

**Progress in Stewardship of the DOE Colonie, New York, Site - 22223**

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**ABSTRACT**

The mission of the US Department of Energy (DOE) Office of Legacy Management (LM) is to fulfill the long-term stewardship responsibilities for 103 sites and protect human health and the environment. The DOE Colonie, New York, Site is a 4.5-hectare (11.2-acre) vacant property that includes 56 commercial and residential vicinity properties that had become contaminated. The site was owned and operated by National Lead Industries from 1937 to 1984 to manufacture nuclear fuel and weapons components using uranium and thorium. Depleted uranium dust, emitted from exhaust stacks, contaminated the site and surrounding vicinity properties. Portions of the site were landfilled with industrial waste and volatile organic compounds that were released to groundwater. The New York State Supreme Court ordered the factory closed in 1984 because of the unpermitted dust emissions. The site was then transferred to DOE for cleanup, and the site was added to the Formerly Utilized Sites Remedial Action Program (FUSRAP). DOE remediated 53 of the 56 vicinity properties and razed the buildings onsite.

The US Army Corps of Engineers (USACE) undertook remedial actions under FUSRAP beginning in 1997. All the vicinity properties have since been remediated, and soil contamination was remediated to residential standards except for three small onsite areas that have residual metals contamination. Those three areas are protected by an environmental easement under an agreement with the New York State Department of Environmental Conservation. The easement requires the use of a site management plan that describes maintenance, monitoring, and notification requirements for the easement areas.

There is a tetrachloroethene (PCE) plume in groundwater beneath the site. USACE investigated the geochemical conditions and determined that the aqueous PCE and its breakdown products are undergoing reductive dechlorination. USACE produced a Record of Decision and selected the remedy of monitored natural attenuation. USACE commenced long-term monitoring of groundwater and estimated that contaminants would degrade to cleanup goals by approximately 2025. The site was transferred to LM in 2019.

To support the organizational mission, LM developed a long-term surveillance and maintenance plan that continues the long-term monitoring, long-term periodic reviews, and use of institutional controls that are specified by the USACE Records of Decision. LM's ultimate goals for the site are to achieve groundwater remedial objectives, maintain institutional controls, support beneficial reuse, and effectively manage site records. These goals are efficiently achieved through a variety of traditional and innovative techniques in consideration of the site's location, conditions, and resources available.

LM performed analyses for monitored natural attenuation parameters and confirmed that reductive dechlorination is continuing. The concentrations of contaminants in the plume continues to decrease. Long-term monitoring will continue until PCE and its breakdown products reach site-specific target cleanup goals. Statistical analysis of contaminant trends indicates that sampling should be done every 2 years. Long-term periodic reviews will take place every 5 years as long as institutional controls are needed. The site is safe for residential use except that groundwater use is prohibited without prior approval and planning for buildings requires investigating for potential vapor intrusion. Digging or gardening in the three easement areas is also prohibited.

LM is utilizing geographic information system (GIS) technology in its ongoing stewardship, and among the more recent developments for the Colonie site are story maps and interactive web maps. In 2019,

coinciding with the Colonie site's transfer from USACE to LM, a public-facing story map was developed to communicate the site's history, remediation status, and ongoing long-term stewardship activities to stakeholders. Shortly after, LM's Enterprise Geospatial Strategy was developed to map out how the organization is to leverage enterprise and web GIS technologies across programs, projects, and sites. Within the FUSRAP program a web application is being developed to connect a program dashboard with site-specific story maps (including one for Colonie), each containing web maps, graphics, summary text, and links to stakeholder resources and key documents for further study. Such tools can improve decision-making, speed analysis, and provide managers, support staff, and contractors with easy access to the information they need. As development continues, LM is also looking into ways of using GIS to improve operational efficiency, streamline site inspections, and improve data collection in the field.

LM is making the site available for reuse through the US General Services Administration. Site records, including the Administrative Record and current long-term monitoring reports, are available on a public webpage. Lessons learned about the site transfer include the value of collaboration with stakeholders and the importance of continuity in the strategy for stewardship.

The work at the Colonie site presents an example of successful, continued protection of human health and the environment between two government agencies. Additionally, LM demonstrates using both traditional and innovative techniques to achieve remedial goals.

