionuclides by the nature and thickness of the soils at the site.

Certification and Regulator Concurrence

None.

Agreements and Permits

A site access agreement was obtained between LM and the current property owner, Chemtura Corporation, on March 24, 2016. This agreement provides site access to LM for the purposes of performing surveys, investigations, sample collection, and such other work as may be necessary and incidental to the implementation of the FUSRAP work for a period of 10 years beginning with the date of the agreement.

On April 21, 2017, Chemtura Corporation merged into a subsidiary of LANXESS Corporation, with Chemtura Corporation being the surviving entity. The result of this merger was that the LANXESS Corporation acquired all of the stock of Chemtura Corporation. Immediately after the merger, Chemtura changed its name to LANXESS Solutions US Inc. As for the LM access agreement, LANXESS Solutions US Inc. is the Chemtura Corporation, and the existing agreement remains in force.

26.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Painesville site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Painesville site.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at
https://www.energy.gov/lm/articles/painesville-ohio-site-fact-sheet.

Desktop Assessment

The desktop assessment is applicable to the Painesville site. For sites that were released for unrestricted use and that contain supplemental limits areas, DOE will conduct annual data verification to ensure that land usage is consistent with the site certification land use in accordance with the remedy and determine if a site visit is necessary.

Although the Painesville site does not contain supplemental limits, a desktop assessment is conducted to verify that land use remains industrial as a protective measure.

Every 5 years after March 31, 2017, LM will perform a site assessment summary for the Painesville site. The assessment summary will compile the results of the previous 5 years of annual desktop assessments. This assessment is designed to meet the intent of oversight on a CERCLA site (EPA 2001). The latest site assessment summary was prepared in February 2022.

Monitoring

No monitoring is required at the Painesville site. As long as the site maintains its current designation as industrial land use, it meets the ROD criteria.

Field Operations

No system operations are required at the Painesville site.

Regulatory Interfaces

No regulatory interfaces are required at the Painesville site.

26.4 References

DOE (U.S. Department of Energy), 1992. *Authorization for Remedial Action at Diamond Magnesium Site in Painesville, Ohio*, memorandum by J. Wagoner II, director division of off-site programs September 25, 1992.

EPA (U.S. Environmental Protection Agency), 2001. *Comprehensive Five-Year Review Guidance*, OSWER No. 9355.7-03B-P, June.

OAC 3701:1-38-22(B). "Decommissioning," *Ohio Administrative Code*.

USACE (U.S. Army Corp of Engineers), 2006. *Final Record of Decision, Authorized Under the Formerly Utilized Sites Remedial Action Program (FUSRAP), Painesville Site, Painesville, Ohio*, Buffalo District, Hazardous, Toxic, and Radiological Waste (Design District for Great Lakes and Ohio River Division), April.

USACE (U.S. Army Corp of Engineers), 2014. *Site Closeout Report for the Painesville Site, Painesville, Ohio*, Buffalo District, January.

27.0 Seymour, Connecticut, Site

27.1 Site Conditions

The Seymour, Connecticut, Site is at 15 Franklin Street in Seymour, Connecticut, approximately 50 miles southwest of Hartford, Connecticut. The site occupies 60 acres along the west side of the Naugatuck River off Connecticut Route 8 and just north of Connecticut Route 67 (Figure 27-1).

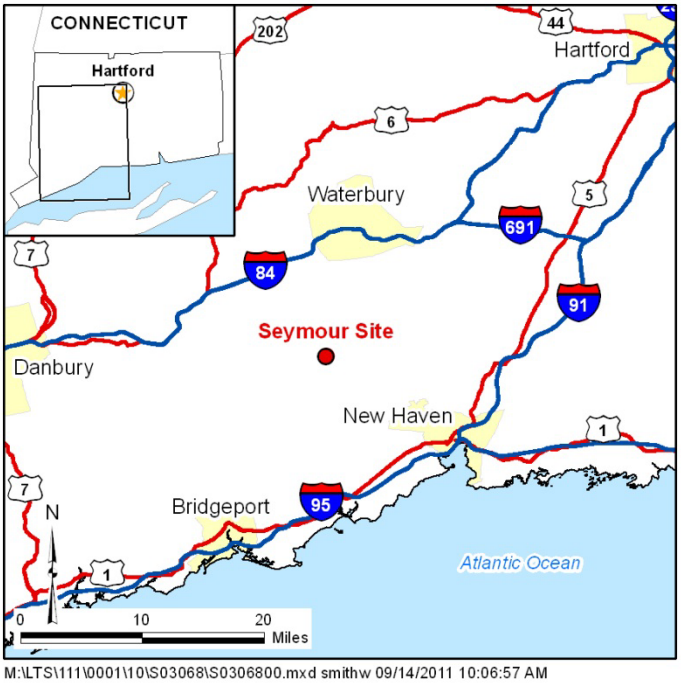


Figure 27-1. Location of the Seymour, Connecticut, Site

Reactive Metals Inc., a subsidiary of Bridgeport Brass Company, formerly occupied the Seymour site. From 1962 to 1964, Reactive Metals Inc. used one building (Rufert Building) at the site for the developmental extrusion of uranium metal. The operations included performing research and developing a process for cold-forming or extruding natural uranium metal. Analytical support work and storage of radioactive material for the extrusion process also occurred at the site. The work was performed under an AEC contract. Activities at the site ceased in 1964 when the operations were transferred to a Reactive Metals facility in Ashtabula, Ohio. All of the AEC work occurred in the Rufert Building. Characterization surveys of the building confirmed that uranium was the primary contaminant.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminant was natural uranium metal.

27.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined the Seymour site to be eligible for FUSRAP in December 1985 (DOE 1985).

Cleanup Criteria

The Seymour site was remediated to criteria in DOE Order 5400.5 (archived). The guidelines are summarized in Table 27-1. A site-specific limit for uranium in soil was not developed because contaminated soil was not expected to be encountered. Typical ^{238}U limits are 35 to 50 pCi/g.

Table 27-1. Archived DOE Order 5400.5 Surface Contamination Limits

Natural Uranium, ^{235}U, ^{238}U, and Associated Decay Products on Structural Surfaces	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2
Surface Contamination Limit for Beta/Gamma Emitters	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2

Note:
Where surface contamination by both alpha and beta/gamma-emitting nuclides exists, the limits established for alpha and beta/gamma-emitting nuclides should apply independently.

Supplemental limits were applied to uranium contamination in inaccessible areas in three manholes and 540 ft of interconnecting drain pipes beneath the Rufert Building; the maximum gamma radiation exposure rate for a decontamination and demolition worker was estimated to be 0.5 μR/h. The 1993 FSS measured residual beta-gamma emitter surface contamination levels up to 172,000 dpm/100 cm^2. Uranium concentrations remaining in the drain system were estimated to be as high as 2700 pCi/g. DOE will determine if waste management oversight is required for the removal of contaminated material in the supplemental limits area. The total quantity of uranium was compared to allowable exempt quantities. According to a 1993 hazard assessment memo (DOE 1993a),

> This value is less than the small quantity of source material that is exempt from licensing procedures in the U.S. Nuclear Regulatory Commission (NRC) rules (10 CFR 40.22(a)). It is also less than the U.S. Environmental Protection Agency's (EPA) reportable quantity (100 pounds of uranium as nitrate) specified under Superfund rules. This estimate should be added to the report to further demonstrate that little uranium is present at the site and that the amounts present are below the regulatory thresholds established by NRC and EPA.

Remedial Action

In 1993, a radiological survey identified radioactive contamination in six rooms of the Rufert Building and two areas outside the building. Contamination inside the building was found on the walls, floors, floor drains, expansion joints, overhead beams and trusses, overhead pipes, overhead ducts and fans, and overhead light fixtures. Decontamination methods included HEPA-filtered vacuum cleaners, hand-wiping and light-abrasion techniques, mechanical shot blasting, variable-speed cylinder hones, concrete cutting with a circular saw, and carbon dioxide blasting. Remedial action performed on the exterior areas of the site involved excavating the contaminated soil and backfilling the excavated areas.

Remedial action was completed in 1993. Approximately 33 yd^3 of contaminated building debris and 4 yd^3 of contaminated soil were removed from the site; additionally, 21 yd^3 of the building debris also included ACM. A total of 37 yd^3 of radioactive wastes were shipped to a licensed facility in Clive, Utah, for final disposition.

Supplemental limits were applied to three manholes and the connecting piping because the contamination was fixed, underground, and extremely resistant to decontamination efforts. The hazard assessment concluded that leaving the residual contamination in place would not pose unacceptable current or future exposure risk (DOE 1994a).

After remediation, ^{226}Ra and ^{232}Th concentrations were less than 2 pCi/g. The ^{238}U concentration in exterior soil was 7 pCi/g. The maximum gamma radiation exposure rate was 5.8 μR/h above background. Surface activities were less than authorized limits for alpha and beta-gamma emitter activity. Supplemental limits were applied to contaminated drains and manholes that were grouted to contain residual uranium contamination; the maximum gamma radiation exposure rate for a decontamination and demolition worker would be 0.5 μR/h. Uranium concentrations remaining in the drain system were estimated to be as high as 2700 pCi/g (DOE 1994a).

DOE personnel most recently visited the site in November 2014. The affected building was in use as a retail landscape products store and light manufacturing facility for stone fire pits and similar pieces. The remainder of the former Seymour Specialty Wire facility has been demolished, and structures were redeveloped for commercial and municipal government uses (Figure 27-2).

Release Survey

In accordance with the *Post-Remedial Action Report for the Removal Action at the Seymour Specialty Wire Site, Seymour, Connecticut* (DOE 1994b), the postremedial action survey data indicated that the radiological condition of the Seymour site is in compliance with applicable DOE standards and guidelines for cleanup of residual radioactive contamination. DOE certified that radiological conditions at the Seymour site comply with decontamination criteria to protect health, safety, and the environment for continued use (DOE 1995).

Figure 27-2. Seymour, Connecticut, Site, 2014

Independent Verification

The results of the independent verification survey of the site demonstrate that all contaminated areas have been remediated to radionuclide concentrations and activity levels below the applicable guidelines set by DOE and were documented by ORNL in the *Results of the Independent Radiological Verification Survey at the Former Bridgeport Brass Company Facility, Seymour, Connecticut* (DOE 1993b).

Use Restrictions

There are no use restrictions at the Seymour site. The site was released for unrestricted use.

Assessment of Risk

The *Hazard Assessment for Radioactive Contamination at the Seymour Site* (DOE 1994a) concluded that leaving the residual contamination in place would not pose unacceptable current or future exposure risk. No additional protective measures by DOE are warranted following the 2017 technical workshop review of site conditions and risk.

