First Five-Year Review Report

MacKenzie Chemical Works Superfund Site
Central Islip
Suffolk County, New York

Prepared by:

United States Environmental Protection Agency
Region 2
New York, New York

October 2011

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FIGURE/TABLES

Acronyms Used in this Document	
ARAR	Applicable or Relevant and Appropriate Requirement
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FS	Feasibility Study
ISCO	*In-Situ* Chemical Oxidation
ISVE	*In-Situ* Vapor Extraction
MCLs	Maximum Contaminant Levels
µg/l	Micrograms per Liter
NPL	National Priorities List
NYSDEC	New York State Department of Environmental Conservation
O&M	Operation & Maintenance
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager
VOCs	Volatile Organic Compounds

EXECUTIVE SUMMARY

This is the first five-year review for the MacKenzie Chemical Works Superfund site. Currently, the remedy is functioning as intended by the decision documents and is protecting human health and the environment.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name *(from WasteLAN)*: MacKenzie Chemical Works Site		
EPA ID *(from WasteLAN)*: NYD980753420		
Region: 2	**State:** NY	**City/County:** Central Islip/Suffolk County
SITE STATUS		
NPL Status: ■ Final ☐ Deleted ☐ Other (specify)		
Remediation Status (choose all that apply): ☐ Under Construction ■ Operating ☐ Complete		
Multiple OUs? ☐ YES ■ NO	**Construction completion date:** 10/03/06	
Are portions of the site in use or suitable for reuse? ■ YES ☐ NO ☐ N/A		
REVIEW STATUS		
Lead agency: ■ EPA ☐ State ☐ Tribe ☐ Other Federal Agency		
Author name: Mark Granger		
Author title: Remedial Project Manager	**Author affiliation:** EPA	
Review period: 10/03/2006 - 10/03/2011		
Date(s) of site inspection: 06/16/2011		
Type of review: ☐ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only ☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐ Regional Discretion ■ Policy ☐ Statutory		
Review number: ■ 1 (first) ☐ 2 (second) ☐ 3 (third) ☐ Other (specify)		
Triggering action: ☐ Actual RA On-site Construction at OU #1 ☐ Actual RA Start at OU # ■ Construction Completion ☐ Previous Five-Year Review Report ☐ Other (specify)		
Triggering action date *(from WasteLAN)*: 10/03/06		
Due date ***(five years after triggering action date)***: 10/03/11		
Are recommendation(s) and follow-up action(s) included? ☐yes ■no **Acres in use or suitable for use:** **restricted:** 0.4 **unrestricted:** 1		

Five-Year Review Summary Form (continued)

Other Comments on Operation, Maintenance, Monitoring, and Institutional Controls

This site has ongoing operation, maintenance, and monitoring activities as part of the remedy. As was anticipated by the decision documents, these activities are subject to routine modification and adjustment. Table 3 identifies suggestions for improving, modifying and/or adjusting these activities, including the sampling of additional monitoring wells and adjusting the analytical detection level for groundwater.

Issues, Recommendations, and Follow-Up Actions

There are no recommendations or follow-up actions stemming from this five-year review.

Protectiveness Statement

The soil and groundwater remedy at the MacKenzie Chemical Works site is expected to be protective upon completion of the remedy. In the interim, exposure pathways that could result in unacceptable risks are being controlled.

I. Introduction

This five-year review for the MacKenzie Chemical Works site, located in Central Islip, Suffolk County, New York, was conducted by United States Environmental Protection Agency (EPA) Remedial Project Manager (RPM) Mark E. Granger. The review was conducted pursuant to Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, 42 U.S.C. §9601 *et seq.* and 40 CFR 300.430(f)(4)(ii) and in accordance with the Comprehensive Five-Year Review Guidance, OSWER Directive 9355.7-03B-P (June 2001)(the five-year review guidance). The purpose of five-year reviews is to ensure that implemented remedies protect public health and the environment and that they function as intended by the site decision documents. This report will become part of the site file.

In accordance with Section 1.3.2 of the five-year review guidance, a policy five-year review is triggered by the signature date of the preliminary close-out report (PCOR). The trigger for this first five-year review is October 3, 2006, the approval date of the PCOR. This five-year review provides background information, covers the site history, discusses past data-collection efforts along with information collected in the past five years, and re-evaluates risk and remedy protectiveness based on updated assumptions.

The work at the site is being conducted as a single operable unit, which covers on-site surface and subsurface soil and on- and off-property groundwater. This five-year review found that the remedy is functioning as intended and continues to protect human health and the environment.

II. Site Chronology

Table 1 (attached) summarizes the site-related events from discovery to the present.

III. Background

Site Location

The 1.4-acre MacKenzie Chemical Works site is located in a residential/light commercial area. The property originally contained numerous buildings and structures, including three one-story block buildings (a former manufacturing building and two warehouses) and a two-story block building (a former laboratory/warehouse), all of which were removed between 2004 and 2006. The property is bounded to the north by the Long Island Rail Road and commercial properties, to the east by a residential property and an abandoned parking lot, to the south by residential properties, and to the west by Cordello Avenue and an outdoor-furniture warehouse. **Figure 1** (attached) presents the site layout.

