Third Five-Year Review Report
for
Hyde Park Landfill Superfund Site
Niagara County
Niagara Falls, New York

Prepared by:

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

September 2006

Third Five-Year Review Report
Hyde Park Landfill Superfund Site

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List of Acronyms

APL	Aqueous Phase Leachate
CIC	Community Involvement Coordinator
EDD	Enforcement Decision Document (precursor of ROD)
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
NAPL	Nonaqueous Phase Leachate
NPL	National Priorities List
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
MCL	Maximum Contaminant Level
PRP	Potentially Responsible Party
RI	Remedial Investigation
RA	Remedial Action
RD	Remedial Design
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
RRT	Requisite Remedial Technology
OBCS	Overburden Barrier Collection System
O&M	Operation and Maintenance

Executive Summary

This is the third Five-Year Review for the Hyde Park Landfill Superfund Site (the "Site") located in Niagara Falls, Niagara County, New York.

Based upon reviews of the Enforcement Decision Document, the Stipulation on Requisite Remedial Technology, Quarterly Sampling Results, Annual Operation & Maintenance Reports, Site Inspection Reports as conducted by the New York State Department of Environmental Conservation and a Site inspection by EPA in August 2006, it has been concluded that the remedies as defined by the Site's decision documents continue to protect human health and the environment.

Five-Year Review Summary Form

SITE IDENTIFICATION

Site Name *(from WasteLAN)*: Hooker Hyde Park Landfill Superfund Site

EPA ID *(from WasteLAN)*: NYD000831644

Region: 2	**State:** NY	**City/County:** Niagara Falls/Niagara

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:** 07/18/03

Has site been put into reuse? ☐ YES ■ NO ☐ N/A

REVIEW STATUS

Lead agency: ■ EPA ☐ State ☐ Tribe ☐ Other Federal Agency _____

Author name: Gloria M. Sosa

Author title: Remedial Project Manager	**Author affiliation:** EPA

Review period:** 09/28/2001 to 09/01/2006

Date(s) of site inspection: 08/23/2006

Type of review:
☐ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only
☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead
☐ Regional Discretion ■ Statutory

Review number: ☐ 1 (first) ☐ 2 (second) ■ 3 (third) ☐ Other (specify) _____

Triggering action:
☐ Actual RA Onsite Construction at OU #____ ☐ Actual RA Start at OU#__1__
☐ Construction Completion ■ Previous Five-Year Review Report
☐ Other (specify) _____

Triggering action date *(from WasteLAN)*: 09/28/2001

Due date *(five years after triggering action date)*: 09/28/2006

Does the report include recommendation(s) and follow-up action(s)? ☐ yes ■ no
Acres in use or available for use: **restricted:** 15 **unrestricted:** 0

Five-Year Review Summary Form (continued)

Issues, Recommendations, and Follow-Up Actions

This Site has ongoing operation, maintenance and monitoring activities as part of the selected remedy. As was anticipated by the decision documents, these activities are subject to routine modification and adjustment. This report did not identify any issue or make any recommendation for the protection of public health and/or the environment which was not included or anticipated by the Site decision documents.

Protectiveness Statement

The remedy at the Hyde Park Landfill Site protects human health and the environment. There are no exposure pathways that could result in unacceptable risks and none are expected as long as the engineered controls currently in place continue to be properly operated, monitored, and maintained.

Third Five-Year Review Report
Hyde Park Landfill Superfund Site

I. Introduction

This third Five-Year Review of the Hyde Park Landfill Superfund Site (the "Site") 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 purpose of a Five-Year Review is to ensure that implemented remedies continue to be protective of public health and the environment and that they continue to function as intended by the Site's decision documents. This document, prepared by the Hyde Park Landfill Site Remedial Project Manager, Gloria M. Sosa, will become part of the Site file.

This is the third Five-Year Review for the Site. Since, after the completion of the remedial action, contaminants remain onsite, a statutory Five-Year Review is required. In accordance with the Section 1.3.3 of the Five-Year Review guidance, a subsequent statutory Five-Year Review is triggered by the signature date of the previous Five-Year Review Report. The trigger for this third Five-Year Review is the date of the previous Five-Year Review Report, which was September 28, 2001.

II. Site Chronology

Table 1, which is attached, summarizes the Site-related events running from the placing of hazardous wastes on the Site through the present.

III. Background

Physical Characteristics

The Hyde Park Landfill is a fifteen-acre Site in the northwest corner of the Town of Niagara, New York. The geology underlying the Site is glacial overburden overlying Lockport Dolomite, a fractured bedrock. Groundwater in the vicinity of the landfill flows in both the overburden and the bedrock. Generally, the overburden is saturated at depths below ten feet. The ground-water movement from the landfill is both downward and horizontal. Some of this groundwater exits the Niagara Gorge Face in the form of seeps which flow into the Niagara River. Contaminants migrate from the landfill in two forms: aqueous phase liquid (APL or contaminated groundwater) and dense non-aqueous phase liquid (NAPL). The fractured bedrock environment typical of the Niagara Falls area makes it difficult to locate and remove NAPL.

The Hyde Park APL plume is composed primarily of benzoic acids, chlorobenzoic acids, chlorendic acid and phenol. Total organic halogen, phenols and other compounds have been

detected in the APL Plume in the bedrock seeps at the Niagara Gorge Face in the parts per million (ppm) range. TCDD has been detected in the Gorge Face seeps at 0.18 parts per trillion (ppt).

The major known constituents of the Hyde Park NAPL are dichlorotoluene, chlorotoluene, toluene, tetrachloroethylene, phenol, methyl benzoate, benzoic acid and benzochlorotrifluorides. Twenty ppm of TCDD and substantial amounts of polychlorinated biphenyls have been detected in the NAPL. Forty to fifty per cent of the constituents of NAPL are high molecular weight compounds which have not been identified by gas chromatograph mass spectrometry analysis. Hyde Park NAPL is denser than water, weighing approximately 80 pounds per cubic foot, compared to water which weighs 62.4 pounds per cubic foot. TCDD has been detected in the bedrock water within the NAPL plume at between 0.44 and 0.9 ppt.