Certification of Regulator Concurrence

A notice of cleanup certification for the site was published in the *Federal Register* on January 24, 1995 (60 FR 4612).

Agreements and Permits

There are no agreements or permits.

27.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Seymour site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Seymour site.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at https://www.energy.gov/lm/articles/seymour-connecticut-site-fact-sheet.

Desktop Assessment

The desktop assessment is applicable to the Seymour site. For sites that were released for unrestricted use and that contain supplemental limits areas, DOE will conduct annual data verification to ensure that land usage is consistent with the site certification land use in accordance with the remedy and to determine if a site visit is necessary. The latest desktop assessment was conducted in February 2023.

Monitoring

No monitoring is required at the Seymour site.

Field Operations

There are no field operations required at the Seymour site.

Regulatory Interfaces

No regulatory interfaces are required at the Seymour site.

27.4 References

60 FR 4612. U.S. Department of Energy, "Certification of the Radiological Condition of the Seymour Specialty Wire Site, Seymour, Connecticut, 1992–1993," *Federal Register*, January 24, 1995.

DOE (U.S. Department of Energy), 1985. *Designation of Sites for Remedial Action—Metal Hydrides, Beverly, MA; Bridgeport Brass, Adrian, MI, and Seymour, CT; and National Guard Armory, Chicago, IL*, memorandum by W. Voigt, December 17.

DOE (U.S. Department of Energy), 1993a. *Hazard Assessment for the Radioactive Contamination at the Seymour Site, Seymour, Connecticut*, memorandum by J. Wagoner Director Division of Off-site Programs, August 10.

DOE (U.S. Department of Energy), 1993b. *Results of the Independent Radiological Verification Survey at the Former Bridgeport Brass Company Facility, Seymour, Connecticut*, ORNL/TM-12390, prepared by Oak Ridge National Laboratory, March.

DOE (U.S. Department of Energy), 1994a. *Hazard Assessment for Radioactive Contamination at the Seymour Site, Revision 2, Seymour, Connecticut*, Oak Ridge, Tennessee, prepared by Bechtel National Inc., August.

DOE (U.S. Department of Energy), 1994b. *Post-Remedial Action Report for the Removal Action at the Seymour Specialty Wire Site, Seymour, Connecticut*, DOE/OR/21949-370, prepared by Bechtel National Inc., January.

DOE (U.S. Department of Energy), 1995. *MI.01-7- Certification Docket for the Remedial Action Performed at the Seymour Specialty Wire Site in Seymour, Connecticut, 1992–-1993.* December.

DOE Order 458.1 Chg 4 (LtdChg), *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, September 15, 2020.

28.0 Springdale, Pennsylvania, Site

28.1 Site Conditions

The Springdale, Pennsylvania, Site (formerly the C. H. Schnoor site) is at 644 Garfield Street in Springdale, Pennsylvania, which is about 20 miles east of Pittsburgh, Pennsylvania (Figure 28-1).

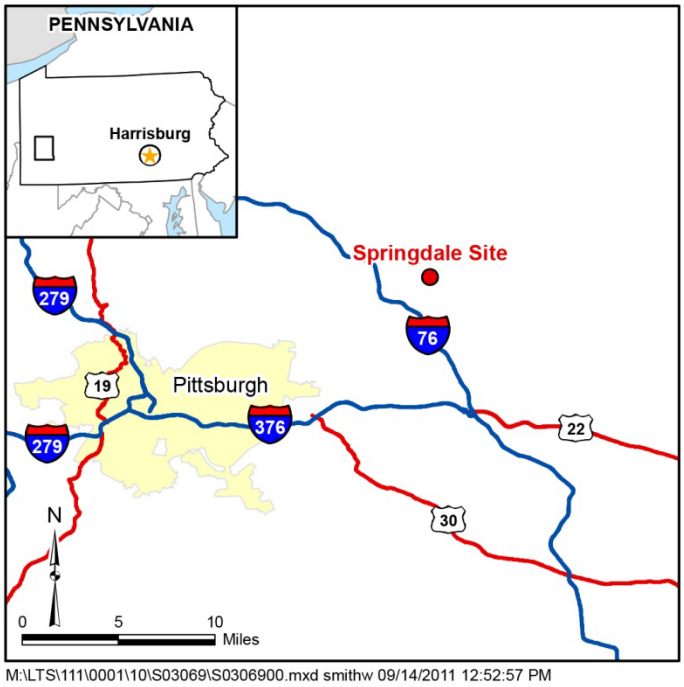


Figure 28-1. Location of the Springdale, Pennsylvania, Site

During the mid-1940s, the Springdale site was owned by C.H. Schnoor and Company and was used for machining extruded uranium metal rods for the Hanford Engineer Works of the USACE MED. Work was done in support of the Hanford Pile Project, which aimed to produce an alternate charge for the Hanford Reactor. The uranium operation appears to have continued until the spring of 1951, when the building was sold to a manufacturer of toys and coat hangers. In 1967, the property was acquired by the Unity Railway Supply Company, which founded the premier Manufacturing Company and used the site to manufacture journal lubricators for railroad cars.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminant was natural uranium.

28.2 Remedial Action

FUSRAP Eligibility Determination

The Springdale site was designated for remedial action under FUSRAP in October 1992 (DOE 1992).

Cleanup Criteria

The site-specific guideline for total uranium was 100 pCi/g when averaged over any 15-centimeter-thick soil layer. These guidelines were adopted by DOE based on their compatibility with EPA criteria for remedial action found in 40 CFR 192, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," and DOE Order 5400.5 (archived).

Because no generic cleanup guidelines for uranium applicable to remedial actions at FUSRAP sites are available, uranium guidelines are derived on a site-specific basis. A concentration of 50 pCi/g for ^{238}U was used as an indicator because the material at the Springdale site was natural uranium. The average background concentration of ^{238}U in soil representative of the site was determined by analyzing three soil samples. These samples were selected because they were near the site but were not significantly influenced by site activities and because they were representative of area land uses. The average concentration of ^{238}U in the background samples was 2.37 pCi/g (DOE 1995).

Remedial Action

Immediately before and during the remedial action, the ORNL radiological survey team performed surface surveys and drilled additional boreholes to assist in accurately defining the boundaries of contamination and to supplement existing information on the extent of contamination. Additional boreholes were drilled and sampled in the Quonset building, the new loading dock, the office area, and the western and southern sides of the supply and belt fabrication area. The ORNL team stationed a mobile gamma radiation spectroscopy system onsite to provide preliminary soil results during the remedial action; the results were used to help determine the limits of the excavation. This system was used in conjunction with hand-held survey instruments such as the field instrument for the detection of low-energy radiation and a Geiger-Mueller counter (HP-260) to direct the remedial action.

As remediation was completed, postremedial action surveys were performed to ensure that decontamination efforts were successful in meeting DOE cleanup criteria. Exposure rate measurements were taken with a pressurized ionization chamber to confirm that radiation levels were below the DOE guideline of 20 μR/h above background for building interiors and the dose limit of 100 mrem/yr to members of the general public, in accordance with 40 CFR 192. Soil samples were collected and analyzed to establish that contaminated soil had been removed to levels below the cleanup guidelines. Concentrations of direct alpha and beta-gamma and transferable alpha and beta-gamma emitter contamination were also measured to ensure that surface decontamination efforts were successful. Uranium metal was machined at this facility, so ^{226}Ra and radon-222 were not of concern. Radon originates from ^{226}Ra decay, therefore, no measurements were taken for radon; however, ^{226}Ra concentrations were measured to ensure that radon was not of concern.

The remedial action lasted approximately 6 weeks from August to October 1994. All remediation efforts were confined to the interior of the main building at the Springdale site. Characterization surveys revealed contamination beneath the concrete floor, primarily in the belt-cutting and the supply- and belt-fabrication areas of the building and in a small area in the loading dock room. Surface contamination was detected on the floor in the loading dock room and on the base of two of the cement block columns after contaminated soil had been removed from around them.

A section of the wall between two pilasters in the northern end of the building was removed so equipment could be brought into the building and remedial action could begin. A concrete saw was used to cut joints in the concrete along the walls and at the perimeter of the contaminated area as determined from characterization data. Joints were cut along the walls to prevent damage to the cement block walls during concrete removal, because the exact construction techniques used to erect the building were unknown. After removal of the concrete began, it was found that use of the concrete saw could be discontinued because no damage would occur to the walls. No contamination was present on the wall.

Equipment fitted with hoe-ram attachments was used to break the concrete floor into approximately 4 × 8 ft (1.2 × 2.4 meter) pieces, which were radiologically surveyed. Uncontaminated concrete was placed in a dumpster for disposal at a sanitary landfill. Contaminated concrete that could not be decontaminated without excessive labor was placed in a tent constructed onsite to protect it from the weather; it was then shipped to the Aliquippa, Pennsylvania, Site, crushed by a commercial rock crusher, and sampled. The average ^{238}U content was determined to be 7.50 pCi/g, which is well below the cleanup guideline of 50 pCi/g. This material was used as backfill at the Springdale site after approval from the Pennsylvania Department of Environmental Resources. In all, 97.4 yd^3 (74.5 m^3) of concrete were removed from the building, of which 56.6 yd^3 (43.3 m^3) were shipped to the sanitary landfill and 40.8 yd^3 (31.2 m^3) were crushed and reused as backfill.

A track excavator, bobcats fitted with buckets, and picks and shovels were used to excavate the contaminated soil from inside the building. The soil was placed in the bucket of the truck loader, which was positioned at the opening in the northern end of the building and loaded into intermodal containers for shipment. This method of soil handling eliminated the need for equipment to enter and leave the controlled area, which would have required equipment surveys to be performed each time. The exterior transfer and loading areas were situated to prevent contamination of the grounds. Figure 28-2 shows the areas of excavation inside the building. The average depth of excavation was approximately 2 ft (0.6 meter). Two small areas excavated to a depth of approximately 3.9 ft (1.2 meter) represent a total area of 280 ft^2 (26 m^2) (shown in Figure 28-3). In all, 626 yd^3 (476 m^3) of soil and debris were excavated from the building. This material was shipped in 37 intermodal containers to a licensed disposal facility. Figure 28-4 shows an exterior view of the Springdale site.