Physical Characteristics

The local topography surrounding the site consists of relatively flat terrain with a very slight southerly downward slope (*i.e.*, a difference in elevation of approximately 70 feet over several miles). Subsurface features reportedly included two former concrete-lined waste lagoons (backfilled with clean soils), at least one cesspool, and at least nine storm-water drywells.

Site Geology/Hydrogeology

Surficial geology is comprised of one to two feet of topsoil/fill underlain by the sand and gravel of the upper geologic unit. Depth to groundwater is approximately 50 feet below ground surface (bgs). Local groundwater flow at the site moves south to southeast. No surface water bodies exist at or near the site. There are no streams or stream-cut channels at or near the property. The nearest surface water bodies are Champlin Creek, which is located over a mile south of the property, and the Connetquot River, which is located approximately two miles east of the property.

There are three primary water-bearing aquifers underlying Suffolk County, comprising a federally-designated sole source of drinking water for Long Island. Therefore, groundwater in the vicinity of the site is a potential source of drinking water. The only known private well near or downgradient of the property is located on a residential property that is hydrologically sidegradient. Sampling of this well has shown that it is not impacted by site-related contaminants. The nearest municipal drinking water supply well is located approximately 3,500 feet southeast of the property (well beyond the contaminant plume) and is screened at a depth of 710 feet bgs.

Land and Resource Use

The property, which has been used for industrial/commercial purposes since 1948, is presently zoned industrial. According to the Town of Islip Department of Planning and Development, it is not anticipated that the land use will change in the future.

History of Contamination

The property was used from approximately 1948 to 1987 for the manufacture of various chemical products by MacKenzie Chemical Works, Inc. (MCW), including fuel additives and metal acetylacetonates. Over the years of operation, the Suffolk County Department of Health Services (SCDHS) and the Suffolk County Fire Department documented poor housekeeping and operational procedures at MCW. According to SCDHS, MCW stored 1,2,3-trichloropropane (1,2,3-TCP) in three 10,000-gallon tanks on the property. Other potential historical waste sources include other storage tanks[1], leaking drums, two waste

[1] All tanks associated with MCW operations were decommissioned; most were scrapped in the 1990s.

lagoons, a cesspool, and storm-water drywells. Spills, explosions, and fires occurred at the facility, including a methyl ethyl ketone (MEK) spill in 1977, a nitrous oxide release in 1978, and an MEK fire in 1979. Based on these and other events, SCDHS ordered MCW to perform a general property cleanup, including the excavation and drumming of stained surface soils. This effort was completed in 1979.

Based on a 1983 assessment conducted by EPA, MCW arranged for the disposal of thirty-three drums of stained surface soils (from the 1979 cleanup effort) and twenty-two drums of liquid wastes. MCW operations at the property ceased in 1987. In 1993, SCDHS installed nine downgradient temporary well points in order to assess the horizontal and vertical extent of groundwater contamination. The results of the SCDHS effort indicated the presence of elevated levels of 1,2,3-TCP, tetrachloroethylene (PCE), and trichloroethylene (TCE) in downgradient groundwater. In 1993, the New York State Department of Environmental Conservation (NYSDEC) completed an investigation of the property. The results of the NYSDEC effort indicated the presence of elevated levels of 1,2,3-TCP, PCE, and TCE in on-site soils and groundwater. Semi-volatile organic compounds (SVOCs) were detected in on-site soils.

Initial Response

In January 1998, NYSDEC commenced a remedial investigation and feasibility study (RI/FS) to determine the nature and extent of contamination at and emanating from the property and to identify and evaluate remedial alternatives. Concurrent with this investigation, NYSDEC emptied the two waste lagoons of all soil and sludge materials and backfilled them with clean soils. The excavated material was disposed of at an approved off-site waste disposal facility.

In June 1999, based on the preliminary findings of the RI, NYSDEC requested that EPA take a response action at the property. In response to NYSDEC's request, EPA collected groundwater samples from off property monitoring wells, two municipal supply wells, and one private well in April 2000. Based upon the results of this investigation, EPA concluded that immediate actions were not required, but that remedial actions should be considered to address potential long-term threats. NYSDEC completed the RI/FS in August 2000.

The site was proposed for inclusion on the National Priorities List (NPL) in June 2001; it was listed on the NPL in September 2001.

Because a number of subsequent occupants had reworked the surface of the property since MCW's operations ceased, EPA undertook sampling in July 2002 in order to assess the conditions related to on-property surface soil. Based upon these sample results, an RI/FS report addendum was completed by EPA in January 2003.

Basis for Taking Action

The RI/FS report and RI/FS-report addendum indicated the presence of elevated levels of 1,2,3-TCP, PCE, and TCE in site soils and groundwater. SVOCs were also detected in site soils.

Based upon the groundwater sampling results, it was determined that an approximately 1,500-foot long, 300-foot wide, and 140-foot deep groundwater volatile organic compound (VOC) plume extends in a southeasterly direction from the western portion of the property.