There were two onsite lagoons and four rail tank cars in which NAPL was stored.

The Bloody Run is a small drainage area flowing north from the landfill and considered part of the Site. The stream flows under a neighboring industry via a storm sewer, and under University Drive via a storm sewer which emerges at the Niagara Gorge.

Land and Resource Use

The Site is immediately surrounded by several industrial facilities and property owned by the New York Power Authority. Residential neighborhoods are located to the northwest and south of the landfill. The Niagara River, an international boundary, is located 2,000 feet to the northwest, down the Niagara Gorge which descends approximately 350 feet below the surface of the landfill. The Niagara River flows into Lake Ontario approximately 10 miles downstream of the Site. Lake Ontario is a drinking-water source for millions. Niagara University, which has three thousand students, is less than one mile in distance from the Site.

History of Contamination

Hooker Chemical and Plastic Corporation, now Occidental Chemical Corporation (OCC), disposed of approximately 80,000 tons of waste (drummed and bulk liquids, and solids) at the Site, from 1953 to 1975, primarily chlorobenzenes, chlorotoluenes, halogenated aliphatics and 2,4,5-trichlorophenol (TCP) still bottoms. An estimated 3,300 tons of TCP were disposed of at the Site; TCP wastes are known to contain significant amounts of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). EPA has estimated that approximately 0.7 - 1.6 tons of TCDD were associated with the TCP wastes at the Site.

Basis for Taking Action

EPA filed a lawsuit in 1979 in federal district court under the authority of the Resource Conservation and Recovery Act and the Clean Water Act seeking to require that OCC remediate the Site. EPA, New York State and OCC filed a *Stipulation and Judgment Approving Settlement*

Agreement (Settlement Agreement) in January 1981, which the Court approved in April 1982. The Settlement Agreement required OCC to perform an Aquifer Survey (which can be compared to a remedial investigation study) to define the extent of contamination in the overburden and bedrock and assess remedial alternatives. OCC completed this effort in 1983. The results of the aquifer survey were used by the negotiation team (EPA/NY State and OCC) to agree on remedial actions to be performed at the Site. These required remedial actions were documented in a *Stipulation on Requisite Remedial Technology* (RRT Stipulation), which was approved by the Court in August 1986. EPA issued an Enforcement Decision Document (EDD - a precursor to a Record of Decision) on November 26, 1985, which documented the remedial action selected for Site cleanup. The Site is listed on the National Priorities List, a list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories.

EPA acknowledged that the APL and NAPL plumes would not be remediated to drinking-water standards because of the persistent nature of NAPL. Therefore, the goal of the remedies selected in the EDD is to hydraulically contain contaminated groundwater (APL plume) in the vicinity of the Site, while extracting as much NAPL as is practicable. The achievement of hydraulic containment of APL would be proved by the creation of an inward hydraulic gradient surrounding the landfill (*i.e.*, groundwater in the vicinity of the Site would flow radially inward towards the landfill). The reduction of NAPL volume would create less driving force (head) on the NAPL plume, preventing further NAPL migration. The RRT stipulated that the extracted NAPL would be destroyed by incineration.

The RRT established the basis for a groundwater monitoring program to provide data for assessing any potential adverse impacts from the Site to the surrounding community. A series of monitoring programs were also established to determine if contaminants from the Site had migrated beyond the shale, which was believed to be an aquitard that would prevent contamination from further downward migration.

Under the agreement, OCC was required to cap the landfill and its perimeter to prevent further infiltration of rain water, which produces leachate. Remedial action would be performed by OCC at neighboring industries. Sediments in the Bloody Run would be excavated or capped. Remedial action would be conducted at the Niagara River Gorge Face.

During the RRT negotiations, EPA performed a risk assessment using worst case exposure scenarios which indicated that the greatest risk from the Site was the consumption of fish contaminated with TCDD. Therefore, the RRT required that a study be performed by EPA, New York State and OCC to determine if TCDD was bioaccumulating in fish consumed by anglers in Lake Ontario.

IV. Remedial Actions

Remedy Selection

The Hyde Park Landfill remedy selected in the 1985 EDD includes the following specific elements:

- Source control (prototype extraction wells);
- Containment and collection of APL and NAPL in the overburden;
- Containment and collection of APL and NAPL in the bedrock;
- Treatment of collected APL and NAPL;
- Community Monitoring Program (monitoring wells for early detection of Site chemicals);
- Intermediate and Deep Formations Study (monitoring wells);
- Industrial Protection Program (remediation of sumps and sealing of manholes);
- Perimeter Capping (clay cap around perimeter of landfill);
- Gorge face seeps remediation;
- Bloody Run Excavation or Capping;
- Final capping and Site closure; and,
- TCDD Bioaccumulation Study in Lake Ontario

Remedy Implementation

Source Control

The purpose of the source control program is to reduce the amount of chemicals migrating downward from the landfill by removing any mobile NAPL remaining in the landfill. The source control remedial program, as described in the RRT Stipulation, consists of a prototype system of up to six 36-inch diameter wells installed in the overburden inside the landfill. These wells were designed to collect NAPL for subsequent destruction by incineration.

As required by the RRT, OCC installed two 36-inch extraction wells in the landfill in 1990. OCC performed pump tests on these wells and also investigated potential NAPL source areas within the landfill through 1993. However, the large-diameter source-control wells did not collect as much NAPL as was expected. The source control system was redesigned using the 2-inch NAPL extraction well design OCC had successfully utilized at its Durez facility. OCC installed four 2-inch source control wells in the landfill with two-phase flow pumps to facilitate the pumping of NAPL. Nine monitoring wells were also installed in the landfill. One source-control well has since been converted to a monitoring well because of low NAPL collection.

The source control program has not yielded large amounts of NAPL. EPA believes that most of NAPL which was once present in the overburden in the landfill has either flowed into the bedrock, been captured, or remains in pockets or pools that are not hydraulically connected to the source control wells. In addition, the installation of the final cap on the landfill has eliminated the continued production of leachate from rainfall and thereby dramatically reduced the hydraulic head of APL within the landfill, removing the driving force for the NAPL.