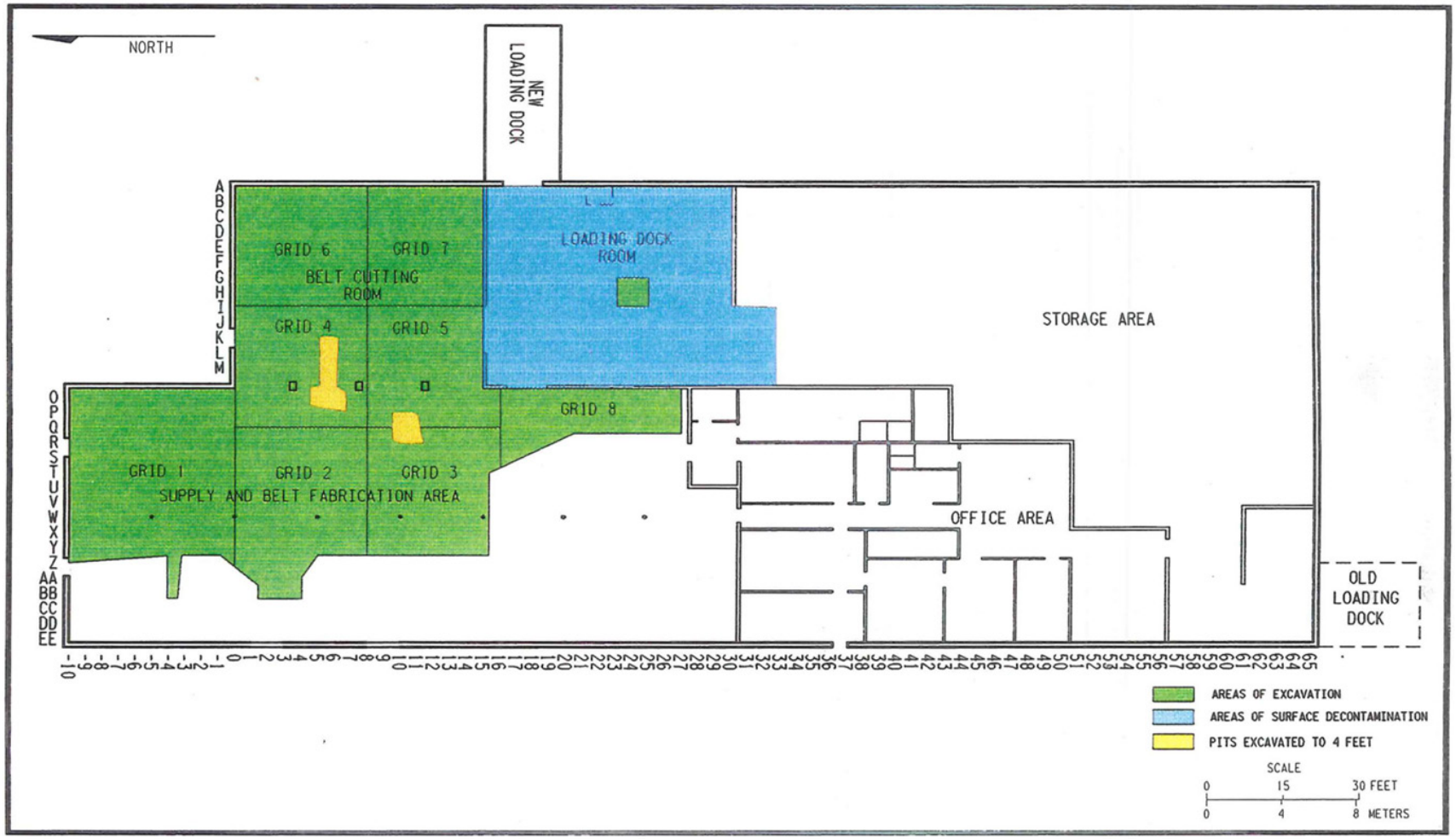


Figure 28-2. Excavation and Surface Decontamination Areas at the Springdale Site

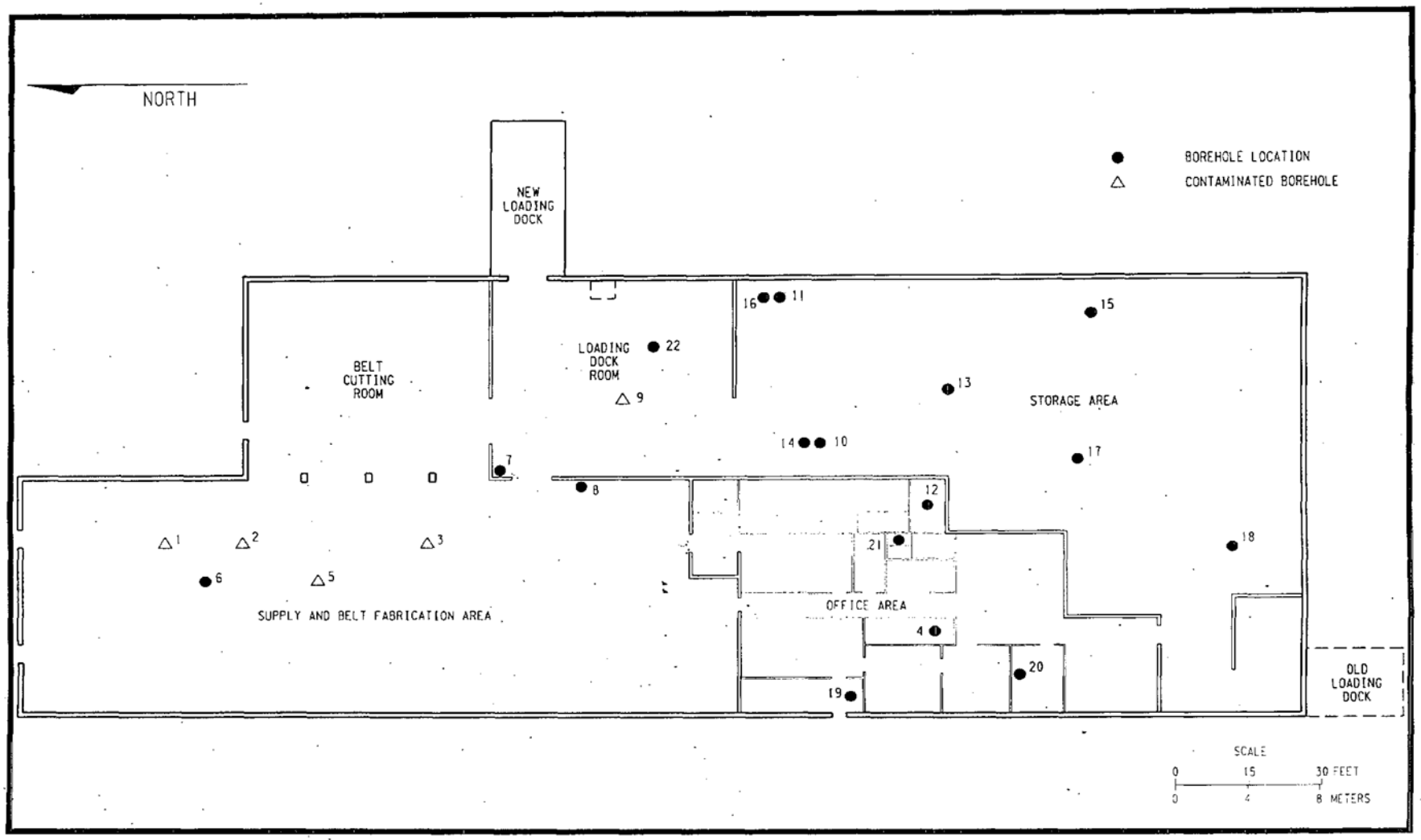


Figure 28-3. Boreholes Drilled During BNI Surveys

Figure 28-4. Springdale, Pennsylvania, Site, September 2005

In addition to excavation, surface decontamination was performed in the loading-dock room and on the base of two cement block columns. A VacuBlast unit (self-contained dustless wet and dry abrasive vacuum system) was used to remove most of the surface contamination in the loading dock room and a grinder and needle gun were used for smaller areas. A total of approximately 915 ft^2 (85 m^2) of surface area was decontaminated in the loading dock room. The two cement block columns at the northern end of the room and the footer between them, which were determined to contain surface contamination, were decontaminated with the grinder and needle gun. Waste from this effort was also placed in intermodal containers and shipped to the licensed disposal facility.

Release Survey

Analytical results for postremedial action surveys indicated that the levels of radioactivity in the remediated areas met applicable DOE cleanup guidelines. The independent verification contractor, ORNL, reviewed the postremedial action surveys and results and determined that the measurements obtained verified that the remediated areas complied with the established DOE guidelines for unrestricted use. No areas of contamination above DOE guidelines remain at the site (BNI 1995).

Independent Verification

Review of BNI survey results by ORNL and the independent radiological-verification survey by ORNL at the former C.H. Schnoor and Company site confirm that the site meets the DOE radiological guidelines for unrestricted use.

Use Restrictions

In accordance with the *Results of the Independent Radiological Verification Survey at the Former C.H. Schnoor and Company Site, 644 Garfield Street, Springdale, Pennsylvania*, "There are no use restrictions at this site. Results of the independent radiological verification survey at the former C.H. Schnoor and Company Site confirm that the residual uranium contamination at the site is below DOE FUSRAP guidelines for unrestricted use" (ORNL 1995).

Assessment of Risk

The scope of LTS at any radiologically contaminated site that has undergone remediation is based on the amount, if any, of residual contamination that remains at the site once remediation is complete. During the transition of a site to LM, DOE performs an independent due-diligence analysis of residual contamination to identify all necessary LTS activities that will be required to ensure long-term protection of human health and the environment. For the transition of the Springdale site, a team from ORNL conducted an independent radiological-verification survey from September to October 1994 to verify that the site was remediated to levels below DOE guidelines for FUSRAP sites.

Results of the independent radiological-verification survey at the Springdale site confirmed that the residual uranium contamination at the site is below DOE FUSRAP guidelines for unrestricted use.

Certification and Regulator Concurrence

A notice of cleanup certification for the site was published in the *Federal Register* on September 12, 1996 (61 FR 48135–48136).

Agreements and Permits

There are no agreements or permits.

28.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Springdale site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Springdale site.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at https://www.energy.gov/lm/articles/springdale-pennsylvania-site-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to the Springdale site.

Monitoring

No monitoring is required at the Springdale site.

Field Operations

There are no field operations required at the Springdale site.

Regulatory Interfaces

No regulatory interfaces are required at the Springdale site.

28.4 References

40 CFR 192. U.S. Environmental Protection Agency, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations*.

61 FR 48135–48136. U.S. Department of Energy, "Notices for Certification of the Radiological Condition of the C.H. Schnoor Site," *Federal Register*, September 12, 1996.

BNI (Bechtel National Inc.), 1995. *Post-Remedial Action Report for the C.H. Schnoor Site, Springdale, Pennsylvania*, DOE/OR/21949-386, Oak Ridge, Tennessee, September.