The results of the risk assessment indicate that ingestion of and dermal contact with on-property subsurface soils by future on-property construction and utility workers, ingestion and inhalation of groundwater by hypothetical on-property workers and hypothetical off-property adult and child residents, and inhalation of on-property soil gas by future on property workers pose unacceptable excess cancer risks. The total estimated Hazard Index (HI) values for future on-property construction and utility workers exposed to subsurface soil and ingestion and inhalation of groundwater by hypothetical on-property workers and hypothetical off-property adult and child residents pose a chronic adverse non-cancer health risk to such receptors. Contamination in the surface soil may pose a potential unacceptable risk to burrowing animals that may come into contact with these soils.

IV. Remedial Actions

Remedy Selection

The following remedial action objectives were established for the site:

- Restore groundwater to levels which meet state and federal standards within a reasonable time frame;
- Mitigate the potential for contaminants to migrate from soils and drainage structures on the property into groundwater;
- Mitigate the migration of the affected groundwater; and
- Reduce or eliminate any direct contact, ingestion, or inhalation threat associated with contaminated soil on the property.

Based upon the results of the RI/FS, in March 2003, EPA signed a Record of Decision (ROD), selecting a remedy for the site. The major components of the selected remedy include the following:

- Treatment of the unsaturated soils using thermally-enhanced in-situ soil vapor extraction (ISVE) in on-property source areas which exceed New York State Technical and Administrative Guidance Memorandum No. 94-HWR-4046 (TAGM) levels for VOCs. Post-treatment confirmatory samples will be collected to ensure that all source areas have been effectively treated to the cleanup levels. Off-gases from the ISVE system may need to be treated to meet air-discharge requirements. Soil-vapor monitoring in the treatment areas and in adjacent residential areas will also be conducted, as necessary. Should this monitoring indicate a potential vapor intrusion problem with respect to residences, appropriate actions will be taken.

- Excavation and off-site disposal of approximately 100 cubic yards of SVOC-contaminated soils which exceed TAGM levels for SVOCs. In addition, any contaminated drywell structures, cesspools, and associated piping will also be excavated and disposed of off-site. Confirmatory sampling will be conducted to ensure that all SVOC-contaminated soils above the cleanup levels have been removed. The excavation will be backfilled with certified clean fill.

- Demolition of the laboratory building. The building debris, after decontamination if necessary, will be disposed of off-site.

- Treatment of the contaminated groundwater using air sparging with ozone injection. The exact configuration and number of injection wells will be determined during the design phase. The system will be operated until state and federal groundwater standards are attained. Soil-vapor monitoring will be conducted in the treatment areas, as necessary. Should this monitoring indicate a potential vapor intrusion problem, appropriate actions will be taken.

- Long-term groundwater monitoring in order to verify that the concentrations and the extent of groundwater contaminants are declining, that the remedy remains effective, and that public water supplies are protected. The exact frequency and parameters of sampling and the location of any additional monitoring wells will be determined during the design phase.

- Institutional controls restricting the installation and use of groundwater wells at and downgradient of the property until groundwater quality has been restored. Institutional controls will be in the form of existing restrictions limiting the use of groundwater as a potable or process water, as required by the Suffolk County Department of Health Services and/or NYSDEC.

- Engineering controls, such as fencing and signs, in order to protect the integrity of the remedy and to limit property access until cleanup levels have been attained.

Remedy Implementation

Building Demolition

In August 2004, EPA's contractor, Earth Tech Inc., demolished the laboratory building. To facilitate the implementation of the soil remedy, the remaining buildings were demolished in August 2006. Since their structural integrity was questionable, installing vapor extraction wells to address contaminated soils under the slabs would have presented safety risks to the remediation workers. Metal from the buildings was recycled. Wood and rubble was disposed of in an EPA-approved facility in Suffolk County. None of the debris required decontamination.

Soil Excavation

On August 28, 2006, Earth Tech excavated approximately 20 cubic yards of SVOC-contaminated soils which exceeded the TAGM objectives for SVOCs. The excavated soils were stockpiled. The soils were removed from the site to an EPA-approved facility in Suffolk County.

Soil Remediation

The effectiveness of a conventional ISVE system is dependent on the chemical and physical properties of the contaminants and the soil characteristics. Based on the results of the RI, it was concluded in the ROD that the site's soils would be conducive to vapor extraction. The ROD also concluded that the chemical and physical properties of 1,2,3-TCP suggested that thermal enhancement might be necessary for ISVE to be effective in the contaminant's removal (*i.e.*, heating would make 1,2,3-TCP more volatile).

In October 2003, Earth Tech, Inc. commenced treatability studies related to the ISVE remedy. During the treatability studies, it was determined that thermal enhancement of the ISVE system was not necessary[2]. The ISVE treatability study was completed in December 2004, at which time, full-scale operation commenced.

The ISVE system was expanded in summer 2006 to include contaminated soils around and underlying the slabs of two former on-site buildings (the buildings had been demolished, leaving only the slabs). The expanded system was brought on line on September 13, 2006. There are seventeen soil-vapor extraction wells (four through the building slabs) over a 0.5-acre area. The system is presently operating on a part-time basis (nighttime weekday) as part of an optimization strategy that integrates more efficient contaminant recovery with energy conservation while taking advantage of discounted nighttime electricity rates. A single 2,000-pound vapor-phase granular-activated carbon vessel is used to treat the ISVE effluent.