## **INTRODUCTION**

The mission of the US Department of Energy (DOE) Office of Legacy Management (LM) is to fulfill the long-term stewardship responsibilities for 103 sites and protect human health and the environment [1]. The Colonie, New York site was formerly a defense contractor's manufacturing facility that had been closed by the state court due to unauthorized emissions of depleted uranium dust. The US Congress assigned the cleanup responsibility to DOE. DOE and the US Army Corps of Engineers (USACE) have worked together to restore the site and vicinity properties for residential or commercial uses.

### **Site Description**

The site is in the town of Colonie and lies on the border of the city of Albany (Figure 1). The site comprises 4.5 hectares (11.2 acres) of federally owned, vacant land (Figure 2). Commercial and municipal properties are on the northern, western, and eastern boundaries of the site. Residential properties are south of the site. Homes and businesses in the area are served by a public water supply.

The site is on relatively flat, slightly rolling terrain. The water table is the Pine Bush Aquifer, which is a lacustrine sand unit that was iteratively blown into dunes. The dunes developed on the bed of the former glacial Lake Albany that extended across eastern New York State [2].

The topographic relief across the site is approximately 4.5 meters (m) [15 feet (ft)]. The land slopes gently from the northwest toward the south-southeast. A steep embankment exists south of the rail lines on the southern site boundary. A creek traverses the site within in a culvert from the northwest to the south.