DOE (U.S. Department of Energy), 1992. *Authorization for Remedial Action at the Former C.H. Schnoor & Company Site, Springdale, Pennsylvania*, memorandum by R.P. Whitfield, Deputy Assistant Secretary for Environmental Restoration, October 8.

DOE (U.S. Department of Energy), 1995. *Certification Docket for the Remedial Action Performed at the C.H. Schnoor Site, Springdale, Pennsylvania, in 1994*, OR-FSRD, November.

DOE Order 458.1 Chg. 4 (Ltd Chg), *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, September 15, 2020.

ORNL (Oak Ridge National Laboratory), 1995. *Results of the Independent Radiological Verification Survey at the Former C.H. Schnoor and Company Site, 644 Garfield Street, Springdale, Pennsylvania* (CVP001), ORNL/RASA-95-1, Oak Ridge, Tennessee, September.

29.0 Toledo, Ohio, Site

29.1 Site Conditions

The Toledo, Ohio, Site (formerly known as the Baker Brothers site) is at 2551–2555 Harleau Place in Toledo at the intersection of Harleau Place and Post Street (Figure 29-1). The site consists of several buildings and grounds situated approximately 0.25 mile east of Interstate 75 and 0.25 mile west of Ohio Route 24.

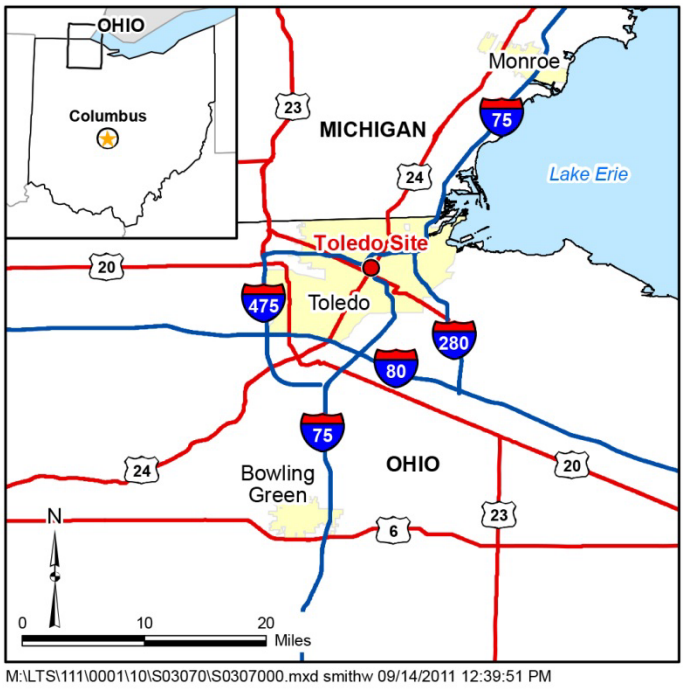


Figure 29-1. Location of the Toledo, Ohio, Site

Under subcontract to the MED, Baker Brothers Inc. machined and shaped natural (neither enriched or depleted) uranium from processed uranium metals for both the Clinton Semi-Works in east Tennessee and the DOE Hanford Site nuclear reactor complex in the state of Washington. The estimated amount of material machined at the Toledo site was between 90 and 300 tons. The primary radioactive material of concern was ^{238}U. After the subcontract with MED was terminated in 1944, the site was decontaminated and determined to be in compliance with guidelines in effect at that time. In 1944, Baker Brothers assets were liquidated, and the property was sold to two independent interests.

When the northern portion of the property was resold in 1992, the new owner contacted DOE and inquired about the radiological status of the property. DOE subsequently learned that soil and debris potentially contaminated with residual uranium had been moved from the site to a 7-acre residential property at 4400 Piehl Road in Ottawa Lake, Michigan, approximately 15 miles northwest of Toledo, for use as fill material. This property comprises one owner-occupied house; a barn; and a small, 0.4-acre pond. The Ottawa Lake property was addressed as a VP of the Toledo site (formerly known as the Ottawa Lake Vicinity Property).

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminant was natural uranium metal.

29.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined the Toledo site to be eligible for FUSRAP in September 1992 (DOE 1992).

Cleanup Criteria

The Toledo site was remediated to criteria in DOE Order 5400.5 (archived), with a site-specific total uranium-in-soil standard of 35 pCi/g (DOE 1994). The guidelines are summarized in Table 29-1.

Table 29-1. Archived DOE Order 5400.5 Surface Contamination Limits

Natural Uranium, ^{235}U, ^{238}U, and Associated Decay Products on Structural Surfaces	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2
Surface Contamination Limit for Beta/Gamma Emitters	
Maximum fixed	15,000 dpm/100 cm^2
Average fixed	5,000 dpm/100 cm^2
Maximum removable	1,000 dpm/100 cm^2

Note:
Where surface contamination by both alpha and beta/gamma-emitting nuclides exists, the limits established for alpha and beta/gamma-emitting nuclides should apply independently.

Remedial Action

Areas of the Toledo site requiring remediation were (1) the south building floors, shelves, concrete floors, and a manhole cover; (2) north building floors, walls, overhead structures, and portions beneath the concrete floor; and (3) exterior soil, concrete bins, courtyard walls, a concrete pad, and manholes. Remediation took place between April and September 1995.

Remediation techniques used in the areas included HEPA-filtered vacuuming, use of hand tools, mechanical shot blasting, mechanical grinding, cutting with pneumatic-powered saws, demolition, and excavation. Approximately 356 yd^3 of low-activity radiological waste and 5 yd^3 of mixed waste were generated from the Toledo site and shipped to a licensed disposal facility in Clive, Utah.

The Ottawa Lake Vicinity Property remediation took place between October 1994 and January 1995. Radioactively contaminated soil and debris were excavated using earth-moving equipment. This material was removed manually in places where access was limited. Main areas of contamination included an area south (the front) and east of the house, a 6-foot-high and

50-foot-long, L-shaped berm northwest of the house, and isolated spots, mostly near the berm. Approximately 1920 yd^3 of contaminated material—including soils, gravel, asphalt, concrete debris, grass, roots, stumps, and shrubbery—were removed and transported for disposal at the licensed disposal facility in Clive, Utah.

After remediation at the Toledo site, the maximum total uranium concentration in soil was less than the authorized limit. Maximum beta-gamma and alpha emitter surface activities were less than the authorized limits, and most measurements were at background levels. Gamma radiation exposure rates also were less than the authorized limit in exterior areas.

After remediation at the Ottawa Lake Vicinity Property, the maximum total uranium concentration in soil was less than the authorized limit. The maximum gamma radiation exposure rate was at background levels.

Release Survey

In accordance with the *Post-Remedial Action Report for the Former Baker Brothers, Inc. Site, Toledo, Ohio* (DOE 1997) and the *Post-Remedial Action Report for the Baker Brothers Vicinity Property in Ottawa Lake, Michigan* (DOE 1996a), the postremedial action survey data indicated that the radiological condition of the site is in compliance with applicable DOE standards and guidelines for the cleanup of residual radioactive contamination.

Independent Verification

The results of the independent verification survey of the site demonstrate that all contaminated areas have been remediated to radionuclide concentrations and activity levels below the applicable guidelines set by DOE and were documented by ORNL in two separate reports: the *Verification Survey of the Former Baker Brothers, Inc., Toledo, Ohio* (ORISE 1996) and *Results of the Independent Radiological Verification Survey at 4400 Piehl Road, Ottawa Lake, MI* (DOE 1996b).

Use Restrictions

There are no use restrictions at the Toledo site.

Assessment of Risk

Because the site was remediated to the conservative dose-based standards of DOE Order 5400.5 (archived), there was no site-specific risk assessment performed.

Certification of Regulator Concurrence

A notice of cleanup certification for the site was published in the *Federal Register* on August 24, 2001 (66 FR 5019).

Agreements and Permits

There are no agreements or permits.

29.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Toledo site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Toledo site.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at https://www.energy.gov/lm/toledo-ohio-site-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to the Toledo site.

Monitoring

No monitoring is required at the Toledo site.

Field Operations

There are no field operations required at the Toledo site.

Regulatory Interfaces

No regulatory interfaces are required at the Toledo site.

29.4 References

66 FR 5019. U.S. Department of Energy, "Notice of Certification," *Federal Register*, August 24, 2001.

DOE (U.S. Department of Energy), 1992. *Authorization for Remedial Action at the Former Baker Brothers, Inc., Site, Toledo, Ohio*, memorandum by J. Wagoner Director Division of Off-site Programs, September 25.

DOE (U.S. Department of Energy), 1994. *Uranium Guidelines for the Ottawa Lake, Michigan, Vicinity Property*, memorandum by J. Wagoner, November 24.

DOE (U.S. Department of Energy), 1996a. *Post-Remedial Action Report for the Baker Brothers Vicinity Property in Ottawa Lake, Michigan*, DOE/OR/21949-392, prepared by Bechtel National Inc., July.

DOE (U.S. Department of Energy), 1996b. *Results of the Independent Radiological Verification Survey at 4400 Piehl Road, Ottawa Lake, MI*, ORNL/RASA-95/16, prepared by Oak Ridge National Laboratory, April.

DOE (U.S. Department of Energy), 1997. *Post-Remedial Action Report for the Former Baker Brothers Site*, *Toledo, Ohio*, DOE/OR/21949-402, prepared by Bechtel National Inc., February.

DOE Order 458.1 Chg 4 (LtdChg), *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, September 15, 2020.

ORISE (Oak Ridge Institute for Science and Education), 1996. *Verification Survey of the Former Baker Brothers, Inc., Toledo, Ohio*, prepared for the U.S. Department of Energy, December.

30.0 Tonawanda, New York, Site

30.1 Site Conditions

The Tonawanda, New York, Site is a privately owned facility at 175 East Park Drive in the town of Tonawanda, Erie County, New York (Figure 30-1).