[2] The noted changes to the remedy were documented in a September 2011 ESD.

Groundwater Remediation

In October 2003, Earth Tech commenced field-scale treatability studies related to the ISCO (*e.g.,* air sparging with ozone injection). Based upon the results of the air sparging and ozone injection treatability study, it was concluded that this particular application of the ISCO technology was insufficient to effectively remediate the groundwater. A bench-scale evaluation of enhancements to the technology was performed, resulting in the proposed deployment of ISCO using persulfate. Treatability studies using persulfate were conducted in the spring of 2006, leading to the full-scale deployment of this technology in August 2006[2]. Injections are accomplished through sixty-eight on-site injection wells and six downgradient injection wells. Three rounds of on-property injections (March 2006, August 2006, and November 2008) have been completed. The August 2006 injection event also included downgradient off-property injections within the plume via OS-3S, OS-3D, OS-7S, and OS-2D **(see Figure 1)**.

Institutional Controls Implementation

Existing SCDHS regulations require new residences and businesses to hook up to public water supplies whenever public water mains are reasonably available. Where such mains are not available, the SCDHS regulations require proposed wells for new residences and businesses to be tested for water quality prior to use. For certain contaminant ranges, appropriate treatment is to be provided. The area affected by site-related contamination has public water mains. Therefore, the institutional controls to restrict the installation and use of groundwater wells at and downgradient of the property until groundwater quality has been restored are in the form of the existing regulations.

Operation and Maintenance

The site is inspected regularly to ensure that secure conditions are maintained and that all facilities (ISVE system, injection well network, monitoring wells, *etc.*) are in proper working order. Monitoring wells at and downgradient from the property are sampled on an annual basis.

The first ISCO injection event occurred in March 2006. At that time, approximately 17,000 gallons of sodium persulfate were injected into 68 injection points. In August 2006, a second ISCO injection event took place. At that time, approximately 17,000 gallons of sodium persulfate solution were injected into seven existing groundwater wells, 32 existing injection points and seven additional Geoprobe injection locations. In November 2008, a third ISCO injection event took place at which time approximately 12,000 gallons of sodium persulfate solution were injected. Another on-site injection event is planned for Fall 2012. While past results indicate that this may be the final injection, the need for subsequent injections will be determined based on the results of this injection event.

The ISVE system ran continuously from its installation until February 2010, when part-time operation began (nighttime weekday). Over the years, there have been several system shutdowns. Some of the shutdowns were due to the system intake of water. The system shuts down automatically when the water level in the knockout tank reaches a certain level. Once the tank is drained, the system can be restarted. Regular draining of the tank prevented the system shutdown from occurring frequently. Another cause of shutdowns was the partial loss of power at the site. This has occurred because of normal outages due to storms and blown transformers due to birds (in most instances, one phase of the three phase power was lost). In these cases, the Long Island Power Authority was notified and rectified the power outage problems within hours of the outages being discovered. During almost all instances of system shutdown, the system was usually off for no longer than a weekend. The system has also been shut down intentionally for general maintenance, during post-ISCO injection periods and during holiday demobilization periods.

All soil vapors are piped through one, 2,500-pound carbon vessel that is filled with 2,000 pounds of vapor-phase activated carbon before being released to the atmosphere. A second 2,500-pound carbon vessel, also filled with activated carbon, acts as a spare unit. Once one vessel is spent (*i.e.,* monitoring results detect breakthrough), the effluent piping can be attached to the spare. As soon as the spare vessel shows signs of becoming spent, the process for a carbon change out will begin. Carbon change outs have occurred on three occasions, approximately every 1.5 to 2 years (December 18, 2006, October 24, 2008, and March 31 2010). In each instance, both vessels were emptied and filled with fresh vapor-phase activated carbon. No reactivated carbon has been used.

The aqueous phase carbon located in the knockout tank effluent carbon vessel has been replaced on a regular basis, depending upon how much water has been pumped out of the knockout tank and through the carbon vessel.

ISVE vacuum, flow, VOC, and other readings have been collected on a biweekly to weekly basis. VOC, oxygen, carbon monoxide, hydrogen sulfide, and lower explosive limit readings are measured directly from the wells. VOCs are measured using a Photoionization Detector (PID) and a Flame Ionization Detector (FID). Prior to use, all instruments are calibrated according to manufacturer's specifications. Average total influent flow rates have been approximately 480 cubic feet per minute. Individual well flows have varied depending on the total number of wells open.

V. Five-Year Review Process

Administrative Components

This is the first five-year review for the site. The five-year review team consisted of Mark Granger (RPM), Louis DiGuardia (OSC), Diana Cutt (hydrogeologist), and Charles Nace (human-health and ecological risk assessor).