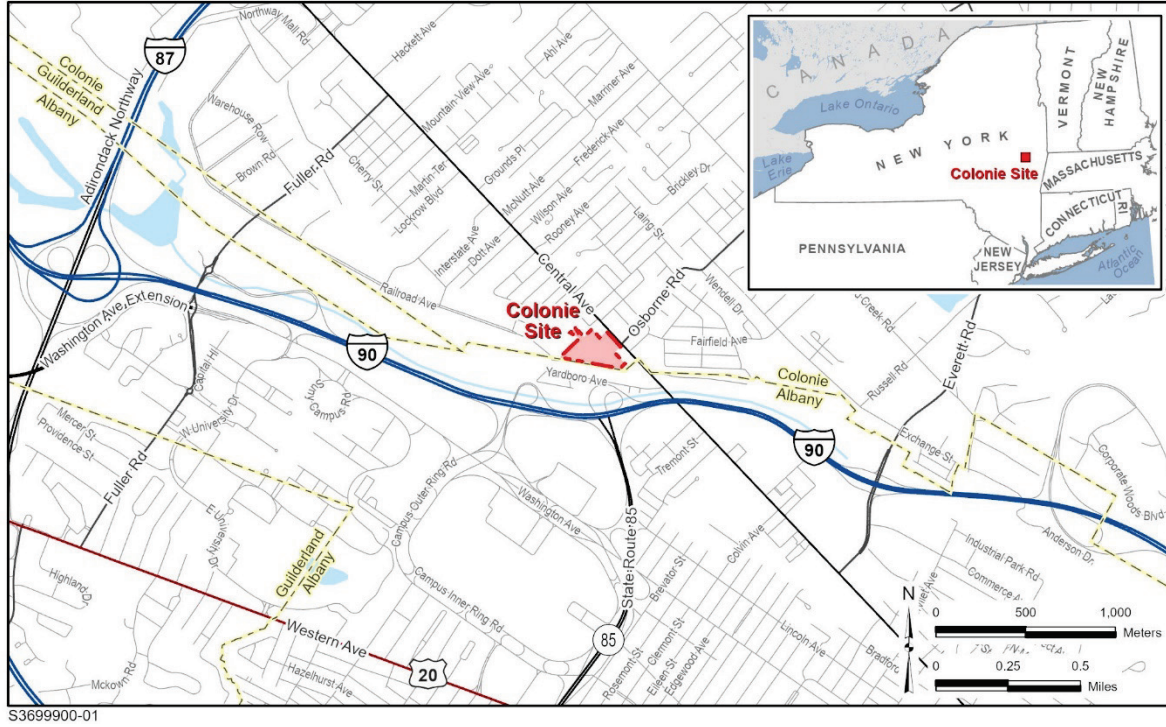


Figure 1: Site Location

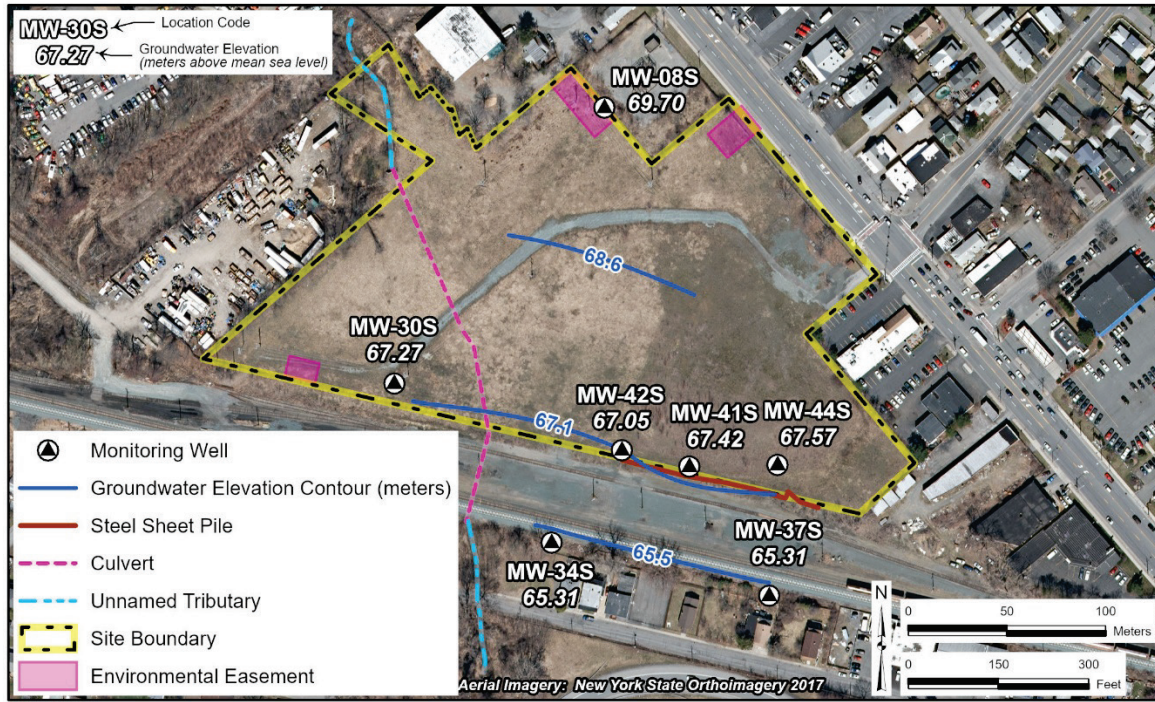


Figure 2: Site Layout

The soil units are shown in Figure 3 and described below, beginning from ground surface:

**Artificial Fill:** This unit consists of fill materials placed at the site at the end of the soil remediation project.

**Dune Sand:** This unit is a fine-grained sand. This unit thins from northwest to southwest across the site and occurs near the ground surface, predominantly above the water table.

**Upper Silt:** This unit consists of lacustrine sandy silt and is the saturated unit that forms the water table aquifer. All the wells on the site are screened in the Upper Silt. The thickness ranges from 4.5 to 6 m (15 to 20 ft). Hydraulic conductivity averages  $5.3 \times 10^{-4}$  centimeters per second.

**Upper Clay:** This unit consists of a varied sequence of clay and silt. The thickness is approximately 3 m (10 ft) across most of the site.

**Lower Silt:** This unit consists predominantly of silt with some clay. The unit is approximately 3 m (10 ft) thick. The Lower Silt was investigated and is not contaminated.

**Lower Clay:** This massive clay is homogenous and is approximately 30 m (100 ft) thick.

### Site History

Industrial activity began at the site in 1923, when a wooden toy company was established. In 1927, a new owner established a brass foundry. In 1937, National Lead purchased the site and continued to operate the brass foundry.

By 1941, National Lead began filling a lake on the western side of the site with used casting sand. The lake was used for additional waste disposal through 1961. The used casting sand contained high concentrations of heavy metals, primarily lead, copper, and arsenic.

In 1958, National Lead began producing items manufactured from uranium and thorium under a license from the US Atomic Energy Commission (AEC). National Lead also held several contracts to manufacture nuclear fuel components. National Lead converted depleted uranium (DU) tetrafluoride to DU metal, which was then fabricated into both commercial and military components [2]. The AEC contract was terminated in 1968, and work at the plant afterward was devoted to fabricating shielding components, aircraft counterweights, and artillery projectiles from DU. Some of the processes produced