NAPL is extracted by the source-control wells and flows into a decanter at the onsite Storage and Treatment Facility. The total recovered NAPL volume is measured monthly and the potential amount of NAPL contributed by each well is estimated annually by OCC. The source-control wells are currently pumped only once per month because of low NAPL volume.

Overburden - APL and NAPL Plume Containment System

The goal of the remedy selected for the overburden is to contain the lateral migration of the NAPL plume and contain the APL plume, to the extent practicable, as stated in the RRT Stipulation. The remedy was implemented by construction of the Overburden Barrier Collection System (OBCS), a drain around the entire landfill to contain and collect contaminated groundwater. The OBCS was installed in 1991. Eight monitoring-well pairs were installed beyond the alignment of an existing drain around the landfill. One well from each pair is inside the APL plume limits and one well from each pair is outside the APL plume. The inner wells are pumped to create an inward hydraulic gradient. Hydraulic stabilization was deemed to have occurred in 1994, following one year of continuous dewatering of the OBCS (*i.e.*, no accumulation of water in the wet wells).

Hydraulic monitoring of the OBCS is performed by water-level measurements taken at the eight well pairs. Water-level measurements indicate whether an inward gradient is being achieved, thereby capturing the contaminated groundwater associated with the Site.

NAPL was not observed in any of the overburden monitoring well locations, indicating that the OBCS serves as an effective barrier to offsite NAPL migration.

Bedrock NAPL Plume Containment System

OCC performed an investigation which defined the extent of the NAPL plume in the bedrock surrounding the landfill in 1982 and revised the extent of the NAPL plume again in 1996 after performing further investigation. OCC performs NAPL presence checks at all 49 bedrock wells and these checks indicate that the NAPL plume has not significantly migrated since 1996.

The NAPL Plume Containment System was designed to create an inward hydraulic gradient in the bedrock aquifer surrounding the landfill in order to capture groundwater contaminated by Site chemicals. The system was designed and installed in a phased approach in order to achieve proper placement of the extraction wells. The first set of wells would be installed, pump tested and connected by force mains to the onsite treatment facility. The capture zones of the wells would be evaluated, and based on the results of the evaluation, additional wells would be installed in areas where capture was not being attained.

Phase I, consisting of six purge wells, was installed by OCC in 1990. Two well nests of three wells each were installed in the upper, middle and lower units of bedrock. OCC conducted pump tests on individual and multiple wells throughout 1991. OCC submitted to EPA and New York State a Phase I pump test report in February 1993. EPA and New York State approved OCC's

recommendation for the location of Phase II purge and recirculation wells and required OCC to install two additional wells. The installation of the Phase II wells was completed in 1993. OCC conducted pump tests on the Phase II wells which were completed in 1994. The results of these pump tests indicated that further hydraulic control was necessary. Additional wells were installed and a network of eleven bedrock purge wells was operational in 1997.

The RRT Stipulation established a monitoring program with well location selected along vectors radiating from the center of the landfill. As required, the purge wells are on the inside of the NAPL plume with monitoring wells outside the NAPL plume. The RRT required an inward gradient across the NAPL plume boundary. Implementation of the vector scheme has not proven to be an effective monitoring system. Practical considerations frequently impact the selection of well locations. Certain vectors are located in nonwater-bearing rock. Other vectors show a flat gradient. To enhance the vector monitoring scheme, with which OCC reports its Site cleanup progress, local groundwater contour maps were developed.

In 2000, as discussed below, OCC began a re-characterization of the Site. The conceptual model of three groundwater zones in the bedrock was replaced with eleven distinct flow zones. OCC retrofitted existing wells to monitor the groundwater in these 11 zones. After collecting water levels over a two year period, OCC concluded that the Bedrock NAPL Plume Containment System satisfies the performance objectives of the RRT and that the containment objective is maintained year-round.

Bedrock APL Plume Containment System

The APL Plume Containment System, consisting of three purge wells installed at the Niagara Gorge Face, was designed to collect a significant portion (60-88%) of the contaminated groundwater outside the NAPL plume (as required by the RRT). These wells were installed in 1994. The portion of the APL plume not collected is monitored by 3 flux monitoring well clusters to the west of the Site and 3 piezometer clusters in the northern and eastern portion of the APL plume.

The RRT established APL Plume Flux Action Levels for the following chemicals: TCDD (0.5 grams/year); perchloropentacyclodecane [Mirex] (0.005 lbs/day); Aroclor 1248 (0.005 lbs/day); and, chloroform (1.7 lbs/day). These action levels represent concentrations of these contaminants that, if detected entering the river (flux of contaminants to the river) at or above these concentrations, would cause OCC to take additional remedial actions (*e.g.* increased pumping, installing additional wells or other remedial measures) to reduce these contaminant levels. Sampling conducted in November 2004 indicated that the concentrations of the APL Flux parameters were all below their respective Flux Action Levels with the exception of perchloropentacyclodecane [Mirex]. In the case of Mirex, results were reported as non-detect at a level (9.52 µg/L) above the Target Detection Level (1µg/L). The flux to the river for Mirex was calculated to be 1.28 g/yr, which is far below the Flux Action Level of 0.005lbs/day (827 g/yr).

Leachate Storage and Treatment Facility

APL is treated onsite at the Leachate Storage and Treatment Facility constructed by OCC which began operating in April 1990. The APL/NAPL mixture is pumped from the wells through force mains into a decant tank. The NAPL, denser than water, settles to the bottom. APL is taken off the top of the decanter and pumped into the storage tanks. The APL first passes through sacrificial activated carbon beds (which cannot be recycled because of the dioxin and are disposed of offsite). The APL is then treated in an activated carbon system.

The treatment capacity of the Leachate Treatment Facility was designed to process 70 gallons per minute (gpm) of influent. This proved not to be sufficient capacity. Excess water (much of it clean) was entering the OBCS from the northwest. A clay barrier wall was installed to the north and west of the OBCS in an attempt to eliminate some of the excess water. The Treatment Facility was upgraded to 110 gpm. Since the recent years have been wetter than the period for which the facility was designed, OCC increased the treatment capacity to 400 gpm in 2001 to be able to adequately handle periods of large water volume.

