FIVE-YEAR REVIEW REPORT

HYDE PARK LANDFILL SUPERFUND SITE

NIAGARA FALLS, NIAGARA COUNTY, NEW YORK

Prepared by
U.S. Environmental Protection Agency
Region II
New York, New York

September 2001

139727

I. PURPOSE

It is the policy of the United States Environmental Protection Agency (EPA) to conduct periodic (no less often than every five years) reviews of remedies selected before the enactment of the Superfund Amendments and Reauthorization Act where hazardous substances, pollutants or contaminants remain at a site above levels that allow for unlimited use or unrestricted exposure. The purpose of a five-year review is to assess whether the remedial actions being implemented continue to be protective of human health and the environment.

EPA conducted a Type 1 Five-Year Review of this site in September 1994. This is the second Type-1 review at this site. The remedial action has not been completed at the site. However, the remedy has many separate components, and many of these components have been completed. EPA believes that the remedy selected for the Hyde Park Landfill, when completed, will be protective of human health and the environment.

II. SITE HISTORY AND CONDITIONS

Site History

The Hyde Park Landfill is a fifteen-acre site in the northwest corner of the Town of Niagara, New York. 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.

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 of Canadians.

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.

OCC performed an Aquifer Survey in 1982 to determine the limits of the APL and NAPL plumes in both the overburden and bedrock. The limits of the APL and NAPL plumes have been refined by subsequent sampling surveys.

The 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 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.

The Bloody Run is a small drainage area flowing north from the landfill which is 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. University Drive borders Niagara University, which has three thousand students.

Enforcement History

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.

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.

OCC has implemented remedial actions at the site since 1987 under the oversight of EPA and NYSDEC and is in compliance with the court-approved documents. The RRT requires OCC to create an inward hydraulic gradient at the site and the remedial action at the site will not be complete until this goal is achieved. OCC is currently installing additional extraction wells at the site that are expected to increase the capture zone of the current bedrock system to one hundred per cent.

Site Remedy

The Hyde Park Landfill remedy 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

III. SUMMARY OF RESPONSE ACTIONS

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 insufficient 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 extracted by source-control wells flows into a decanter at the on-site 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 insufficient 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 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 a barrier to off-site 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 on-site 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 presence of NAPL has caused severe operational difficulties because it clogs pumps and wells.

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 non-water-bearing rock. Other vectors show a flat gradient. To enhance the vector monitoring scheme, with which OCC reports its site clean-up progress, local groundwater contour maps were developed.

Hydraulic monitoring of the bedrock has been conducted since 1996. For the purpose of monitoring, the bedrock is divided into three separate flows zones: upper zone, middle zone and lower zone. Currently,

there are 12 bedrock extraction wells and one NAPL purge well (NAPL flows in and is bailed out) in operation. An inward hydraulic gradient has not been achieved by the current system. OCC is currently installing additional extraction wells in order to achieve complete capture of the contaminated groundwater.

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. The only parameter detected in 2001 was TCDD. OCC calculated the flux of TCDD to the Niagara River as 7.06×10^{-5} grams/year, which is several orders of magnitude below the Flux Action Level.

Leachate Storage and Treatment Facility

APL is treated on-site 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 is 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 during 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 have been treated to date by the Hyde Park Leachate Treatment Facility.

NAPL Treatment

During the early remedial operations at the site, NAPL was is 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.

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, 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 2000.

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.

A rock slide occurred in 1994 on the lower slopes of the Bloody Run, below the New York Power Authority road. Globules of NAPL were exposed on some rocks. These rocks were removed and the remaining rocks were covered with native rocks. Residual NAPL remains hidden in this slope.

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 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. However, it is currently unclear whether the levels of TCDD present in sediment at the mouth of the Bloody Run are a risk to the environment. EPA will complete a Screening-Level Ecological Risk Assessment in December 2001.

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 on-site 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 on-site 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.

Operation and Maintenance

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.

Groundwater Modeling Study

OCC conducted a groundwater modeling study of the site during 2000-2001 to address uncertainties with respect to groundwater flow. The site is located in a very complex hydrogeologic setting and OCC sought to formulate a conceptual model which synthesized data collected from the site and the regional hydrogeologic setting. During this study, OCC extensively reviewed all available site data. OCC expanded on an existing United States Geological Survey model for the Niagara area, creating a detailed model of the site area.

The calibrated model was then used to evaluate the performance of the current bedrock remedial pumping system. 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 zone was being captured by the lower zone).