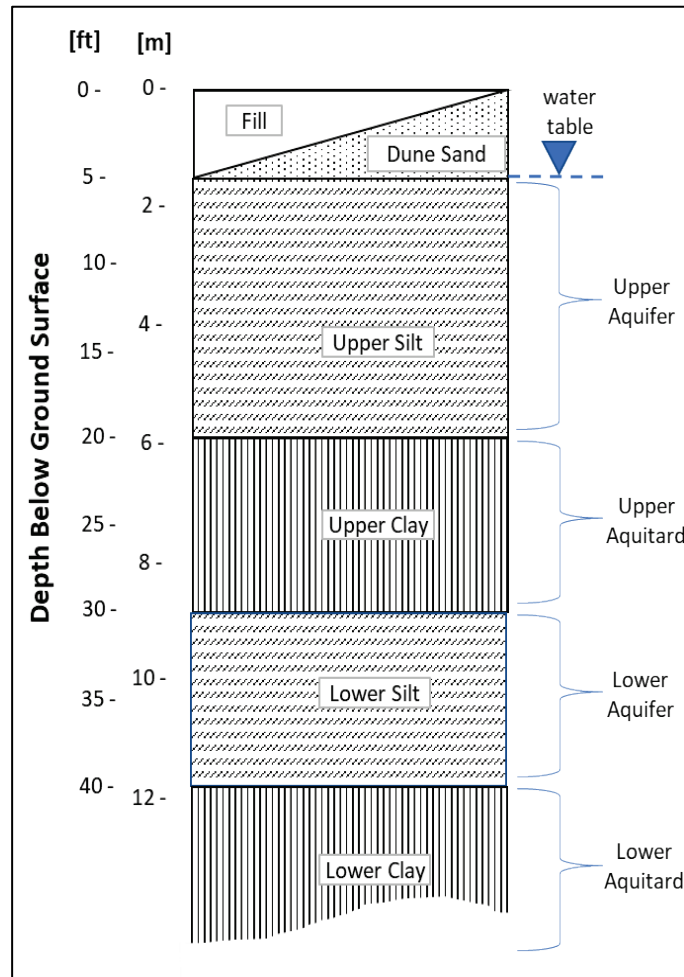


Figure 3: Generalized Cross Section

DU powder as waste. National Lead oxidized these powders in an onsite incinerator, which resulted in aerial emission of DU particulates onto the site and vicinity properties [3]. Operations were terminated by the New York State Supreme Court in 1984 due to the unpermitted air emissions.

### Remedial Actions

Cleanup of the site was assigned to DOE by the US Congress in 1984 [4], and DOE added the site to the Formerly Utilized Sites Remedial Action Program (FUSRAP). DOE performed investigations and removal actions at vicinity properties under the authority granted under the Atomic Energy Act of 1954. In 1998, the US Congress designated the USACE as the lead federal agency for performing FUSRAP cleanups [5]. USACE was directed to use the administrative, procedural, and regulatory provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)[6] and the National Oil and Hazardous Substances Pollution Contingency Plan [7]. The site is not on the US Environmental Protection Agency (EPA) National Priorities List, nor is there a Federal Facility Agreement with EPA. The New York State Department of Environmental Conservation (NYSDEC) takes an active role as the regulator.

USACE divided the site into three operable units (OUs) and conducted a series of remedial investigations and risk assessments using the CERCLA process. After conducting risk assessments and feasibility studies for soil and groundwater, USACE developed final remedies that were documented in Proposed Plans and Records of Decision (RODs), which satisfy the statutory requirements of CERCLA and the NCP. NYSDEC has concurred with all three RODs. The risk-based target cleanup goals (TCGs) for soil and groundwater are shown in Table I. The following paragraphs describe the remedies for each OU.

### Soil Operable Unit

USACE removed all radioactively contaminated soils exceeding the TCGs, regardless of depth, and excavated all accessible metals-contaminated soils exceeding TCGs to a maximum depth of 2.7 m (9 ft) below ground surface. USACE also removed soil where VOCs were encountered. By the end of 2007, USACE completed the removal of 103,401 cubic meters (135,244 cubic yards) of contaminated soil under a Revised Action Memorandum [8]. The excavated soil was replaced with clean fill. The Soil ROD was executed in 2015 [9].