More than 30,000,000 gallons of groundwater were treated in 2005 at the Hyde Park Leachate Treatment Facility.

NAPL Treatment

During the early remedial operations at the Site, NAPL was transferred by tanker truck to OCC's Buffalo Avenue Plant in Niagara Falls for incineration. OCC required a permit modification for its Buffalo Avenue Plant incinerator to burn wastes containing dioxins. There was no commercial incinerator available to destroy these wastes. The five years spent in obtaining the permit modification significantly delayed the Hyde Park remedial schedule. OCC was issued this modification by EPA and New York State Department of Environmental Conservation in November 1990. This was the first industrial incinerator permitted to burn dioxin.

OCC suspended incinerating NAPL at its Buffalo Avenue Plant in 1996 and it now trucks the NAPL to Laidlaw Environmental Services in Deer Park, Texas, for incineration. In the first quarter of 2001, 1034 gallons of NAPL were collected by the bedrock system and 252 gallons were collected by the OBCS. To date, more than 300,000 gallons of NAPL have been removed and destroyed. Five hundred gallons of NAPL were collected in 2005.

Lake Ontario TCDD Bioaccumulation Study

The APL Plume Flux Action Level for TCDD in the RRT Stipulation is 0.5 grams/year. TCDD is presently found in fish in levels in excess of Federal, State and Canadian fish health advisories. At the time of the development of the RRT, there was no consensus in the scientific community on the bioaccumulation of dioxin. Without this consensus, fish uptake of TCDD could not be calculated. Therefore, the RRT required that EPA, New York State and OCC perform a Lake Ontario TCDD Bioaccumulation Study in order to determine a bioaccumulation factor for TCDD

specific to Lake Ontario. The results of this study would then be used to reexamine the TCDD APL Plume Flux Action Level.

EPA Region II, New York State and OCC designed and implemented a work plan to collect fish and sediment samples from Lake Ontario and analyze them for TCDD. Lab studies were performed by EPA's Duluth lab and the University of Minnesota. The draft Lake Ontario TCDD Bioaccumulation Study was completed in July 1989 and distributed for scientific peer review. The final TCDD Bioaccumulation Study report reflecting the comments of the peer reviewers was released to the public in September 1991.

As part of this study, EPA's Large Lakes Research Station in Grosse Ile, Michigan, collaborated with Manhattan College's Department of Environmental Engineering to produce the Lake Ontario TCDD Modeling Report. A mass-balance model was developed based upon models of fallout radionuclides and PCB contamination of the Great Lakes. With the assistance of a panel of scientists convened by EPA, the model was refined and reparameterized for TCDD.

The predicted steady-state TCDD concentrations for an input comparable to the TCDD APL Plume Flux Action Level of 0.5 grams/year are 0.026 nanograms/year (sorbed sediment concentrations) and 9.5×10^{-5} picograms/liter (water column dissolved concentration).

The TCDD Study, together with the model, indicated that TCDD was bioaccumulating in the tissues of various species of Lake Ontario fish at a range of rates such that the overall TCDD APL Plume Flux Action Level of 0.5 grams/year stipulated by the RRT remains protective.

Landfill Cap

The Settlement Agreement required OCC to cap the landfill with 36 inches of clay and with a 12-inch vegetative cover. Before a final cap could be placed on the landfill, wastes associated with remedial activities needed to be managed. OCC developed the Waste Disposal Plan, which was implemented in 1988. Waste disposal cells lined with clay were constructed on top of the landfill to consolidate wastes resulting from remedial actions and investigations conducted at the Site. Contaminated soils from investigative activities and sediment from the Bloody Run remediation were consolidated in the landfill. The perimeter cap of the landfill was completed in 1991, and the entire landfill was capped in 1994. The final cap consisted of the following: low-permeability clay; a synthetic membrane; a drainage layer and topsoil seeded with native vegetation for barrier protection. EPA routinely inspects the landfill cap for erosion. The current condition of the cap is excellent.

Community Monitoring Program

The Community Monitoring Wells, a system of wells installed in 1987 throughout the neighborhood, provide early warning of the presence of Hyde Park contaminants in the groundwater. These wells are sampled and analyzed quarterly. Should contamination be detected, OCC must take further remedial action. Hyde Park contaminants have never been

detected in these wells. The data collected have demonstrated that the groundwater flow is vertically downward in the nearby community. EPA and New York State review the analytical results from sampling of these wells to ensure the community is being protected.

Industrial Protection Program

The Industrial Protection Program, implemented in 1987, established engineering controls to eliminate the exposure of nearby workers to contaminants present in the NAPL and APL plumes. Sumps and manholes in neighboring industries, including Grief Brothers, were sealed, eliminating worker exposure to vapors that may migrate into the sump. OCC relocated a sewer at neighboring Tams Ceramics in 1989. The College Heights sewer was remediated in 1990.

OCC has recently purchased the Grief Brothers building. Future access to this facility is now controlled by OCC. Periodic surveys of neighborhood manholes and sumps are performed to ensure the remedies remain intact.

Bloody Run Remediation

The Bloody Run received drainage from the landfill prior to any remedial measures. Residents living alongside contracted chloroacne, a skin disease, from exposure to the contaminated water. OCC relocated several families who lived next to this stream.

The Settlement Agreement set forth two possibilities for remedial action at the Bloody Run, sediment excavation or capping. The 1992 EPA risk assessment determined the excavation of sediments in the Bloody Run would not pose an adverse risk (from fugitive dust emissions), would be protective of human health, and, was the preferred alternative.

OCC excavated approximately thirty thousand cubic yards of contaminated sediment from the Bloody Run drainage area. The area was then backfilled and covered with riprap. This work was completed in January 1993. The Bloody Run now flows via a storm sewer which surfaces at the Niagara Gorge. The restored area was observed to have abundant vegetation during a Site visit in August 2006.