Groundwater model simulations using the flow rate data from the first quarter of 2001 indicate that 52.1% of the upper, 90.4% of the middle, and 98.8% of the lower bedrock zone groundwater are being captured.

The northern portion of groundwater in the upper bedrock within the NAPL plume is not captured. This is due to a combination of vertical hydraulic gradient and an inferred zone of relatively high transmissivity. The southern portion of the groundwater within NAPL plume is captured. The major portion of

groundwater within the middle bedrock zone NAPL plume is captured. Groundwater within the lower bedrock zone NAPL plume is captured, except for small portion of the northwest corner.

Installation of Additional Wells in 2001

OCC used the results of the model to select the locations of six additional wells which are currently being installed. The installation of these wells and associated monitoring wells, and the construction of the associated force mains will be completed by December 2001. The model predicts that 100% of the contaminated groundwater will be captured once these wells are in operation. Once these wells are installed, OCC will used a combination of inward hydraulic gradients, groundwater contour maps and model results to determine if these wells have achieved complete capture of the contaminated groundwater at the site. If complete capture is not attained with these additional wells, then OCC must consider further remedial measures.

Community Involvement

The public has expressed concern about the Hyde Park Landfill site. Public participation was extensive during the remedy selection and RRT negotiation process. EPA maintains a public information office in Niagara Falls that responds to citizen concerns and requests regarding Superfund sites. EPA held numerous public meetings through the remedy selection process and subsequent implementation of remedial action by OCC. Public Availability sessions are held in the public information office, which also distributes fact sheets and citizen updates. The public has a moderate level of interest in the site.

MOE has expressed concern over the levels of TCDD in the sediments in the Niagara Gorge at the mouth of the Bloody Run. EPA has taken sediment samples and is currently conducting a Screening-Level Ecological Risk Assessment in response to these concerns.

Costs

To date, Occidental Chemical has spent over $55 million at the Hyde Park Landfill. The federal government, including EPA, has spent over $11 million. OCC spends approximately $2 million dollars per year on O&M.

IV. SCOPE AND NATURE OF THE FIVE-YEAR REVIEW

EPA has previously conducted a type-1 Five-Year Review. The remedy is not yet final. OCC is currently pumping the existing wells at the site to collect NAPL and APL, but an inward hydraulic gradient has not been established for all vectors of the bedrock NAPL Plume Containment System.

The OBCS, the overburden remedy, has been installed and is operating since 1991, containing and collecting the groundwater in the overburden. The Bloody Run sediments have been excavated and consolidated within the landfill. Access by humans to Gorge Face seeps has been eliminated, preventing human contact with any contaminated groundwater. The Community Protection Program is in place and providing an early warning system if Hyde Park contaminants were to be present in the groundwater. The Industrial Protection Program has been completed, preventing the workers from exposure to Hyde Park contaminants. There is a fenced perimeter, preventing access by potential trespassers. A security guard is provided at night when the plant operators are not present. Residents and business in the City of Niagara Falls and in the Town of Niagara use public water supplies. There are no wells located in areas of contamination that use potable or non-potable supplies.

The site was visited at least four times during the past year by the EPA project manager. The purpose of these visits was to determine the current status of remedial actions at the site and the whether the site cleanup was adhering to all approved plans, specifications and protocols. Oversight of the remedial actions at the site is conducted on a day-to-day basis by EPA's contractor, TAMS Consultants, Inc.

In addition to site visits, the following documents, data and information were examined in completing the Five-Year Review:

- *Stipulation and Judgment Approving Settlement Agreement*
- *Stipulation on Requisite Remedial Technology*
- *Enforcement Decision Document, Remedial Alternative Selection, Hyde Park Landfill*
- *Monitoring Report, Intermediate Formations Wells*
- *Bedrock Prototype Purge Well Program, Phase I Pump Tests and Assessment*
- *APL/NAPL Plume Refinement Report*
- *Bloody Run Investigation Excavation Soil Survey*
- *Plans and Specifications for the Overburden Barrier Collection System*
- *APL/NAPL Plume Refinement Report*
- *Quarterly Monitoring Reports* (1996 - 2001) - Bedrock Monitoring Data: NAPL & APL Plume Containment System and Overburden Monitoring Data: OBCS, Community Monitoring System and Leachate Treatment System - OCC
- *Annual Monitoring Report* (1997-2000) - (Source Control, Intermediate Formations, Gorge Face Seep Survey, Bloody Run Monitoring, Collected Liquids Monitoring, Bedrock NAPL/APL Ratio Testing and Existing Well Survey - OCC