Three small areas ranging from 40 to 113 square meters (437 to 1220 square feet) were inaccessible to excavation due to the presence of utilities and were placed under an environmental easement. In New York, an environmental easement is a form of deed restriction that is regulated under the Environmental Conservation Law Article 71, Title 36. USACE and LM coordinated to produce a site management plan and to emplace the easement. The easement restricts certain land uses within the easement areas. [10]

TABLE I. Target Cleanup Goals

Contaminants of Concern	Target Cleanup Goals
<b>Soil</b>	
Uranium-238	1.3 Bq/g [35 pCi/g]
Thorium-232	0.10 Bq/g [2.8 pCi/g]
Lead	450 mg/kg
Copper	1912 mg/kg
Arsenic	7.4 mg/kg
<b>Groundwater</b>	
Tetrachloroethene (PCE)	5.5 µg/L
Trichloroethene (TCE)	18 µg/L
<i>cis</i> -1,2-dichloroethene (cDCE)	1800 µg/L
Vinyl chloride (VC)	1.4 µg/L

**Abbreviations:** Bq/g = becquerels per gram; mg/kg = milligrams per kilogram; µg/L = micrograms per liter; pCi/g = picocuries per gram

## Groundwater Operable Unit

USACE continued groundwater investigations that were initiated by DOE. Multiple studies were performed to investigate hydrogeologic conditions and evaluate the nature and extent of groundwater contamination. The upper (unconfined) aquifer has been impacted by historical releases of tetrachloroethene (PCE). Sequential dechlorination processes have resulted in concentrations of trichloroethene (TCE), *cis*-1,2-dichloroethene (cDCE), and vinyl chloride (VC). The lower (confined) aquifer was investigated and determined to be uncontaminated. The remedial investigations identified areas of impact beneath the former building and a former lake that had been filled with industrial waste.

The Groundwater ROD was signed in 2010 [2]. Site-specific remedial action objectives were developed (1) to limit exposure of potential future onsite urban residents to volatile organic compounds (VOCs) that could have migrated toward homes via the vapor intrusion pathway and (2) to reduce the concentrations of VOCs in onsite groundwater to levels that are protective of future onsite urban residents who may be exposed to these compounds via the vapor intrusion pathway. The proposed action was implemented to reduce excess cancer risk due to inhalation of vapors intruding into a hypothetical onsite residence to less than 1 in 1 million.

Four chlorinated VOCs have been identified as contaminants of concern (COCs). Radiological COCs no longer need to be monitored. The COCs and their TCGs are summarized in Table I. USACE conducted 16 groundwater sampling events to demonstrate that natural attenuation is occurring. Groundwater contamination levels have consistently decreased after excavation of source zone soils was completed in 2007 [2]. The presence of PCE breakdown products TCE, cDCE, and VC indicates that natural degradation processes are occurring. As a result, monitored natural attenuation (MNA) was considered a viable means of achieving the TCGs [2, 11, 12].

The groundwater remedy of MNA includes a long-term groundwater monitoring program that will continue until natural environmental processes reduce the contamination to concentrations below TCGs [1]. In 2017, based on modeling, USACE estimated that contaminants would achieve the TCGs in 15 years [12].

Both the Soil ROD and the Groundwater ROD require long-term periodic reviews. Those reviews are required after CERCLA corrective actions where hazardous substances continue to exceed the levels that would allow for unlimited use and unrestricted exposure. Long-term periodic reviews are also required under the environmental easement. The *First Five-Year Review Report for Colonie Groundwater Operable Unit* [12] was completed in September 2017, and the first long-term periodic review by LM will be completed in 2022.

## Vicinity Property Operable Unit

DOE remediated 53 VPs from 1984 to 1997, and USACE completed cleanups in the remaining 3 VPs in 2007 [11]. An evaluation of the DOE-remediated VPs was completed in 2012, and additional contaminated soil was removed from one property in 2013. Indoor dust sampling was performed at several VPs in 2014. The Colonie FUSRAP Site Vicinity Property ROD was issued in 2017 [13]. That VP ROD states that no further action is required for the vicinity properties.

## Transfer to DOE

The *Site Closeout Report for the Colonie FUSRAP Site* was finalized by USACE in January 2018 [8]. The Site Closeout Report documents final conditions at the end of the remedial action. The issuance of the Site Closeout Report started the transition process between the USACE and LM.

At the culmination of the transition process, the site was transferred from USACE to DOE in September 2019. The LM FUSRAP long-term stewardship program is guided by the *Program Management Plan for the Formerly Utilized Sites Remedial Action Program* [14].

## **LONG TERM SURVEILLANCE AND MAINTENANCE**

LM is responsible for ensuring that DOE's postclosure responsibilities are met, including long-term monitoring, records management, property management, and beneficial reuse planning. The planning for long term stewardship of the site is detailed in the *Long-Term Surveillance and Maintenance Plan for the Colonie, New York, FUSRAP Site* [15]. DOE performed the first annual site inspection [16] and the first DOE round of groundwater sampling under the long-term monitoring program in July 2020 [17].