Niagara River Gorge Face Remediation

Groundwater seeps from the rock at the Niagara Gorge, approximately 2000 feet from the Site. TCDD was detected in one sample from a seep during remedial investigations at 0.2 ppt. EPA and New York State determined that humans should be isolated from the seeps to prevent an exposure pathway to the contaminants. The Gorge Face Seeps were remediated in 1988, except for the Bloody Run portion, which was remediated in 1994. Access by humans to the seeps has been prevented by the installation of fences and the diversion of seeps into culverts. All contaminated sediments were scraped away. Annual inspections of the Gorge Face are conducted by representatives of EPA, New York State and OCC. The pumping of the APL wells has strongly influenced the seeps, drying many.

The Ontario Ministry of the Environment (MOE) has collected surficial sediment samples at the base of the Bloody Run, as well as samples of caged mussels kept in the river near these sediments for 21 days. The sampling is conducted as part of the Niagara River biomonitoring program. The September 1999 biomonitoring report indicates that concentrations of dioxins and furans in sediment and mussels are lower than pre-remediation levels. The report suggests that remedial action taken to cover contaminated sediment on the river bank has reduced the bioavailability of the dioxins and furans present. However, the MOE raised concern that these levels were higher than in other Great Lakes basins. TCDD was found in sediment at 45 parts per billion (ppb) in the MOE sampling results.

In order to verify if TCDD was present in sediments at the mouth of Bloody Run, EPA took 3 sediment samples in 1999. TCDD was detected in one of these samples at 14 ppb. The Centers for Disease Control guideline of 1 ppb for TCDD was developed for human residential exposure such as a person would be exposed to in their backyard. The area where the sediment was collected does not provide the same exposure as a residential setting because of several factors. The sediment is covered by the river early in the morning and remains covered until after dark because the release of water from the power authority raises the level of the river by several feet. The sediment is not available for human exposure when underwater. In addition, the population EPA considers most at risk from exposure to this sediment is child anglers. A child, however, would only be at this location for a limited time each year, considering school attendance and winter conditions prevent all-year access. Using these exposure assumptions, EPA performed risk assessment calculations which indicated that the level of TCDD in the sediment is with EPA's acceptable risk range of 10^{-4} - 10^{-6} excess cancers.

Intermediate and Deep Bedrock Formations Study

The Intermediate and Deep Formations Study was designed to determine if contaminants from the Hyde Park Landfill had penetrated the Rochester Shale (aquitard) formation below the Lockport Dolomite. If action levels documented in the RRT are exceeded in the Intermediate Formations, then monitoring wells will be installed in the Deep Formations. In addition, a total flux to the Niagara River is calculated, and if the Flux Action Levels are exceeded, further remedies would be required to reduce the loading to the river.

Monitoring wells were installed in the intermediate formations in 1990 without detecting the presence of NAPL. Most wells contained insufficient volumes of groundwater for sample collection after purging activities, indicating that the shale is a good aquitard. The *Monitoring Report, Intermediate Formations Wells, November 1991/1992* summarizes the results of the investigation. Most of the parameters were not detected above the survey levels determined in the RRT Stipulation. However, phenol, total organic halogen, PCB-1248 and conductivity did exceed the survey levels. OCC calculated a flux in the monitoring report which was four to five orders of magnitude below action levels.

OCC was not required to install monitoring wells in the Deep Formations because the Intermediate Formations' investigation indicated that Hyde Park contaminants had not migrated through the shale and were not present in the Intermediate Formations.

Additional Remedial Action

OCC has performed additional remedial actions at the Site in addition to those previously discussed. The onsite lagoons were remediated in 1991. NAPL in the lagoons was pumped into the leachate storage facility and the lagoons were closed. NAPL was also pumped from four railroad tank cars, which had been used onsite for years as storage for NAPL generated from remedial investigations because there was no facility permitted to destroy dioxin. In 1991, the tank cars were placed in the waste disposal cells.

OCC also remediated sewers in the area. Sewers provided preferential pathways for contaminants to migrate through the overburden. As previously mentioned, OCC relocated a sewer at TAM Ceramics and remediated the College Heights sewer. The remediation of the University Drive (bordering Niagara University) sewer was completed in August 1993. NAPL contaminated soils were removed from under University Avenue; these soils were placed in a waste disposal cell at the landfill, prior to installing the final cap.

Site Re-Characterization

Miller Springs Remediation Management, Inc (MSRM, a subsidiary of OCC which manages all its waste sites) performed a detailed groundwater modeling study of the Site during 2000-2001 to address uncertainties with respect to groundwater flow and evaluate the performance of the bedrock remedial system. The Site is located in a very complex hydrogeologic setting and MSRM sought to formulate a conceptual model which synthesized data collected from the Site and the regional hydrogeologic setting. Particle tracking was utilized to determine the capture zones of the existing bedrock wells. The model indicated that there was a vertical component of flow (i.e., some of the water from the Upper Bedrock zone was being captured in the Lower Bedrock zone).

Subsequent to the development of the ground-water model, MSRM revised the Site conceptual model which provided the basis for the numerical simulation of the hydrogeologic system. MSRM conducted field investigations from 2001 to 2003, including down-borehole geophysics and water-level measurements in 113 piezometers (retrofitted monitoring wells.) The analysis of the field data resulted in a revised hydrolgeologic framework consisting of eleven discrete flow zones separated by aquitards. MSRM has documented its revised hydrogeologic framework in two documents: *Site Characterization Report: Revised Geologic and Hydrogeologic Characterization* (February 2002) and *Site Characterization Report: Hydrologic Characterization* (February 2003).

The eleven flow zones replace the Upper, Middle and Lower Bedrock framework formerly used at this Site. Groundwater monitoring has been conducted in the eleven flow zones since late 2002 and MSRM is now building a data base of water-level measurements.

After the geology at the Site was re-characterized, MSRM revised their ground-water model to assist them in determining if the groundwater remedy provides capture of the contaminated water associated with the Site. *Site Characterization Report: Groundwater Flow Model*, dated June 2003, was prepared for MSRM by SSPA. The results of the groundwater model indicate that capture of contaminated groundwater is achieved in the bedrock.