Community Involvement

The EPA Community Involvement Coordinator for the MacKenzie Chemical Works site, Cecilia Echols, published a notice in the *Long Island Advance*, a local newspaper, on June 2, 2011, notifying the community of the initiation of the five-year review process. The notice indicated that EPA would be conducting a five-year review of the site to ensure that the site is protective of public health and the environment and that the implemented components of the remedy are functioning as designed. It also indicated that once the five-year review is completed, the results would be made available in the local site repository. In addition, the notice included the RPM's address and telephone number for questions related to the five-year review process or to the MacKenzie Chemical Works site. No questions or comments were received.

Document Review

The documents, data, and information that were reviewed in completing the five-year review are summarized in **Table 2** (attached).

Data Review

The effectiveness of the source treatment was evaluated in July 2011 by comparing baseline and post-treatment soil-sampling results. Baseline soil sampling was performed in 2006 and post-treatment soil sampling was performed in 2009. The evaluation indicated that the source treatment reduced the overall contaminant mass within the source area by greater than 92 percent. Specifically, the data shows substantial reductions of 1,2,3-TCP concentrations throughout the source area. In the 2004 soil-sampling data set, levels of 1,2,3-TCP greater than 5,000 micrograms per kilogram (µg/kg) were common and were encountered as high as 530,000 µg/kg. In the most recent sampling in 2009, the level of 1,2,3-TCP in soil within the source area was above 5,000 µg/kg only from 20 to 24 feet at one location. Concentrations of 1,2-, 1,3-, and 1,4-dichlorobenzene were more commonly encountered in the 2009 sampling than was 1,2,3-TCP, but these constituents were all present at levels below their respective New York State (NYS) Part 375 unrestricted residential soil cleanup objectives. Concentrations of PCE, TCE, and 1,1,1-TCA are not present at levels of concern in source-area soils.

Soil-vapor data has shown a significant drop in 1,2,3-TCP concentrations in the ISVE wells. For example, in 2004, extraction well SVE-3 was shown to have a 1,2,3-TCP concentration of 459,796 micrograms per cubic meter (µg/m^3); this concentration had fallen to 2,300 µg/m^3 by 2009. Concentrations in extraction well SVE-4 fell from a level of 119,427 µg/m^3 in 2004 to a level of 586 µg/m^3 in 2009. Both of these wells are directly in the contaminant source zone.

Concentrations of 1,2,3-TCP in the groundwater in the source area have dropped significantly since the start of the ISVE system and ISCO-injection events. The two most heavily contaminated groundwater monitoring wells were EPA-MW-1 and EPA-MW-2.

1,2,3-TCP levels in EPA-MW-1 fell from 91,000 micrograms per liter (µg/l) in July 2004 to 0.79 µg/l in May 2011. 1,2,3-TCP levels in EPA-MW-2 fell from 59,000 µg/l in July 2004 to non-detect in May 2011 (at a method-detection limit of 0.5 µg/l). The majority of the other on-site wells show 1,2,3-TCP concentrations to be non-detect (at a method-detection limit of 0.5 µg/l). For groundwater downgradient of the source area, data collected in May 2011 indicate the highest current concentration of 1,2,3-TCP to be 71 µg/l in off-site well OS-2D (see **Figure 1**). The ten-foot screen of this well is approximately 150 to 160 feet below ground surface. Concentrations of 1,2,3-TCP have declined to non-detect (at a method-detection limit of 0.5 µg/l) or less than 1 µg/l in all of the downgradient wells closer to the site (the OS-3, OS-6, OS-7, and OS-8 clusters), as has the 1,2,3-TCP concentration in the well further downgradient from well OS-2D (*i.e.,* well OS-4D, screened similarly to OS-2D). With one exception, concentrations of PCE, TCE, and 1,1,1-TCA in groundwater have been substantially less than 10 µg/l for the entire review period (there was a single result for PCE of 13 µg/l in 2009). Similarly, concentrations of 1,2-, 1,3-, and 1,4-dichlorobenzene were substantially less than 10 µg/l for the entire period covered by this review.

EPA conducted soil vapor intrusion evaluations of sixteen residential properties in 2005 and 2006. No 1,2,3-TCP was detected in the subslab soil vapor or indoor air of any of the properties sampled. PCE was detected at very low levels in the subslab soil vapor of several homes. Only one property was found to have PCE in subslab vapor and indoor air at levels that might indicate soil vapor intrusion could be occurring (160 µg/m^3 subslab and 30 µg/m^3 indoor air). EPA determined at the time that since the indoor air concentration of PCE was only slightly greater than concentrations typically found in indoor air (approximately 10 µg/m^3) and was well below the New York State Department of Health Indoor Air Guide value of 100 µg/m^3, no further action was warranted for this structure. EPA also concluded that since the results from this structure were not consistent with data from other structures sampled that were closer to the site, nor with site-related groundwater data, the PCE detected in subslab soil vapor and indoor air were probably not site-related.

Site Inspection

On June 16, 2011, a five-year review-related site inspection was conducted by EPA RPM Mark Granger, along with technical-team members Louis DiGuardia, Diana Cutt, and Charles Nace. Nothing of note was observed during the inspection.

Interviews

No interviews were conducted during the review period.

Institutional Controls Verification

SCDHS regulations require new residences and businesses to connect to public water supplies when public water mains are reasonably available. The area affected by site-related contamination has public water mains.