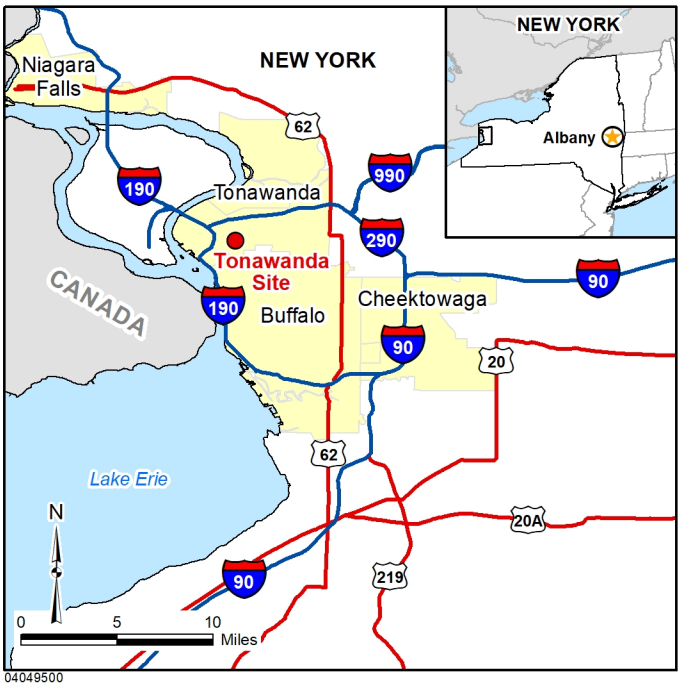


Figure 30-1. Location of the Tonawanda, New York, Site

From 1942 to 1946, portions of the Tonawanda site formerly owned by Linde Air Products Co. (Linde), a subsidiary of Union Carbide Industrial Gases Inc., were used for uranium ore processing under contract with the MED. The processing and disposal activities resulted in elevated levels of radionuclides in portions of the property and buildings. Subsequent disposal and relocation of processing wastes from the site resulted in elevated levels of radionuclides at three nearby properties in the town of Tonawanda: the Seaway Site and Tonawanda North Units 1 and 2 (USACE 2015). The liquid waste was discharged into storm sewers, sanitary sewers, and onsite injection wells on the Tonawanda site (The Aerospace Corporation 1981).

A three-step process was used to separate uranium from the uranium ores and tailings: in Step I, ores and occasional residues (from Step II operations and other MED processes) were processed to produce uranium trioxide (or orange oxide); in Step II, uranium trioxide was converted to uranium dioxide (or brown oxide); and in Step III, uranium dioxide was converted to uranium tetrafluoride (or green salt). Residues from Steps II and III were recycled, whereas Step I produced large amounts of liquid and solid residue (USACE 2004).

The Tonawanda site is currently an active industrial facility owned and operated by Praxair Inc. A merger between Praxair and German-based Linde was completed in November 2018 and the

combined company adopted the Linde name. However, until completion of necessary divestitures, the companies were required to operate as separate and independent companies. The Linde website indicates that divesture was completed in March 2019 and the company has fully integrated its business. It has been verified that the property owner was still listed as Praxair Inc. in county records as of February 2023. The property contains several buildings, including warehouses, fabrication buildings, storage areas, and parking lots.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were ^{226}Ra, ^{230}Th, total uranium (made up of ^{234}U, ^{235}U, and ^{238}U), and their decay products.

30.2 Remedial Action

FUSRAP Eligibility Determination

The Tonawanda site was designated for remedial action under FUSRAP in 1980 (DOE 1980).

Cleanup Criteria

The Tonawanda site was remediated to cleanup criteria outlined in the ROD documents for ^{226}Ra, ^{230}Th, and total uranium (^{234}U, ^{235}U, and ^{238}U). The DCGLs, based on a construction worker exposure scenario, as stated in the soils ROD (USACE 2000) are shown in Table 30-1.

Table 30-1. Tonawanda Site Soil Remediation Goals

Constituent	Background (pCi/g)	Soil Remediation Goal (pCi/g) (averaged over 100 m^2)		Soil Remediation Goal (pCi/g) (at any location)
		Surface	Subsurface	
^{226}Ra	1.1	5[a]	15[a]	N/A
^{230}Th	1.4	14[b]	44[b]	N/A
Total U	6.1	554[b,c]	3021[b,c]	600
^{238}U (surrogate for total U)	3.1	262[c]	1429[c]	293

Notes:
[a] Requirement specified in 40 CFR 192 and 10 CFR 40 Appendix A.
[b] Derived based on a dose limit of 8.8 mrem/yr for surface soil contamination and 4.1 mrem/yr for subsurface soil contamination for an industrial worker scenario.
[c] Based on isotopic composition of natural uranium.

Abbreviations:
N/A = not applicable
U = uranium

Remedial Action

There were three OUs identified for the Tonawanda site: a Soil OU, a Building 14 OU, and a Groundwater OU.

The Soil OU included surface and subsurface soil and building surfaces and infrastructure, but not Building 14 or the soil below Building 14. The selected remedy for cleanup was excavation

and offsite disposal. Site remediation began in 1999 and continued into 2013. The remedy included excavating contaminated soil, building surfaces, and infrastructure and offsite transportation and disposal at licensed disposal facilities.

The Building 14 OU includes Building 14 and the soil beneath Building 14. The selected remedy for cleanup was removal and offsite disposal. Removal of Building 14 and the associated soil began in 2004 and continued into 2005. The remedy included excavating contaminated soil, building surfaces, and infrastructure and offsite transportation and disposal at a licensed disposal facility. As part of this remedial action, the utility tunnel beneath Building 14 was relocated to allow for removal of contamination within and around the tunnel structure. Building components and soil under the building were surveyed to ensure that all remaining material and soil met site remediation goals.

For the Groundwater OU, USACE concluded a no-action remedy allowing for unrestricted conditions for the Groundwater OU at the Tonawanda site based on the conclusion that there were no complete pathways to human or environmental receptors existing for current or future exposure to FUSRAP-eligible constituents in affected groundwater.

Release Survey

The soil and structures at the Tonawanda site were verified at levels that allow for release without restrictions (USACE 2015).

No CERCLA action was warranted for groundwater at the Tonawanda site because there were no completed exposure pathways to human or environmental receptors. A no-action remedy was selected that allowed for unrestricted conditions for the groundwater at the Tonawanda site.

Independent Verification

ANL performed an independent review of the gamma walkover data, including mapping and plotting verifications. New York State Department of Environmental Conservation (NYSDEC) also conducted verification gamma scans. In accordance with the site closure report, USACE and NYSDEC gamma scans were based on professional judgment and the nature and extent of contamination in that area. Any anomalies, elevated areas, or discrepancies in the data were investigated and resolved. Concurrence was received from all parties before USACE approval to backfill an excavation (USACE 2015).

Use Restrictions

No land use restrictions are required at the site since the implemented remedy resulted in FUSRAP-eligible residuals at levels that allow for unlimited exposure and unrestricted use (USACE 2015). The reasonably anticipated future land use of the Tonawanda site will be for commercial/industrial purposes.

Assessment of Risk

The postremediation radiological dose assessment was performed to determine the potential radiation doses under two scenarios, one for a commercial/industrial worker and one for a construction worker. The estimated annual radiation dose rates for the commercial/industrial

worker and construction worker were determined to be 2.03 and 0.50 mrem/yr, respectively, which both meet the derived benchmark dose of 8.8 mrem/yr for surface cleanups and 4.1 mrem/yr for subsurface cleanups.

Certification and Regulator Concurrence

In 2017, NYSDEC distributed letters to four of the Tonawanda site property owners stating that NYSDEC did not agree with the USACE cleanup criteria and that limited subsurface contamination remained on these properties above the state's criteria. The letters stated that the material presents no significant health risk as it currently exists but that there might be a risk if intrusive activities are performed. The letters also stated that the waste is regulated under Title 6 *New York Codes, Rules and Regulations* Part 380-1.2(b) (6 NYCRR 380-1.2[b]). It was stated in the March 1, 2018, quarterly LM/USACE Buffalo District meeting that neither NYSDEC nor the property owners have contacted USACE about any of the properties discussed in the letters. There have been no inquires to LM since site transfer.

Agreements and Permits

There are no agreements or permits.

30.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Tonawanda site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Tonawanda site.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at https://www.energy.gov/lm/articles/tonawanda-new-york-site-fact-sheet.

Desktop Assessment

The desktop assessment is applicable to the Tonawanda site. For sites that were released for unrestricted use and that contain supplemental limits areas, DOE will conduct annual data verification to ensure that land usage is consistent with the site certification land use in accordance with the remedy and determine if a site visit is necessary.

Although the Tonawanda site does not contain supplemental limits, a desktop assessment is conducted to verify that land use remains industrial as a protective measure.

Every 5 years after March 31, 2017, LM will perform a site assessment summary. The assessment summary will compile the results of the previous 5 years of annual desktop assessments as listed above. This assessment is designed to meet the intent of oversight on a CERCLA site (EPA 2001). The latest site assessment summary was prepared in February 2022.

Monitoring

No monitoring is required at the Tonawanda site.

Field Operations

No system operations are required at the Tonawanda site.

Regulatory Interfaces

No regulatory interfaces are required at the Tonawanda site.

30.4 References

6 NYCRR Part 380-1.2(b). "Prevent and Control of Environmental Pollution by Radioactive Materials," *New York Codes, Rules, and Regulations*.

DOE (U.S. Department of Energy), 1980. *Notification of Need for Some Form of Remedial Action – Linde Air Products Division, Union Carbide Corporation, Tonawanda, New York*, February.

EPA (U.S. Environmental Protection Agency), 2001. *Comprehensive Five-Year Review Guidance*, OSWER No. 9355.7-03B-P, June.

The Aerospace Corporation, 1981. *Evaluation of the 1943-to-1946 Liquid Effluent Discharge from the Linde Aire Products Company Ceramics Plant*, prepared for the Office of Operational Safety, U.S. Department of Energy, December.

USACE (U.S. Army Corps of Engineers), 2000. *Record of Decision for the Linde Site, Tonawanda, New York*, Buffalo District Office, March.

USACE (U.S. Army Corps of Engineers), 2004. *Feasibility Study Report for the Groundwater Operable Unit, Linde Site, Tonawanda, New York*, Buffalo District Office, October.

USACE (U.S. Army Corps of Engineers), 2015. *Site Closeout Report for the Linde FUSRAP Site, Tonawanda, New York*, Buffalo District Office, March.

31.0 Tonawanda North, New York, Site Units 1 and 2

31.1 Site Conditions

The Tonawanda North, New York, Site Units 1 and 2 are in Tonawanda, New York, on New York Highway 266, east of Interstate 190, near the city of Towanda, which is a suburb of Buffalo, New York (Figure 31-1).

Figure 31-1. Location of the Tonawanda North, New York, Site, Units 1 and 2

From 1944 to 1946, approximately 8000 tons of low-grade uranium-ore-processing waste was transported from the Tonawanda site (also known as the Linde site) to a 10-acre area known then as the Haist property, now called Tonawanda North site Unit 1. In 1960, the property was transferred to the Ashland Oil Company for use in the company's oil refinery activities.