Systems Operation/Operation and Maintenance (O&M)

OCC conducts extensive operations and maintenance (O&M) at the Site. The carbon beds at the Treatment Facility are routinely changed and regenerated. The sacrificial carbon beds must also be changed and disposed. OCC conducts influent and effluent analyses to ensure compliance with the discharge permit.

Quarterly sampling is performed. Hydraulic and chemical data are collected and analyzed. These results are documented in a Quarterly Report.

OCC must perform extensive well and pump maintenance, as NAPL often fouls wells and pumps.

OCC performs an annual Gorge Face Seep Survey to ascertain that the remedial actions taken in the Gorge remain protective of human health and the environment.

Table 2 is an estimate of annual operation and maintenance costs.

V. Progress Since Last Five-Year Review

The second Five-Year Review was completed in September 2001, pursuant to OSWER Directives 9355.7-02 (1991), 9355.7-02A (1994), and 9355.7-03A (1995). The second Five-Year Review concluded that although all the remedial actions at the Site were not yet completed, the remedial actions implemented at that time were protective of human health. Since then, the remedy at the Site has been completed and an extensive groundwater monitoring program has been implemented. Groundwater monitoring which has occurred since the second Five-Year Review has been discussed in this Report.

VI. Five-Year Review Process

Administrative Components

The Five-Year Review Team consisted of: Gloria M. Sosa (Remedial Project Manager), Edward Modica (Hydrogeologist), Marian Olsen (Risk Assessor) and George Shanahan (Attorney).

Community Involvement

The EPA Community Involvement Coordinator for the Site, Michael J. Basile, published a notice in the *Niagara Gazette*, a local newspaper, on September 14, 2006, notifying the community of the initiation of the Five-Year Review process. The notice indicated that the EPA would be conducting a Five-Year Review of the remedy for the Site to ensure that the implemented remedy remains protective of public health and the environment and is functioning as designed. It was also indicated that once the Five-Year Review is completed, the results will be made available in the local Site repository. The notice also solicited public comments or questions related to the Five-Year Review Process or to the Site.

In addition, the notice included the RPM's mailing address, e-mail address, and telephone number for any public comments or questions. A similar notice will be published when the review is completed.

Document Review

The documents, data, and information which were reviewed in completing this third Five-Year Review are summarized in Table 3 (attached).

Monitoring and Data Review

MSRM issued the *Site Characterization Report: Remedial Characterization Report* (RCR) which concludes that the Bedrock NAPL Plume Containment System satisfies the performance objectives of the RRT (inward gradient). Although the data for two of the flow zones suggest some uncertainty in the inward gradient, chemical analyses of the groundwater from these two zones indicate that Site-related contaminants are not present in this groundwater. This indicates that no migration of contaminants outside of the containment system is occurring.

In November 2003, MSRM issued the *Major Ions Study*. This report concluded that sulfate ions are an indicator of the relative age of groundwater and that the vertical and horizontal distribution of sulfate ions near the Site support the revised conceptual model of groundwater flow. Sampling results from the Gorge Seeps indicate that the seeps appear to originate primarily from surface runoff (water of a very young age) and not water which has migrated from the Site (water of an older age.)

MSRM issued the *Comprehensive Remedial Characterization Report* (CRCR) in August 2004. This report concludes the conventional hydraulic performance monitoring requirements defined in the RRT were not suitable for the Site because of the complex hydrogeologic complexity of the Lockport bedrock which was poorly understood when the RRT was issued. EPA recognizes that there may be concerns with conventional monitoring approaches in *Elements for Effective Management of Operating Pump and Treat Systems* (542-R-02-009 OSWER 9335.4-27FS-A) and recommends utilizing converging "lines of evidence" for containment demonstration. OCC adopted this approach for the performance evaluation documented on the CRCR. Several lines of evidence were selected for the performance evaluation:

1. Flow directions interpreted from potentiometric surface maps;
2. Flow directions estimated from vertical gradients
3. The distribution of Site-related parameters in groundwater;
4. The distribution of major ions and the relative age of groundwater; and,
5. Groundwater-flow modeling.

Following these lines of evidence, the Bedrock NAPL Plume Containment System satisfies the performance objectives of the RRT and the containment objective is maintained year-round. The Bedrock NAPL Plume Containment System has been maintained and upgraded continuously since 1993.

The results of the Gorge Face Seep Survey performed on August 23, 2006 indicate that conditions in the Gorge have not changed since the previous survey in 2004 and that no additional actions are necessary.

Site Inspection

The Site was inspected by EPA's Remedial Project Manager, Gloria M. Sosa, on February 22, 2006. The Site was inspected by EPA's Section Chief, Kevin Lynch, EPA's Risk Assessor, Marian Olsen and OCC's Project Manager, Don McLeod, on August 23, 2006. The current condition of the cap is excellent.

Interviews

No interviews were conducted for this review.

VII. Technical Assessment

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

The remedial objectives as set forth in the Enforcement Decision Document called for hydraulic containment and collection of contaminated groundwater and NAPL in the overburden and fractured-carbonate bedrock aquifer (Lockport Dolomite) beneath the Site. The overburden NAPL/APL plume containment system has been operating since 1991 and has been consistently

functioning as intended by the decision documents. Source control purge wells continue to remove mobile NAPL remaining in the landfill. The barrier collection system (OBCS), consisting of a system of drains and sumps encircling the landfill, continue to work to prevent lateral migration of contaminated groundwater. Regular inspection and maintenance of the landfill cap ensures that the cap is in good condition and works to significantly reduce leachate. Liquids collected in the treatment system are monitored quarterly at nine sampling locations to ensure compliance with discharge requirements.

The bedrock NAPL/APL plume containment system has been designed to prevent lateral migration of groundwater in the bedrock by creating inward and downward flow gradients. However, prior to 2002, it could not be demonstrated that full containment had been achieved in the bedrock aquifer. A recent investigative effort aimed at re-characterizing the Lockport bedrock (see question C) showed that the bedrock consists of multiple discreet bedding-parallel flow zones. As a result of the investigation, plume boundaries were re-defined for each flow zone, previously-installed wells were retrofitted to communicate with specific flow zones, and a Performance Monitoring Plan was modified to reflect the updated understanding of the bedrock flow system. In the bedrock plume containment system, hydraulic containment is implemented by controlling water levels at set points. To control flow migration in the area between the landfill and wells APW-1 and APW-2 (near the Gorge Face), unsaturated conditions are now maintained in flow zone 09 in this area by keeping water levels at a fixed elevation (526 feet). With these changes, it is expected that the bedrock plume containment system can maintain full hydraulic control in bedrock flow zones. However, monitoring data from the revised hydraulic monitoring program will continue to be collected and evaluated to confirm that hydraulic control has been fully established.