Other Comments on Operation, Maintenance, and Institutional Controls

This site has ongoing operation, maintenance, and monitoring activities as part of the remedy. As was anticipated by the decision documents, these activities are subject to routine modification and adjustment. **Table 3** summarizes several observations and offers suggestions with which to address them.

VII. Technical Assessment

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

The 2003 ROD, as modified by the 2011 Explanation of Significant Differences (ESD), called for, among other things, the treatment of the VOC-contaminated soils using ISVE; excavation and off-site disposal of approximately 100 cubic yards of SVOC-contaminated soils; demolition, decontamination as necessary, and off-site disposal of the laboratory building; treatment of the contaminated groundwater using in-situ chemical oxidation; long-term groundwater monitoring; institutional controls restricting the installation and use of groundwater wells at and downgradient of the property until groundwater quality has been restored; and engineering controls, such as fencing and signs, in order to protect the integrity of the remedy and to limit property access until cleanup levels have been attained. The implemented remedy is protective by eliminating all potentially complete and hypothetical future exposure pathways.

Since the startup of the ISVE system, approximately 5,500 pounds of VOCs have been removed from soils at the site. Based on initial Summa sampling data, it is estimated that 99% of the VOC material removed by the system was 1,2,3-TCP.

Groundwater and soil sampling results have shown significant drops in the levels of 1,2,3-TCP since the startup of the ISVE system. Based on the monitoring and sampling data, the plume of contamination has also been significantly reduced since the startup of ISVE remediation activities. Concentrations of 1,2,3-TCP in the groundwater in the source area have dropped significantly since the start of the ISVE system and ISCO-injection events. In fact, concentrations of 1,2,3-TCP have declined to non-detect (at a method-detection limit of 0.5 µg/l) or less than 1 µg/l in all on-site and off-site wells, with the exception of OS-2D, where 1,2,3-TCP was reported at 71 µg/l in the most recent sampling event (May 2011). In addition, with one exception, concentrations of PCE, TCE, and 1,1,1-TCA in groundwater have been substantially less than 10 µg/l for the entire review period (there was a single result for PCE of 13 µg/l in 2009).

While the operation of the ISVE system and ISCO injections need to continue, it has been concluded that the remedy is functioning as intended by the ROD, as modified by the ESD, and that groundwater consumption is addressed by existing SCDHS restrictions.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?

The human-health risk assessment conducted for Mackenzie Chemical evaluated exposure to soil from ingestion, inhalation (vapors and dust) and dermal contact, as well as exposure to groundwater from ingestion, dermal contact, and inhalation of vapors for both on-property adult workers, trespassers and construction workers, and off-property residents (adult and child). The exposure pathways, receptors, and exposure assumptions were reviewed as part of this five-year review and they remain valid at this time. The toxicity values in the human-health risk assessment are still valid, although the toxicity value for the primary contaminant of concern, 1,2,3-trichloropropane has become more stringent.

The cleanup goals that were identified in the 2003 ROD were identified as the NYS TAGM values for soil and the Federal and State drinking water standards or State Groundwater Quality Standards for groundwater. The NYS TAGM values for soil have since been replaced with NYS Part 375 values. The cleanup values for the eight chemicals identified in the soil have changed. With the exception of one chemical, Indeno(1,2,3-cd)pyrene (previous TAGM value of 32 mg/kg compared to current NYS Part 375 range of 0.5 to 11 mg/kg), all of the NYS TAGM values fall within the residential, restricted-residential, or commercial values listed in NYS Part 375. However, all of the previous cleanup values for soil fall within the current acceptable EPA risk range. For groundwater, one of the federal maximum contaminant levels (MCLs), arsenic, has changed since the ROD was signed. The previous MCL for arsenic was 50
µg/l and the current MCL is 10 µg/l. Arsenic was identified as a risk driver in the risk assessment, however, it was not identified as a site-related contaminant. Also as indicated above, the EPA toxicity value for 1,2,3-trichloropropane has changed. The previous toxicity value resulted in a range of preliminary remediation goals from 0.0016 µg/l (10^{-6}) to 0.16 µg/l (10^{-4}) while the current toxicity value results in a range of preliminary remediation goals from 0.00072 µg/l (10^{-6}) to 0.072 µg/l (10^{-4}). However, the cleanup goal for 1,2,3-trichloropropane chosen in the 2003 ROD was 0.04 µg/l (based on the NYS Groundwater Quality Standard), which is within the cancer risk range. In addition, while a new toxicity value for TCE was released in September 2011, the toxicity value used in the human-health risk assessment was more stringent than that value. Although some values have changed, all of the previous cleanup goals are within or below EPA acceptable risk range; therefore, the cleanup goals presented in the 2003 ROD are still valid.

The remedial action objectives (RAOs) that were identified are still valid.