The Ashland Oil Company used a portion of what is now Tonawanda North site Unit 1, as a landfill for the disposal of general plant refuse and industrial and chemical by-products. In 1974, the Ashland Oil Company constructed a drainage ditch and a bermed area for two petroleum product storage tanks on Tonawanda North site Unit 1. Soil removed during construction contained radioactive residues, and the Ashland Oil Company transported the contaminated materials to the Seaway Landfill and Ashland Oil No. 2 sites for disposal. In 1982, Ashland Oil closed the industrial landfill and covered it with clay and soil; the property became covered with grass and shrubs over time.

The primary radioactive materials at the Ashland Oil No. 1 and No. 2 sites were ^{238}U, ^{226}Ra, ^{230}Th, and their decay products. Some chemical residues from MED activities were also present. In 1984, DOE determined that the site was eligible for cleanup under FUSRAP. A ROD for the

Ashland Oil No. 1, Seaway Area D, and Ashland Oil No. 2 sites was signed on April 20, 1998. Cleanup at the Ashland Oil No. 2 site was completed in 1999; more than 52,000 tons of material were excavated and shipped offsite for disposal. Cleanup at the Ashland Oil No. 1 site was completed in 2003; 173,000 tons of material were excavated and shipped offsite for disposal.

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were ^{226}Ra, ^{230}Th, ^{238}U, and their daughter products.

31.2 Remedial Action

FUSRAP Eligibility Determination

DOE determined that the site was eligible for cleanup under FUSRAP in June 1984 (DOE 1984).

Cleanup Criteria

The *Record of Decision for the Ashland 1 (including Seaway Area D) and Ashland 2 Sites* (USACE 1998) identified standards in 40 CFR 192, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," as ARARs for ^{226}Ra, ^{230}Th, and ^{238}U in soils at the Tonawanda North site Units 1 and 2. On the basis of the selected ARARs, all soil containing more than 40 pCi/g of ^{230}Th was removed; the residual concentrations of the other COCs would then be low enough to ensure compliance with 40 CFR 192 and 10 CFR 20 and be protective of human health and the environment.

Site-specific guidelines for Rattlesnake Creek range from 4.3 to 16 pCi/g for ^{226}Ra, 12 to 46 pCi/g for ^{230}Th, and 350 to 2000 pCi/g for ^{238}U, varying with the size of the remediated area.

Remedial Action

USACE remediated Unit 1 (including Seaway Area D) and Unit 2. Contaminated soil was excavated and shipped offsite for disposal or reprocessed as alternate uranium ore feed material. Remediation of Unit 2 was completed in 1999; more than 52,000 tons of material were excavated and shipped offsite for disposal. Remediation of Unit 1 was completed in 2003, and approximately 173,000 tons of material were excavated and shipped offsite for disposal.

Results of sampling conducted by USACE during cleanup of Unit 1 indicated that historical activities had contaminated portions of nearby Rattlesnake Creek, and additional cleanup would be necessary. An *Explanation of Significant Differences for the Rattlesnake Creek Portion of the Ashland Sites* (USACE 2004), hereafter referred to as the Explanation of Significant Differences (ESD), was issued in 2004 to include Rattlesnake Creek in the Ashland ROD. Remediation of Rattlesnake Creek began in May 2005 and was completed in September 2005. More than 33,000 tons of material were excavated and shipped offsite for disposal.

Figure 31-2 is an aerial view of the site and remediated areas.

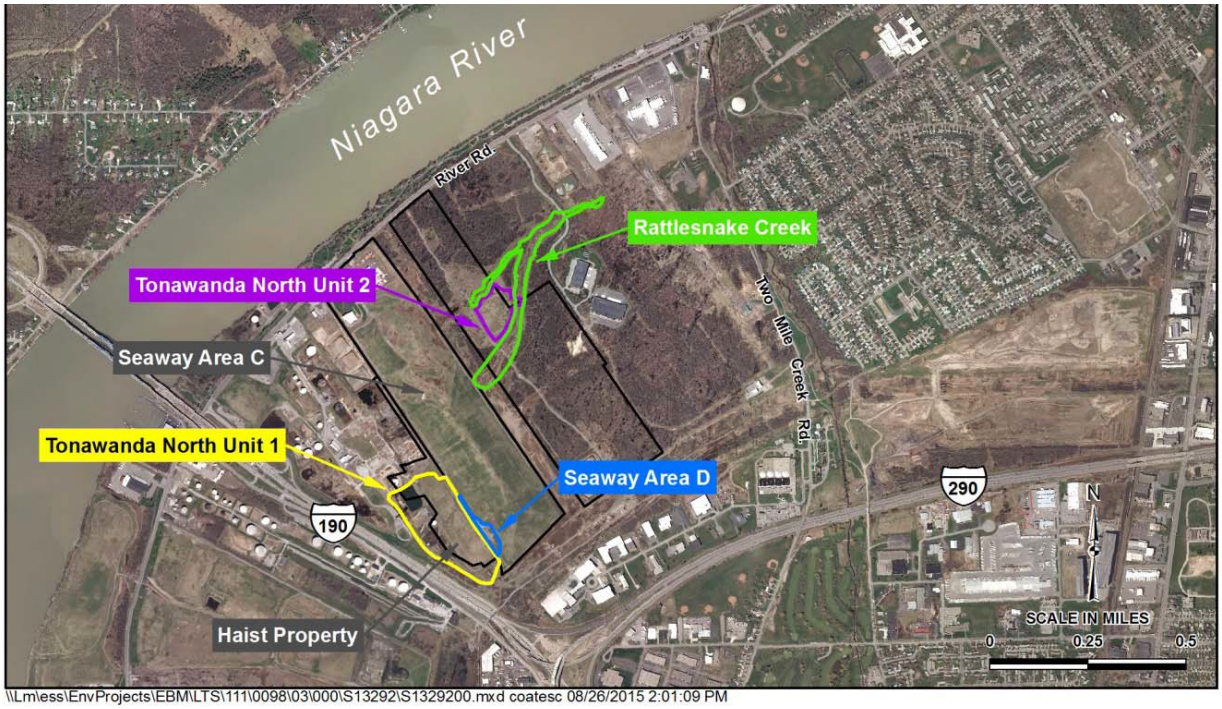


Figure 31-2. Map of the Tonawanda North, New York, Site Units 1 and 2

Release Survey

USACE remediated the contaminated areas to the standards specified in the ROD for Unit 1 (including Seaway Area D) and Unit 2 sites and the ESD for the Rattlesnake Creek portion of the Ashland sites for all pathways of exposure. In accordance with statements made in the *Site Closeout Report for the Ashland 1 (Including Seaway Area D), Ashland 2 and Rattlesnake Creek FUSRAP Sites* (USACE 2006), hereafter referred to as the Site Closeout Report, no further response is needed to protect human health and the environment, and the sites are suitable for unrestricted (urban residential) use.

Independent Verification

No formal independent verification documentation could be identified.

Use Restrictions

There are no use restrictions for urban residential use (i.e., residential use where produce from a home garden is consumed). Because of the above-grade landfill on the adjacent Seaway property, agricultural use is not plausible.

Assessment of Risk

No risk assessment was included in the Site Closeout Report (USACE 2006); however, a dose assessment was included. The results indicated that the residual doses met the requirements of the ROD and ESD.

Certification of Regulator Concurrence

The appropriate regulatory agencies have received the final Site Closeout Report and concurred or acknowledged that the response action has attained the cleanup requirements specified in the ROD and ESD. These signed letters of concurrence are included in the Site Closeout Report (USACE 2006).

Agreements and Permits

There are no agreements or permits.

31.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at Tonawanda North Units 1 and 2. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for Tonawanda North site Units 1 and 2.

Site Fact Sheets

The LM site fact sheet and the LM public webpage will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at
https://www.energy.gov/lm/articles/tonawanda-north-new-york-sites-unit-1-and-2-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to Tonawanda North site Units 1 and 2.

Field Operations

There are no system operations required at Tonawanda North site Units 1 and 2.

Regulatory Interfaces

No regulatory interfaces are required at the Tonawanda North site Units 1 and 2.

31.4 References

10 CFR 20. U.S. Nuclear Regulatory Commission, “Standards for Protection Against Radiation,” *Code of Federal Regulations*.

40 CFR 192. U.S. Environmental Protection Agency, “Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings,” *Code of Federal Regulations*.

DOE (U.S. Department of Energy), 1984. *Authorization for Remedial Action at the Seaway Industrial Park and Ashland Oil Co. (1) Sites at Tonawanda, New York, and Mallinckrodt Chemical Co., St. Louis, Missouri*, memorandum by W. Voigt, June 22.

USACE (U.S. Army Corps of Engineers), 1998. *Record of Decision for the Ashland 1 (including Seaway Area D) and Ashland 2 Sites*, April.

USACE (U.S. Army Corps of Engineers), 2004. *Explanation of Significant Differences for the Rattlesnake Creek Portion of the Ashland Sites*, September 20.

USACE (U.S. Army Corps of Engineers), 2006. *Site Closeout Report for the Ashland 1 (Including Seaway Area D), Ashland 2 and Rattlesnake Creek FUSRAP Sites*, October. (Includes the *Declaration of Response Action Completion & Issuance of the Site Closure Report for Ashland I (including Seaway Area D), Ashland 2, and Rattlesnake Creek,* USACE, signed October 31, 2006 (this report includes regulator letters of concurrence).

32.0 Wayne, New Jersey, Site

32.1 Site Conditions

The Wayne, New Jersey, Site is at 868 Black Oak Ridge Road in Wayne Township, New Jersey, about 20 miles northeast of Newark (Figure 32-1).

Figure 32-1. Location of the Wayne, New Jersey, Site

In 1948, Rare Earths Inc. began processing monazite sand at the Wayne site to extract thorium and rare earths. The Davison Chemical Division of W.R. Grace acquired the site in 1957, and processing activities continued until July 1971, when the plant was closed and the facility licensed by AEC for storage only. In 1974, the property owner performed decontamination activities at the site; buildings were either decontaminated or demolished. The demolition rubble and processing equipment were buried onsite and covered with clean fill.

In 1974, NRC assumed licensing responsibilities formerly held by AEC. In 1975, NRC terminated the storage license following site decommissioning. The site was released without restriction with the only stipulation being that the deed was required to state that radioactive materials were buried onsite (USACE 2012).

The site was proposed for inclusion on the NPL on September 8, 1983, in 48 FR 40674, and then placed on the NPL on September 21, 1984, in 49 FR 37070. In September 1985, ownership of the site transferred from W.R. Grace & Co. to the federal government. In July 1990, DOE signed a Federal Facility Agreement that established cleanup responsibilities under CERCLA.

In March 1998, the original DOE and EPA Federal Facility Agreement was renegotiated between EPA and USACE.