LM (or any subsequent owner) is responsible for implementing, reporting on, monitoring, maintaining, and enforcing the institutional controls. LM is the custodian of site records and is responsible for responding to inquiries from the public, NYSDEC, and other stakeholders. Because ownership of the site is no longer needed to fulfill the mission of LM, LM is pursuing transfer of the site for beneficial reuse.

### **Site Maintenance**

Maintenance activities include lawn care, fence repairs, tree trimming, and upkeep of the well network. Observations of site conditions are made during annual inspections. Prior notification is given to the state regulator, and all site assets are inspected, including fencing, gates, signage, wells, and roads. Aside from the upkeep of site assets, the annual inspections are a required institutional control under the environmental easement.

The 4.5 hectare (11.2-acre) site is primarily covered with grass, although there are 0.5 hectare (1.3 acres) of trees, and an unimproved road traverses the site. There is a lawn area along the frontage on the north side that is mowed twice monthly. The grass within the fence line is mowed monthly. Well maintenance consists of repairs to surface completions and periodic redevelopment of the wells. The fence and gates are repaired as needed.

### **Long-Term Monitoring**

The monitoring events were conducted in accordance with a long-term monitoring program as required by the Groundwater ROD [2]. The long-term monitoring program has evolved through reductions in the number of monitoring wells, constituents analyzed, groundwater zones monitored, and frequency of sampling based on remedy progress. NYSDEC has concurred with all Colonie groundwater LTM program modifications.

The presence of PCE breakdown products—from PCE to TCE, cDCE, and VC and finally the mineralization of VC in site groundwater—indicates that PCE and its breakdown products are being degraded by reductive dechlorination processes. Redox potentials and dissolved oxygen concentrations show that the groundwater is mildly reducing in the PCE source zone [17].

As of the July 2021 monitoring event, PCE concentrations exceeded the TCG in only one well (MW-41S), as shown in Figure 4. This onsite well near the location of the former building had a PCE concentration of 12.7 µg/L in July 2021 compared to 15 µg/L in July 2020. As shown in , contaminant concentrations continue to decrease over time. TCE and cDCE were well below their respective TCGs, while VC was near the detection limit.