- *Niagara River Mussel Biomonitoring Program, 1997* (September 1999) - Ontario Ministry of the Environment
- Affidavits of the following technical experts: Neil Shifrin (fate and transport of chemicals); Charles Faust (geology); Arthur Schatz (environmental data analysis); Paul Jonmaire (toxicology); Joseph Rodericks (risk assessment); Livia Benavides (risk assessment); and Robert Lewis (air monitoring)
- TAMS' monthly oversight reports
- Historical and current analytical data on groundwater and soil at the site
- *Groundwater Modeling Study: Data Review and Conceptual Model, Hyde Park Landfill Site, Niagara Falls, New York* (October 30, 2000)
- *Groundwater Modeling Study: Final Model Report, Hyde Park Landfill Site, Niagara Falls, New York* (February 19, 2001)
- *Groundwater Modeling Study: Conceptual Evaluation of NAPL Plume Containment System, Hyde Park Landfill Site, Niagara Falls, New York* (March 15, 2001)
- OSWER Directive 9355.7-02, *Structure and Components of Five-Year Reviews*

V. RESULTS OF THE FIVE-YEAR REVIEW

All of the remedial systems at the site have been constructed and are properly operating except for the bedrock NAPL Plume Containment System. The performance standard for this system is hydraulic containment. Effective hydraulic containment, as determined by hydraulic gradients, has not yet been achieved. Additional extraction wells and/or other remedial measures are needed to achieve hydraulic containment around the landfill.

OCC is currently installing six additional extraction wells in the bedrock. The model for the site predicts that 100% of the contaminated groundwater will be captured once these wells are in operation. Completion of the wells and force mains is scheduled for December 2001. EPA will then determine if 100% of the groundwater is being captured. After several months of water-level measurements which indicate that the contaminated groundwater is being captured, the system will be declared operational and functional and we will write a remedial action report.

All other components of the remedy have been constructed and are operational and functional. Those components of the remedy which have been completed are as follows: Source-Control Wells; Containment and collection of APL and NAPL in the overburden; Treatment of collected APL and NAPL; Community Monitoring Program; Intermediate Formations Study; Industrial Protection Program; Perimeter Capping; Final Capping; Gorge Face Seeps remediation; TCDD Bioaccumulation Study in Lake Ontario; and the Bloody Run excavation.

The leaky on-site lagoons were emptied and the NAPL contained in them destroyed. The lagoons were closed with a clay cap. One hundred and fifty-five thousand gallons of NAPL formerly stored onsite in the four railroad tank cars were destroyed. Approximately thirty thousand cubic yards of contaminated sediment were removed from the Bloody Run. Nearby sewers have been cleaned, replaced or sliplined.

The remedies devised to prevent exposure to humans by preventing access are in place. There are currently no users of groundwater in the area.

Institutional controls are in place at the site to prevent the transfer of the property without the full knowledge and commitment by the purchaser to continue the groundwater pump and treat system operation for an indefinite period of time.

VI. STATEMENT OF PROTECTIVENESS

Based upon a review conducted by Gloria M. Sosa, Remedial Project Manager, it has been determined that the remedies selected for the Hyde Park Landfill are protective of human health and the environment. Most of these remedies have been implemented and are fully operational. However, a very important component of the total remedy (*i.e.*, hydraulic containment of APL in the bedrock) is not yet completed. Further remedial work is necessary to reach the hydraulic containment performance standard.

Although the groundwater containment remedial actions at the Hyde Park Landfill are not complete, EPA believes that the implemented actions are protective of human health. The remedies already completed at the site prevent human access to contaminants (either directly or through drinking-water consumption). There is a fence around the site and a night security guard to prevent access when the plant is not in operation. The exposure reduction and groundwater containment, collection and treatment remedies, together with site-access prevention, are protective of human health.

Concerning protectiveness of the environment, the landfill containment remedy prevents exposure of plants and animals to contaminants and is protective of the environment. A bioaccumulation study of contaminants in fish has confirmed that overall TCDD APL Plume Flux Action levels are protective of the environment. However, MOE has raised a concern over contaminated sediments at the base of the Niagara River Gorge Face. EPA will perform a Screening-Level Ecological Risk Assessment of sediments in the area of the mouth of the Bloody Run and this study will be completed before December 2001.

VI. NEXT FIVE-YEAR REVIEW

EPA will conduct another Five-Year Review of the remedial action at the Hyde Park Landfill before September 2006.

John S Frisco

for Kathleen C. Callahan, Acting Director
Emergency and Remedial Response Division

9/28/01
Date