EPA conducted soil vapor intrusion evaluations of sixteen residential properties in 2005 and 2006. No 1,2,3-TCP was detected in the subslab soil vapor or indoor air of any of the properties sampled. While a new toxicity value for TCE was released in September 2011 (as noted above), indoor-air values for all residential properties were reported at less than 1 µg/m^3, well below EPA's risk-based screening value. PCE was detected at very low levels in the subslab soil vapor of several homes. Only one property was found to have

PCE in subslab vapor and indoor air at levels that might indicate soil vapor intrusion could be occurring (160 µg/m³ subslab and 30 µg/m³ indoor air). EPA determined at that time that since the indoor air concentration of PCE was only slightly greater than concentrations typically found in indoor air (approximately 10 µg/m³) and was well below the New York State Department of Health Indoor Air Guide value of 100 µg/m³, no further action was warranted for this structure. EPA also concluded that since the results from this structure were not consistent with data from other structures sampled that were closer to the site, nor with site-related groundwater data, the PCE detected in subslab soil vapor and indoor air were probably not site-related.

EPA conducted a screening of ecological risks and concluded that property conditions did not necessitate a quantitative ecological risk assessment. A qualitative ecological evaluation concluded that contamination in the surface soil posed a potential unacceptable risk to burrowing animals that may come into contact with these soils. Since the areas that posed such risks were addressed by the remedial actions that have already been taken at the site, the site no longer poses an ecological risk.

In summary, the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy remain valid.

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

No.

Technical Assessment Summary

Based upon the results of the five-year review, it has been concluded that:

- the remedy is operating as envisioned by the ROD as modified by the ESD.
- no additional measures are needed to protect public health.

VIII. Recommendations and Follow-Up Actions

There are no recommendations or follow-up actions stemming from this five-year review.

IX. Protectiveness Statement

The soil and groundwater remedy at the MacKenzie Chemical Works site is expected to be protective upon completion of the remedy. In the interim, exposure pathways that could result in unacceptable risks are being controlled.

X. Next Review

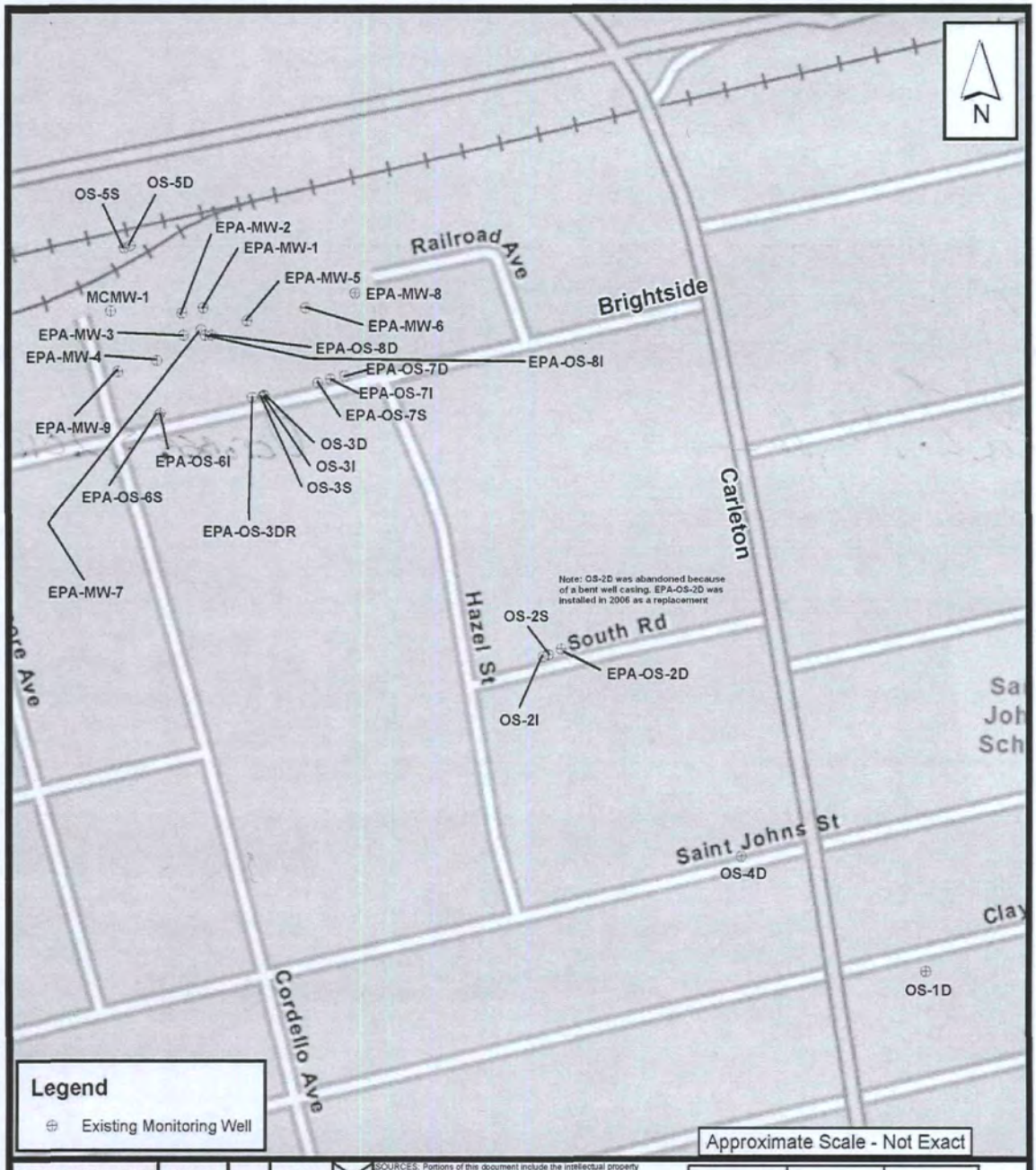
Since hazardous substances, pollutants or contaminants remain at the MacKenzie Chemical Works site which do not allow for unlimited use or unrestricted exposure, in accordance with 40 CFR 300.430 (f) (4) (ii), the remedial action for the site shall be reviewed no less often than every five years. EPA will conduct another five-year review within five years of the signature date below.