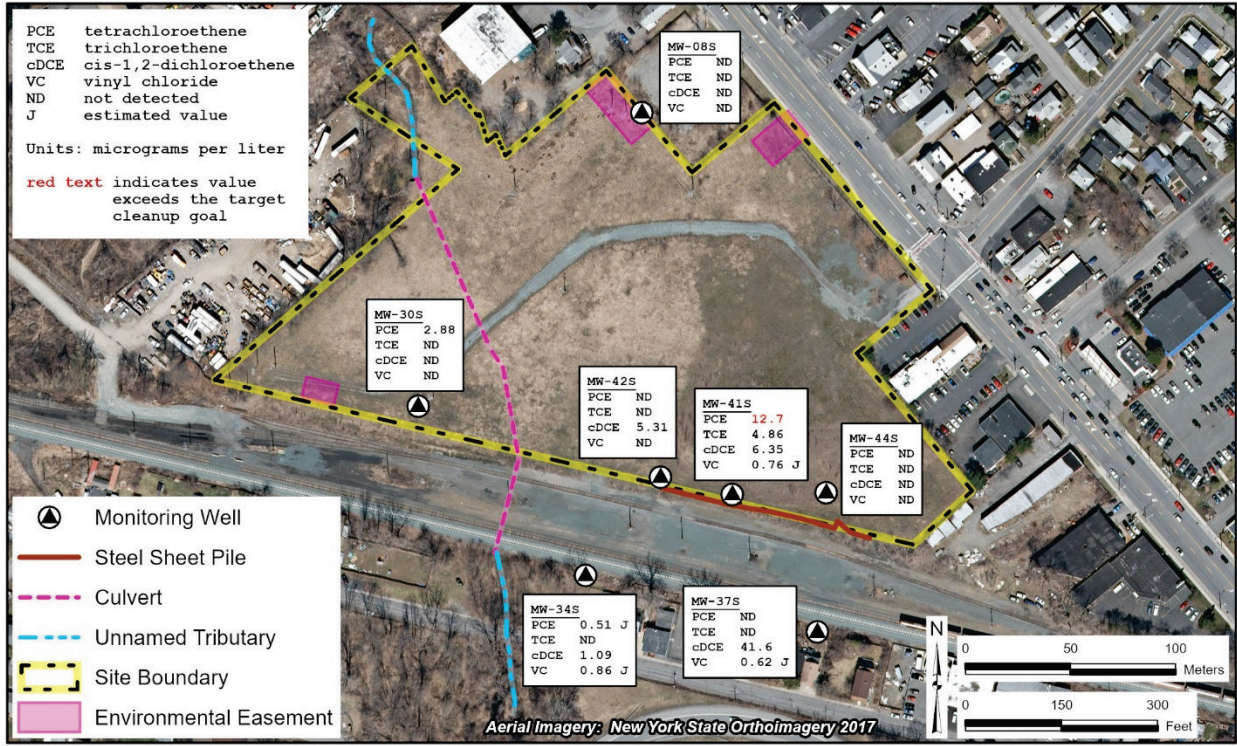


Figure 4: VOC Concentrations, July 2021

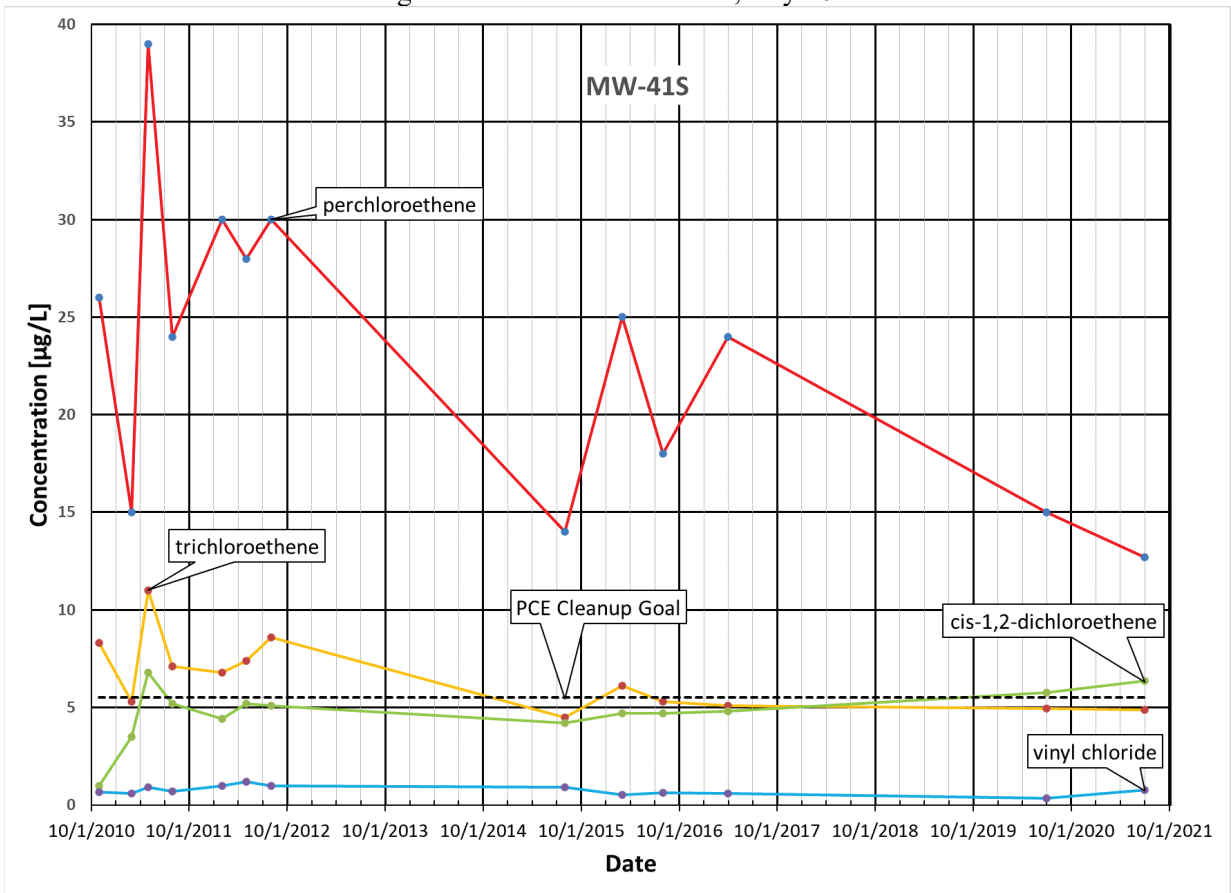


Figure 5: VOCs in Well MW-41S over Time



The Groundwater ROD [2] specifies that the groundwater remedy will be considered complete when compliance has been achieved for all four VOCs with respect to these TCGs at each monitoring well. The environmental easement requires evaluation of the potential for vapor intrusion prior to placement of any buildings, and the use of groundwater is prohibited without prior evaluation and approval by the regulator.