The property is owned by the Township of Wayne and is being used as a public park and dog run called the Family and Friends Park (Figure 32-2). The playground equipment and dog park facilities were installed on the site in 2013.

Figure 32-2. Family and Friends Park at the Wayne Site

FUSRAP-Eligible Contaminants

The FUSRAP-eligible contaminants were ^{226}Ra, ^{232}Th, ^{238}U, and their daughter products.

32.2 Remedial Action

FUSRAP Eligibility Determination

In July 1983, responsibility for the Wayne site was assigned to the DOE by Congress through the Energy and Water Development Appropriations Act of 1984.

Cleanup Criteria

The remedy at the Wayne site and the associated VPs was stated in the *Record of Decision Explanation of Significant Difference for the Wayne Interim Storage Site* (USACE 2003). The following guidelines were provided:

- The maximum permissible concentration of ^{226}Ra and ^{232}Th in soil above background levels averaged over 100 m^3 was 5 pCi/g
- The maximum permissible concentration of total uranium in soil was 100 pCi/g above background

Remedial Action

In 1980, NJDEP requested that an aerial survey be conducted over the Wayne site to determine the radiological conditions. This survey, conducted by EG&G Energy Measurements Group in May 1981, identified elevated radiation levels on the Wayne site and west of the site along Sheffield Brook (DOE 1989).

In 1982, gamma radiation surveys of the Wayne site and the property immediately to the south were performed by the Radiological Site Assessment Program of Oak Ridge Associated Universities. Similar surveys were also conducted by NJDEP. The NJDEP and Oak Ridge Associated Universities surveys indicated surface radionuclide contamination concentrations greater than those acceptable under current DOE remedial action guidelines (DOE 1989).

From 1985 to 1987, DOE conducted removal actions to remove contaminated material from some of the offsite VPs that received contaminants during historical processing operations. The excavated soils and debris were stored on the Wayne site in an interim storage pile because no disposal facilities were available which were licensed or permitted to accept radiological wastes at the time. These actions were outlined in the *Action Description Memorandum (ADM) Review:, Proposed FY 1984 Remedial Actions at Wayne, New Jersey* (DOE 1984).

During 1993, removal actions at the remaining VPs were conducted under the *Engineering Evaluation/Cost Analysis (EE/CA) for the Proposed Removal of Contaminated Materials from Vicinity Properties at the Wayne Site* (DOE 1993). The majority of the waste from the 1993 cleanup actions was shipped directly to a commercial disposal facility. A small amount of contaminated soil from the 1993 cleanup actions was added to the interim storage pile at the site due to offsite waste disposal constraints in effect at the time.

In 1997, the approximately 38,500 yd^3 interim storage pile was removed by DOE and shipped offsite for disposal.

Approximately 41,500 yd^3 of buried contaminated materials within the footprint of the former interim storage pile were removed and shipped offsite for disposal by USACE under a separate CERCLA removal action that began in 1998. This action is documented in the *Engineering Evaluation/Cost Analysis for the Removal of Subsurface Materials at the Wayne Site* (USACE 1998).

In May 2000, EPA and USACE issued the *Record of Decision for the Wayne Interim Storage Site* (USACE 2000), identifying the selected remedy to address the remaining areas at the site.

As a result of this ROD, an additional 55,410 yd^3 of contaminated material and building debris were excavated and disposed of at an offsite licensed disposal facility.

In 2002, USACE began a long-term groundwater monitoring program that continued through 2006.

Preparations for site closeout included a document review that identified two VPs (Pompton Plains Crossroad and Black Oak Ridge Road) in need of additional cleanup. Both had been remediated in the 1980s to criteria that were less stringent than those specified in the ROD (USACE 2000). The additional work was completed under the *Record of Decision Explanation of Significant Difference for the Wayne Interim Storage Site* (USACE 2003) in July and August 2003.

Responsibility for LTS at the Wayne site transferred from USACE to LM in 2007.

In 2009 and 2010, previously inaccessible portions of Pompton Plains Crossroad and Black Oak Ridge Road were made accessible for remediation. The area underwent complete excavation with offsite disposal at US Ecology Idaho in Grand View, Idaho. The analytical data are in the *Construction Close-Out Report for Roadways and Inaccessible Soils* (USACE 2011).

Release Survey

Following the remedial actions at the Wayne site and the associated VPs, USACE reviewed the results of the cleanup actions. In accordance with statements made in the *Final Close-Out Report, W.R. Grace and Co./Wayne Interim Storage Site, Township of Wayne, Passaic County, New Jersey* (USACE 2012), the analytical data demonstrated compliance with the unrestricted use cleanup criteria as set forth in the ROD and, as appropriate, the *New Jersey Administrative Code*.

Independent Verification

No formal independent verification documentation could be identified.

Use Restrictions

There are no use restrictions at the Wayne site. The site was released for unrestricted use.

Assessment of Risk

No risk assessment was included in the *Final Close-Out Report, W.R. Grace and Co./Wayne Interim Storage Site, Township of Wayne, Passaic County, New Jersey* (USACE 2012), also called the Final Close-Out Report; however, references were made to the risk assessment that was included in the 2008 Five-Year Review performed by USACE. According to the Final Close-Out Report (USACE 2012), "the implemented remedy has left all groundwater and soils suitable for use without restriction." Post-excavation soil sampling indicated that the cleanup levels at the site and the VPs had been met. "Attainment of these levels will allow for unrestricted use and unlimited exposure of the properties, as demonstrated in the risk assessment" (USACE 2012).

After 5 years of groundwater monitoring, USACE determined that all groundwater monitoring requirements set forth in the ROD had been met.

Certification of Regulator Concurrence

Because the Wayne site was an NPL site, all activities were coordinated with EPA. EPA had signature authority on the Final Close-Out Report, which stated that it "has determined that no further response action is necessary at the Site to protect human health and the environment."

Agreements and Permits

There are no agreements or permits.

32.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Wayne site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

USACE began a long-term groundwater monitoring program in 2002 that continued through 2006. Results of the groundwater monitoring indicated that the groundwater quality had not degraded, and the groundwater use restriction was removed in 2012 when EPA delisted the site from the NPL. There are no institutional controls in place for the Wayne site.

Site Fact Sheets

The LM site fact sheet and the LM public website will be maintained and updated as required by changes in site conditions.

The LM site fact sheet can be found at
https://www.energy.gov/lm/articles/wayne-new-jersey-site-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to the Wayne site.

Monitoring

No monitoring is required at the Wayne site.

Field Operations

There are no field operations required at the Wayne site.

Regulatory Interfaces

No regulatory interfaces are required at the Wayne site.

32.4 References

48 FR 40674. U.S. Environmental Protection Agency, "Amendment to National Oil and Hazardous Substances Contingency Plan; National Priorities List, Proposed," *Federal Register*, September 8, 1983.

49 FR 37070. U.S. Environmental Protection Agency, "Amendment to National Oil and Hazardous Substances Contingency Plan; National Priorities List, Final," *Federal Register*, September 21, 1984.

DOE (U.S. Department of Energy), 1984. *Action Description Memorandum (ADM) Review: Proposed 1984 Remedial Actions at Wayne, New Jersey,* memorandum by F.E. Coffman, Director Office of Terminal Waste Disposal and Remedial Action August 10.

DOE (U.S. Department of Energy), 1989. *Post-Remedial Action Report for the Wayne Site—1985 and 1987, Wayne, New Jersey*, DOE/OR/20722-88, prepared by Bechtel National Inc., March.

DOE (U.S. Department of Energy), 1993. *Engineering Evaluation/Cost Analysis (EE/CA) for the Proposed Removal of Contaminated Materials from Vicinity Properties at the Wayne Site*, August.

USACE (U.S. Army Corps of Engineers), 1998. *Engineering Evaluation/Cost Analysis for the Removal of Subsurface Materials at the Wayne Site*, March.

USACE (U.S. Army Corps of Engineers), 2000. *Record of Decision for the Wayne Interim Storage Site*, May.

USACE (U.S. Army Corps of Engineers), 2003. *Record of Decision Explanation of Significant Difference for the Wayne Interim Storage Site*, December.

USACE (U.S. Army Corps of Engineers), 2011. *Construction Close-Out Report for Roadways and Inaccessible Soils.*

USACE (U.S. Army Corps of Engineers), 2012. *Final Close-Out Report, W.R. Grace and Co./Wayne Interim Storage Site, Township of Wayne, Passaic County, New Jersey*, April.

33.0 Windsor, Connecticut, Site

33.1 Site Conditions

The Windsor, Connecticut, Site, also known as the Combustion Engineering Site, is a privately owned mixed-use development. The site covers approximately 612 acres. It is at 2000 Day Hill Road, Windsor, Connecticut (see Figure 33-1).

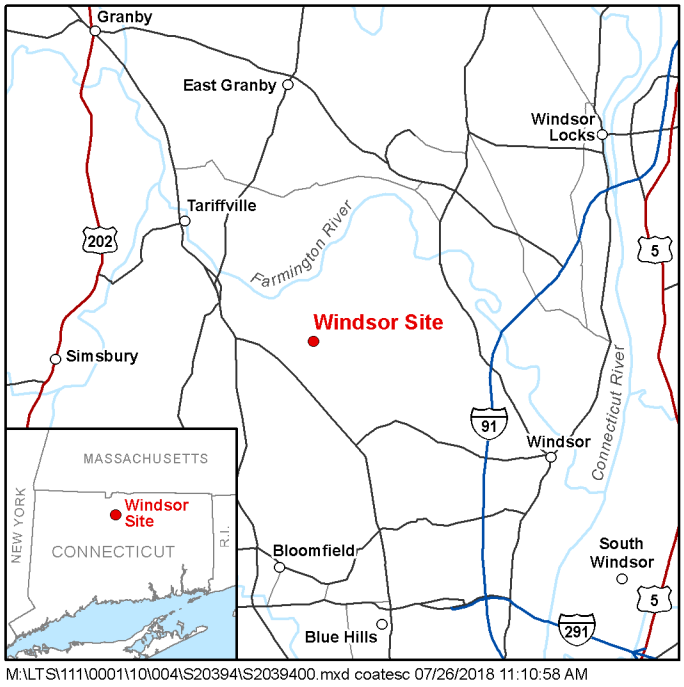


Figure 33-1. Location of the Windsor, Connecticut, Site

The Windsor site is 8 miles north of Hartford, Connecticut, and within 3 miles of the Bradley International Airport. The site is bordered on the south by Day Hill Road, which features agricultural and commercial property. West of the site are commercial properties and a sand and gravel quarry; north of the site is the Windsor/Bloomfield Sanitary Landfill and Recycling Center (Landfill); and east of the site is forested land, as well as residential and commercial properties. The northwest corner of the site is bordered by the Rainbow Reservoir portion of the Farmington River. The nearest residence is approximately 500 ft north of the site in Birchwood, north of the Farmington River.