Other components of the remedy have been in place and are functioning as intended by the decision documents. Bloody Run sediments have been excavated and consolidated within the landfill. The catch basin is checked annually for potential contamination. Access to the Gorge Face has been eliminated thereby preventing human contact with potentially contaminated groundwater. The Gorge Face Seep Inspection program is completed annually to ensure that the potential for public exposure is minimized. The APL Flux Monitoring program is completed annually to ensure that Site-related chemical constituents are not discharging to the Niagara River Gorge above action levels defined in the RRT. A perimeter fence had been installed to prevent access by trespassers and is in good repair. The Community Protection Program has been in place and provides early warning should contaminants be present in groundwater. A vapor monitoring program in overburden community monitoring wells has been implemented.

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

There have been no changes in the physical conditions of the Site over the past five years that would change the protectiveness of the remedy. In general, the Site has limited access based on location within an industrial area and fencing and security guards to limit or prevent access to the Site. The establishment of an inward gradient for groundwater in the area and monitoring within

the community to identify Site-related contaminants in groundwater early, provide additional protection against exposures to the groundwater.

Fish advisories are indicative of potential risk. Fish advisories exist for the Niagara River below Niagara Falls and for Lake Ontario, which is 10 miles downstream from the Site. The contaminants of concern are PCBs, mirex and dioxin. The current 2006-2007 New York State Department of Health (NYSDOH) fish advisory recommendations for each water body are listed below.

Niagara River Below Niagara Falls

- Eat none. American eel, channel catfish, carp, lake trout over 25", brown trout over 20", Chinook salmon and white perch.
- Eat no more than one meal per month. White sucker, rainbow trout, small mouth bass, smaller lake trout, smaller brown trout, and coho salmon over 25".
- Women of childbearing age, infants and children under the age of 15 should not eat any fish species from these waters.

Lake Ontario

- Eat none. American Eel, channel catfish, carp, lake trout > 25", brown trout > 20", and Chinook salmon. An eat none recommendation is in place for white perch from the Lake west of Point Breeze.
- Eat no more than one meal per month. For white sucker, rainbow trout, smaller lake trout, smaller grown trout and coho salmon > 25". The recommendation for white perch from areas East of Point Breeze is also eat no more than one meal/month.
- Women of childbearing age, infants and children under the age of 15 should not eat any fish species from these waters.

Soil and groundwater use at the Site is not expected to change during the next five years, the period of time considered in this review. The Non-Aqueous Phase Liquid (NAPL) Contaminants of Concern identified in the 1985 EDD and 2001 Five-Year Review in groundwater were: 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), dichlorotoluene, chlorotoluene, toluene, tetrachloroethylene, phenol, methyl benzoate, benzoic acid and benzochlorotrifluorides. The Aqueous Phase Liquid (APL) contaminants of concern identified in the 1985 EDD and 2001 Five-Year Review in groundwater were: TCDD, benzoic acid and benzochlorotrifluorides.

The land use remains industrial and is expected to remain industrial.

APL and NAPL

The EDD acknowledged that the APL and NAPL plumes would not be remediated to drinking-water standards because of the persistent nature of NAPL. As a result, the EDD called for achievement of hydraulic containment of APL surrounding the landfill. The reduction of NAPL

volume would create less driving force (head) on the NAPL plume, preventing further NAPL migration.

Community Monitoring Program

Community Monitoring Wells were installed in 1987 throughout the neighborhood, and provide early warning of the presence of Hyde Park contaminants in the groundwater. Hyde Park contaminants have never been detected in these wells. The groundwater flow in these wells is downward. The monitoring results are reviewed by EPA and NYSDOH.

Landfill

The landfill and its perimeter were capped to prevent further infiltration of rain water. The cap was completed in 1994 and is monitored for erosion.

Bloody Run Remediation

The excavation of contaminated sediments from the Bloody Run drainage area was completed in 1993. The area was backfilled and covered with riprap. The area has well-established vegetation.

Niagara River Gorge Face Remediation

Groundwater seeps from the rock at the Niagara Gorge and contaminants of concern include TCDD. Access to the area was interrupted by the installation of fences and the diversion of seeps into culverts. All contaminated sediments were scraped away. Potential exposures to sediment at the mouth of Bloody Run are limited by releases of water from the Power Authority that raises the river level by several feet and conditions during the winter that limit potential access to this area. OCC performed a study which determined that the source of the water in the gorge seeps is from surface runoff and that the source is not from groundwater associated with Hyde Park Landfill.

Protection of Human Health

The implementation of the EDD addresses the groundwater contaminants listed above by creating an inward groundwater gradient onsite. The Community Monitoring Program provides further protection by identifying potential Site related contaminants in groundwater early.

The landfill cap interrupts potential direct contact with soil contaminants through ingestion and dermal contact and inhalation. Other activities such as maintenance of the cap and fencing, and having onsite security interrupt potential exposures by trespassers.

The excavations of contaminants at Bloody Run and Niagara River Gorge have also reduced potential exposures to contaminants. The fences in the area of the Gorge have reduced potential exposures by limiting access.

In conclusion, the remedial actions at the Site and other activities identified above interrupt any potential ingestion, dermal and inhalation contact with soil and sediment. The groundwater actions also reduce potential exposures. These actions have interrupted exposures and the remedy remains protective.

Soil vapor intrusion sampling was not conducted at the Site. The landfill is covered with the equivalent of a Part-360 cap. The landfill is owned by OCC and the RRT Stipulation requires OCC to regularly maintain the landfill in accordance with the O&M Plan and advise EPA of any changes to its condition, including ownership. In addition, the RRT Stipulation requires the Town of Niagara and the City of Niagara Falls to notify EPA and NYSDEC of all applications for permits for construction activities. In the unlikely event that any construction occurs on the landfill, further investigation of the potential for soil vapor intrusion should be conducted using OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway for Groundwater and Soil.