### **Web Application**

LM continues to use geographic information system (GIS) technology as part of its ongoing stewardship of sites, including the Colonie site. In 2019, coinciding with the Colonie site's transfer from USACE to LM, a public-facing story map was developed to communicate the site's history, remediation status, and ongoing long-term stewardship activities to stakeholders. The story map also provides a convenient way to share photos, visualize data, and easily access stakeholder resources and key documents for further study.

USACE maintained the Administrative Record for the cleanup as required by CERCLA. Responsibility for maintaining the Administrative Record was transferred to LM long with the transfer of the site. LM maintains the administrative records for CERCLA cleanups in on-line databases. Links to the story map and to key site documents including the Administrative Record, are on the Colonie webpage at <https://www.energy.gov/lm/colonie-new-york-site>.

Internally, LM is leveraging enterprise and web GIS technologies to support and advance evolving LM missions. Within the FUSRAP program, support staff are developing an interactive program interface whereby both LM site managers and LMS contractor personnel can quickly access and analyze authoritative spatial data, key documents, and other records with the goal of improving decision-making. This application also allows workers to review conditions at multiple sites efficiently and better plan projects and activities. The web application also serves as an educational tool for training new workers about site histories, current conditions, and future stewardship plans.

Other information technologies are being explored with the goal of improving operational efficiency, reducing project costs, streamlining site inspection and sampling events, and efficiently collecting data in the field.

### **Conveyance of the Site**

One of LM's six goals is to "sustainably manage and optimize the use of land and assets" [1]. The intent is to place sites in the most beneficial use while remaining consistent with LM's mission. Where possible, LM makes sites available for government, public, and private use consistent with the tenets of sustainability and good land management practices. LM has reviewed the potential uses of the Colonie site and has determined that DOE ownership of the property is not needed to fulfill DOE's mission, and so the Colonie property has been declared to be excess real property.

Once declared excess by DOE, the property is reported to the US General Services Administration (GSA) Office of Real Property Utilization and Disposal for final disposition. Before making federal property available for disposal, GSA must first offer excess property to other federal agencies that might have a program need for it. If another federal agency identifies a need, the property is transferred to that agency. If there is no need for the property within the federal government, the property is determined to be "surplus." GSA then considers other options for disposal including a review of a variety of public uses to benefit communities.

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In accordance with the McKinney-Vento Homeless Assistance Act, if a property is suitable to assist the homeless, then GSA must first offer the property as a Homeless Conveyance before any other public uses can be considered. The property can be substantially discounted in price if it is used for a qualified public use as a public benefit conveyance.

If a qualified public benefit conveyance cannot be identified for the property, GSA can negotiate a sale at appraised fair market value with a state or local government if the property will be used for a public purpose. This transaction offers state or local governments the right of first refusal on a property before it is offered to the general public. With these types of transfers, the state or local government will either develop the property or make substantial improvements with the intention to resell or lease the land to support and further economic development. To support this type of sale, GSA evaluates whether the benefits to the community are greater than those proceeds recognized under a public sale.

If state and local governments or other eligible nonprofits do not wish or do not qualify to acquire the property, GSA's Office of Real Property Utilization and Disposal can dispose of surplus property via a competitive sale to the public, generally through a sealed bid or auction (oral and online located at <https://disposal.gsa.gov/>). The appraised fair market value is used as a guide to sell federal real property.

The GSA has progressed through each of the alternatives listed above and, as of this writing, GSA will offer the site for sale to the public.

### **CONCLUSIONS**

LM produces a lessons-learned report upon the transfer of a site to LM. The lessons learned from the Colonie transfer included the benefit of close cooperation with the regulator (NYSDEC) and the transferring agency (USACE). USACE and DOE have worked jointly to fulfill the tasks assigned by US Congress and in compliance with federal law to make the Colonie site safe for future residential or commercial use.

The remedies that were selected and initiated by USACE in three RODs have been continued by LM. The institutional controls are being maintained for inaccessible contamination, and the MNA remedy for groundwater is proving to be effective and functioning as anticipated by USACE.

Because DOE ownership of the site is not required to support LM's mission, the site has been made available for use elsewhere through GSA.

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