Approved:

Walter E. Mugdan, Director
Emergency and Remedial Response Division
EPA – Region 2

October 3, 2011
Date

FIGURE 1



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PROJECT NO.: 33-64-060027					PROJECT MANAGER: JOHN LEE	
PROJECT ID: 3364060027C_001		SCALE: AS SHOWN			PLOT DATE: 12/12/2008	CHK BY: JL	CHK DATE: 12/12/2008
REVISION NO.:	REVISION DATE:	DRAWN BY: JPR			DRN DATE: 12/12/2008	APPVD BY: JL	APPVD DATE: 12/12/2008

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FIGURE 2
MACKENZIE GROUNDWATER WELL LOCATION MAP
MACKENZIE CHEMICAL SITE
CENTRAL ISLIP, SUFFOLK COUNTY, NEW YORK

Table 1: Chronology Of Events	
Date	**Event**
1948 to 1987	Property used for manufacture of chemical products by MacKenzie Chemical Works, Inc. (MCW).
1977-1979	Spills, explosions, and fires occur.
1979	Suffolk County Department of Health Services (SCDHS)-ordered property cleanup completed, including excavation and drumming of stained surface soils.
1987	MCW operations at property cease.
1993	SCDHS installs downgradient temporary well points and samples; results indicate presence of volatile organic compounds (VOCs).
1993	NYSDEC completes an investigation of the property that indicates presence of elevated levels of VOCs and SVOCs in site soils and VOCs in groundwater.
1998	NYSDEC commences remedial investigation and feasibility study (RI/FS). During field work, NYSDEC empties two concrete-lined and intact waste lagoons of all soil and sludge materials and backfills them with clean soils.
1999	NYSDEC requests that EPA take response action at the property.
2000	EPA collects groundwater samples from off-property monitoring wells, two municipal supply wells, and one private well and concludes that immediate actions are not required.
2000	NYSDEC completes RI/FS.
2001	Site included on National Priorities List.
2002-2003	EPA conducts supplemental investigation.
2003	EPA signs ROD.
2003-2004	In-situ vapor extraction treat ability studies performed followed by full-scale operation.
2003-2006	In-situ chemical oxidation treatability studies performed followed by full-scale operation
2004-2006	Building demolition
2006	SVOC-contaminated soils excavation
2006	Groundwater Interim Remedial Action Report approved
2006	Preliminary Close-Out Report approved
2006	First ISCO injection
2006	Second ISCO injection
2008	Third ISCO injection
2006-2011	Ongoing O&M and long-term-monitoring activities

Table 2: Documents, Data, and Information Reviewed in Completing the Five-Year Review	
Document Title, Author	**Submittal Date**
Phase II Investigation (NYSDEC)	1993
Remedial Investigation/Feasibility Study (RI/FS)(NYSDEC)	2000
RI/FS Addendum (EPA)	2003
Record of Decision (EPA)	2003
Preliminary Site Close-Out Report (EPA)	2006
Soil-Vapor Intrusion Data Reports (EPA)	2006
Interim Remedial Action Report For Groundwater (EPA)	2006
Groundwater Data Reports (EPA)	2006 to 2011
Soil Vapor Extraction System Summary Report (WRS Compass)	2010
ISCO Post-Remediation Source-Treatment Investigation (ERT)	2011
Explanation of Significant Differences (EPA)	2011
EPA guidance for conducting five-year reviews and other guidance and regulations to determine if any new Applicable or Relevant and Appropriate Requirements relating to the protectiveness of the remedy have been developed since EPA issued the ROD.	

Table 3: Other Comments on Operation, Maintenance, Monitoring, and Institutional Controls	
Comment	**Suggestion**
Sampling of MacKenzie Chemical Works site wells furthest from the source area should be performed on the same schedule as that currently performed within the MCW monitoring-well network.	Wells OS-4D and OS-1D will be considered for inclusion in the regularly-scheduled sampling.
The current aqueous method detection limit for 1,2,3-TCP is 0.5 µg/l, while the groundwater cleanup criteria is 0.04 µg/l. As groundwater cleans up to below 0.5 µg/l, consideration should be given at the appropriate time to adjusting the detection limit downward.	Consideration will be given to adjusting the detection limit downward at the appropriate time to more accurately reflect the groundwater contaminant level for 1,2,3-TCP.