At the current time, the review and analysis of dioxin contamination continues. At the next Five-Year Review, the toxicity of this chemical should be re-evaluated.

Overall, based on the past remedial actions, fish advisories and ongoing monitoring and pumping of groundwater on the Site, the remedy remains protective.

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

No. There is no new information that would call into question the protectiveness of the remedy.

Technical Assessment Summary

Based upon the results of this third Five-Year Review process, including a review of the Site data and the Site inspection, it has been concluded that the remedy is functioning as intended by the Site's decision documents. There have been no changes in the physical conditions of the Site that would affect the protectiveness of the remedy. The hydraulic containment stipulated in the RRT has been achieved. There have been no changes in the toxicity factors for the contaminants of concern and there has been no change to the standardized risk assessment methodology that could affect the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedy.

VIII. Issues, Recommendations and Follow-up Actions

This Site has ongoing operation, maintenance and monitoring activities as part of the selected remedy. As was anticipated by the decision documents, these activities are subject to routine modification and adjustment. This report did not identify any issue or make any recommendation for the protection of public health and/or the environment which was not included or anticipated by the site decision documents.

During the period between 2002 and 2004, MSRM conducted additional investigations at the Site that resulted in a re-characterization of the bedrock (Lockport Dolomite) structure. Data from the study lead to the identification of nine discreet bedding-parallel flow zones beneath the Site. Previously, the bedrock aquifer was regarded as having three major flow intervals – Upper, Middle and Lower Bedrock. Initially, the implementation of bedrock containment component of the remedy was predicated on the assumption that groundwater flowed through three major bedrock intervals; wells had been installed in the bedrock so that long open intervals of the bore coincided with these major bedrock intervals. As a consequence of the investigations, many wells were retrofitted so as to be in hydraulic communication with the narrowly defined flow zones identified in the study to better control plume capture and to measure water-levels at a flow-zone specific level. However, not all wells needed to be retrofitted and those with long-open intervals that were left in place can potentially affect groundwater flow in the bedrock by locally interconnecting flow zones and potentially obscuring interpretation of water-level data. These wells are scheduled to be abandoned in 2007.

IX. Protectiveness Statement

The remedy at the Hyde Park Landfill Superfund Site protects human health and the environment. There are no exposure pathways that could result in unacceptable risks, and none are expected as long as the engineered controls currently in place continue to be properly operated, monitored, and maintained.

X. Next Review

The next Five-Year Review for the Site will be completed before August 2011, five years from the date of this review.

Approved:

George Pavlou, Director
Emergency and Remedial Response Division

9-27-06
Date

TABLE 1: CHRONOLOGY OF EVENTS	
REMEDIAL ACTIVITY	**DATE**
Landfill Closed by Occidental Chemcial Corporation	1975
Clay Cap Placed on Landfill	1978
Stipulation and Judgment Approving Settlement Agreement	04/82
Aquifer Survey	12/83
Enforcement Decision Document	11/85
Stipulation on Requisite Remedial Technology Program	05/86
Community Monitoring Program	04/87
Industrial Protection Program	09/87
Gorge Face Seeps Remediation	11/88
Leachate Treatment Facility	04/90
Intermediate and Deep Formations Study	09/90
NAPL Incineration Permit	11/90
NAPL Plume Containment System: Phase I Extraction Wells	11/90
Source Control: Extraction Wells	12/90
Overburden Barrier Collection System	12/91
TCDD Bioaccumulation Study released to the public	09/91
Perimeter Capping	07/91
Bloody Run Remediation	01/93
NAPL Plume Containment System: Additional Extraction Wells (Phase II)	11/93
Source Control: Additional Extraction Wells	07/94
APL Plume Containment System	08/94
Final Capping/Site Closure	12/94
First Five-Year Review	09/96

TABLE 1: CHRONOLOGY OF EVENTS	
Geophysical Investigation (Site Re-Characterization)	06/01
Second Five Year Review	09/01
NAPL Plume Containment System: Additional Extraction Wells (Phase III)	12/01
Site Characterization Report: Revised Geologic and Hydrogeologic Characterization	02/02
Retrofit of Existing Monitoring Wells to Piezometers Screened in 11 Flowzones	12/02
Site Characterization Report: Hydrologic Characterization	02/03
Site Characterization Report: Groundwater Flow Model	06/03
Site Characterization Report: Remedial Characterization Report	06/03
Superfund Preliminary Close-out Report	07/03
Major Ions Study	11/03
Comprehensive Remedial Characterization Report	08/04
Remedy declared Operational and Functional by EPA	09/04
Third Five-Year Review	09/06

TABLE 2: ANNUAL OPERATION & MAINTENANCE COSTS	
Sampling and Analysis	$300,000
Site Operation/Inspection/Maintenance	$1,200,000
Total Estimated Annual Monitoring Costs	$1,500,000

TABLE 3: LIST OF DOCUMENTS REVIEWED	
Enforcement Decision Document	11/85
Stipulation on Requisite Remedial Technology	5/86
Intermediate and Deep Formations Study	9/90
TCDD Bioaccumulation Study	9/91
First Five-Year Review	9/96
Second Five Year Review	9/01
Site Characterization Report: Revised Geologic and Hydrogeologic Characterization	02/02
Site Characterization Report: Hydrologic Characterization	02/03
Site Characterization Report: Groundwater Flow Model	06/03
Site Characterization Report: Remedial Characterization Report	06/03
Superfund Preliminary Close-out Report	7/03
Major Ions Study	11/03
Comprehensive Remedial Characterization Report	9/04
Performance Monitoring Plan	7/06
Quarterly Monitoring Reports	2002
Annual Report	2002
Quarterly Monitoring Reports	2003
Annual Report	2003
Quarterly Monitoring Reports	2004
Annual Report	2004
Quarterly Monitoring Reports	2005
Annual Report	2005