From 1955 to 1962, under contract to AEC, the Windsor site was used to research, develop, and manufacture nuclear fuel; develop, design, and fabricate fuel element subassemblies for submarines; and construct and operate the S1C test reactor facility for the U.S. Navy.

From the early 1960s to 2000, other non-AEC commercial nuclear fuel operations were performed at the Windsor site, and this caused the FUSRAP-related contaminants to become commingled with and indistinguishable from non-AEC radiological contamination. From 1998 to 2006, additional investigations were performed USACE.

Due to the commingling of the contaminants and the similarities of the materials, and because "cleanup under FUSRAP could result in materials being left in place that would need to be removed later to accommodate NRC sitewide decommissioning criteria," USACE reached an agreement with NRC in August 2007 to allow the owner, ABB Inc., to conduct remediation of the FUSRAP material under the existing NRC license.

Remediation of the FUSRAP areas began in 2009 and was completed in 2011 (Figure 33-2). FSSs of the FUSRAP areas were conducted, and the data were provided to USACE, NRC, and the Connecticut Department of Energy and Environmental Protection (CTDEEP) for concurrence that the areas met the criteria for unrestricted release. NRC License 06-00217-06 was terminated in September 2013.

Figure 33-2. Windsor Site After Remediation, 2016

FUSRAP–Eligible Contaminants

The FUSRAP-eligible contaminants were total uranium, ^{234}U, ^{235}U, ^{238}U, ^{226}Ra, ^{232}Th, and ^{60}Co.

33.2 Remedial Action

FUSRAP Eligibility Determination

The Windsor site was designated for remediation under FUSRAP in June 1994 (DOE 1994).

Cleanup Criteria

The objective was to decommission the site so that it would meet the criteria for an unrestricted use as specified in the License Termination Rule found in 10 CFR 20, Subpart E. The License Termination Rule critical group, defined as "the group of individuals reasonably expected to receive the greatest exposure to residual radioactivity for any applicable set of circumstances," is the construction worker group for the Combustion Engineering site. DOE and NRC require a 25 mrem/yr dose criterion for radiological release for unrestricted use, while Connecticut's Remediation Standard Regulations require a dose limit of 19 mrem/yr. Although the occupational worker was judged the most likely future exposure scenario, the resident farmer was the limiting scenario. As listed in the table below, DCGLs were derived to limit the future potential dose to the resident farmer to 19 mrem/yr (Table 33-1).

Table 33-1. Derived Concentration Guideline Levels

Contaminant	DCGL (pCi/g)
Total uranium	557
Cobalt-60	5.0
Radium-226	5.5
Thorium-232	4.0

Remedial Action

The following AOCs were designated for FUSRAP remediation at the Windsor site. These areas contained highly enriched uranium contamination in soils, sediment, and building surfaces (DOE 2017).

Buildings 3 and 6 (AOC 9)

Building 3 housed the nuclear fuel fabrication facilities where highly enriched uranium, chemicals, and other radiological materials were used, while Building 6 treated radiologically contaminated wastewater from Building 3. Both buildings were decontaminated and demolished from April 2010 to June 2011. The primary objective of the remedial action was to remove subsurface utilities (e.g., the storm drain and sanitary and industrial waste line [IWL] piping) and associated soil in the area that was contaminated above the DCGL.

The Drum Burial Pit (AOC 21)

The Drum Burial Pit was used from 1956 to 1960 to dispose of miscellaneous solid waste materials and contaminated solid wastes generated from radiological processes during the period of contract work for the government. Most of the materials were contained in 55-gallon drums.

Excavation of contaminated soil and debris was performed in a series of excavations from November 2009 to May 2011. The excavated drums varied in condition; some were empty, others were crushed into pieces, and some were fully intact drums containing various quantities of solid or liquid materials. The drums were removed, and the drum contents and underlying

soils were sampled and analyzed for radiological and chemical constituents to characterize the materials for offsite disposal.

Equipment Storage Yard (AOC 10)

The Equipment Storage Yard was used in the mid-1950s to store miscellaneous fill and construction debris. It was designated as a FUSRAP area because it was found to contain highly enriched uranium. The first excavation spanned from December 2009 to October 2010 and removed contaminated materials that were identified during characterization. Buried debris was encountered, including a partially buried drum that required segregation and characterization for offsite disposal. Additional excavation and screening to remove oversized debris and excavate historical fill material to approximate the groundwater table were performed from June to September 2011. Chemical cleanup was completed in October 2011.

Woods Area (AOCs 1 and 4)

The Woods Area was used to store and stage radiologically contaminated materials generated from industrial processes conducted in Buildings 1, 2, 3, 5, 6, 6A, and S1C during the period of contract work for the government. Most of these materials were contained in 55-gallon drums that were stored in the Woods Area before shipment to offsite disposal facilities. Burial of radiologically contaminated materials also occurred in this area. Excavation of the Woods Area was completed from November 2009 to May 2011.

Site Brook (AOC 14) and Debris Piles (AOC 13)

Discharges to the Site Brook included treated sanitary wastewater, industrial wastewater, diluted radioactive wastewater from Building 6, and LLRWs from the S1C facility. Highly enriched uranium was used in industrial processes and was present in the Site Brook floodplain soils and sediment. Uranium levels in the Site Brook were highest at the IWL outfalls, which are near the former wastewater treatment plant. This area also encompasses the Debris Piles between the Site Brook and the former wastewater treatment plant.

Remediation of the Site Brook was performed in segments. The process involved diverting the surface water flow in each segment by way of dewatering pumps, sumps, temporary bladder dams, and diversion piping. After successful diversion, surveys were performed and contaminated sediment and soil removed using small excavation equipment, vacuum equipment, and hand tools. Remediation of the debris piles consisted of complete removal of the surficial debris, along with a few inches of the original ground surface that was exposed following debris removal. Remediation of the IWL outfall areas was accomplished by removing the subsurface piping, manholes, and associated outfall structures. All debris was reduced in size as necessary to comply with the requirements of the offsite disposal facilities.

Industrial Waste Line (AOC12)

The IWL system included two IWLs (installed in 1956 and 1974) and one sanitary line (installed in 1956) that ran in parallel from their origin area near Buildings 3 and 6 to the wastewater treatment plant. Radioactive wastes from Building 3 were discharged to waste dilution tanks in Building 6 and then subsequently to the IWLs installed in 1956. The objective of the remedial actions at the IWLs was to remove the subsurface piping and manholes, the subsurface structure

and utilities associated with the wastewater treatment plant, and any soil or other materials associated with these subsurface structures and utilities found to be above the DCGL.

Remediation of the IWL system was accomplished by removing the subsurface piping and manholes associated with the IWLs and wastewater treatment plant. All debris was reduced in size as necessary to comply with the requirements of the offsite disposal facilities. The overburden soil was stockpiled for later reuse as backfill. This excavation was completed from May to December 2010.

Clamshell Pile

Clamshells were placed in the Site Brook in the late 1950s to buffer the pH of discharged wastewater, including radioactive wastewater. The Clamshell Pile was a mound of soil, sediment, and clamshells that were removed from the streambed of the Site Brook sometime after 1960.

The extent of the excavation of this area was approximately 24 × 44 ft in area and 1.5 to 6 ft in depth (below ground surface). Excavation of the Clamshell Pile was completed in November 2009.

Release Survey

Verification that cleanup criteria for radiological contaminants were achieved in the excavations was performed by conducting an FSS for each AOC in accordance with the *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)* guidance (NRC et al. 2000). The FSS was used to demonstrate that the median radiological concentrations in each survey unit met radiological cleanup levels established for the site. FSS results demonstrated that all survey units met the release criteria for unrestricted release for a resident farmer scenario (USACE 2016).

Independent Verification

Independent verification samples were obtained by CTDEEP.

Use Restrictions

FUSRAP portions of the site were released for unrestricted use based upon a resident farmer scenario.

Assessment of Risk

The site was remediated to levels protective under the unrestricted use scenario for a resident farmer. As presented in Section 33.2 of this chapter, the DCGLs were derived to limit the future potential dose to the resident farmer to 19 mrem/yr (CTDEEP Remediation Standard Regulations). In 2014, EPA revised its recommended protective dose to 12 mrem/yr. The maximum total uranium FSS result from all survey units at Combustion Engineering was 317.9 pCi/g. This corresponds to a potential dose of 10.8 mrem/yr to the resident farmer, which is below both the approved DCGLs and EPA's recommended dose of 12 mrem/yr.

Certification and Regulator Concurrence

During sampling and surveying activities by Combustion Engineering's contractor at the site, controls were implemented to ensure the collection of data of adequate quality and usability to confirm that the project's release levels were met. These controls also ensured that data was verified as authentic, was appropriately documented, and is technically defensible. Quality assurance was achieved through three primary approaches: data management, sample custody, and quality control measurements. In addition, seven FSS reports were submitted to and approved by USACE, NRC, and CTDEEP.

In letters dated June 27, 2013, and July 26, 2013, USACE and CTDEEP stated they had no objection to license termination at the Windsor site.

Agreements and Permits

There are no agreements or permits related to DOE actions at this site.

33.3 LTS Requirements

The following section provides a discussion of the reporting and fieldwork requirements for LTS at the Windsor site. Records generated as part of LTS, such as fact sheets or desktop assessments, will be submitted for permanent retention.

Institutional Controls

There are no institutional controls in place for the Windsor site.

Site Fact Sheets

The LM site fact sheet and LM public webpage will be maintained and updated as required if site conditions change.

The LM site fact sheet can be found at
https://www.energy.gov/lm/articles/windsor-connecticut-site-fact-sheet.

Desktop Assessment

The desktop assessment is not applicable to the Windsor site.

Monitoring

No monitoring is required at the Windsor site.

Field Operations

There are no field operations required at the Windsor site.

Regulatory Interfaces

No regulatory interfaces are required at the Windsor site.

33.4 References

10 CFR 20. U.S. Nuclear Regulatory Commission, "Standards for Protection Against Radiation," *Code of Federal Regulations*.

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DOE (U.S. Department of Energy), 2017. *Site-Specific Transition Plan for the Windsor, Connecticut, FUSRAP Site*, LMS/WIN/S12893, Office of Legacy Management, May.

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USACE (U.S. Army Corps of Engineers), 2016. *Site Closeout Report for the Combustion Engineering Site, Windsor, CT*, December.