FIVE-YEAR REVIEW REPORT

HYDE PARK LANDFILL SITE

NIAGARA FALLS, NEW YORK

Prepared By:

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Region II

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I. PURPOSE

Section 121(c) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, (CERCLA) 42 U.S.C. Section 9601 *et seq*, as amended, and Section 300.430(f)(4)(ii) of the National Contingency Plan (NCP) require that periodic (no less often than every five years) reviews be conducted for sites where hazardous substances, pollutants or contaminants will remain at the site above levels that allow for unlimited use or unrestricted exposure following the completion of all remedial actions for the site. The purpose of such a review is to assess whether the remedial actions being implemented continue to be protective of human health and the environment.

CERCLA and the NCP require that a five-year review be conducted no less often than five years after the initiation of the selected remedial action. Currently, EPA defines the "initiation of remedial action" for the purposes of Section 121(c) of CERCLA as the remedial action contract award date. The Hyde Park Landfill remedial action commenced on June 1, 1988. Accordingly, EPA has prepared this Five-Year Review report. However, not all portions of the remedial plan have been fully implemented. Therefore, this review will only focus on the protectiveness of the work conducted to date.

EPA has established a three-tier approach to conducting Five-Year Reviews, the most basic of which provides a minimum evaluation of protectiveness (Level I review). EPA contemplates that a Level I review will be appropriate in all but relatively few cases where site-specific circumstances suggest otherwise. The second and third levels (Levels II and III) of review are intended to provide the flexibility to respond to varying site-specific considerations requiring further analysis (*e.g.*, the absence of expected change in the level of contaminants, as monitored).

The remedial action is not complete at the site. The final remedial action at the site will be the construction of a cap for the landfill, which is scheduled for completion in October 1994. However, many elements of the remedial action have been completed and EPA remains confident that the entire remedy selected for the Hyde Park Landfill, when completed, will be effective and protective of human health and the environment. Based on these considerations, EPA has determined that a Level I review is appropriate for this five-year review of the site.

II. SITE HISTORY AND CONDITIONS

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 & bulk liquids, solids) from 1953 to 1975 at the site, 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). Approximately 0.7 - 1.6 tons of TCDD are believed to have been 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. There are residential neighborhoods to the northwest and south of the landfill. The Niagara River, an international waterbody, is located 2,000 feet to the northwest, down the Niagara Gorge which descends approximately 350 feet below the surface of the landfill.

The geology underlying the site is glacial overburden overlying Lockport Dolomite, a fractured bedrock. Ground water in the vicinity of the landfill is found in two distinct natural systems: overburden and 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 ground water exits the Niagara Gorge Face in the form of seeps which flow into the Niagara River. Chemicals migrate from the landfill in two forms: aqueous phase liquid (APL or contaminated ground water) and dense non-aqueous phase liquid (NAPL). The fractured bedrock (karst formation) environment typical of the Niagara Falls area renders it difficult to locate and remove NAPL.

The APL plume is composed primarily of benzoic acids, chlorobenzoic acids, chlorendic acid and phenol. Total organic halogen (TOH), 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. At least 20 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.

Associated with the landfill is the Bloody Run, a small drainage area flowing north from the landfill, passing under a neighboring industry via a sewer, and under University Drive via a storm sewer which emerges at the Niagara Gorge. University Drive borders Niagara University, which has 3000 students.

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 to require OCC to remediate the site. EPA, New York State and OCC filed a *Stipulation and Judgment Approving Settlement Agreement* (Settlement Agreement) on January 19, 1981, which the Court approved on April 10, 1982. The Settlement Agreement required OCC to perform an Aquifer Survey (which can be compared to a remedial investigation) 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 the basis of extensive negotiations among EPA, New York State and OCC. The parties subsequently agreed on remedial actions to be performed at the site, which were documented in a *Stipulation on Requisite Remedial Technology* (RRT Stipulation) approved by the Court on August 11, 1986. EPA issued an Enforcement Decision Document (similar to a Record of Decision) on November 26, 1985, documenting the remedies selected for the site.

The remedy includes the following specific elements: source control (prototype extraction wells); containment and collection of leachates (APL & NAPL) in the overburden (Overburden Barrier Collection System); containment and collection of leachates (APL & NAPL) in the Lockport bedrock (purge and recirculation wells); treatment of collected leachates (APL & NAPL); Community Monitoring Program (monitoring wells for early detection of indicator 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 (elimination of exposure to contaminated seeps and sediments); TCDD Bioaccumulation Study in Lake Ontario (ingestion of TCDD contaminated fish is the greatest risk from the site); Bloody Run Excavation or Capping; and, final capping and site closure.

III. SUMMARY OF RESPONSE ACTIONS (SITE CLEANUP)

Due to the complexity and varied nature of the remedial actions to be performed at the Hyde Park Landfill, each remedial action will be discussed separately in this report, although the site was never divided into operable units.

The source control remedial program described in the RRT Stipulation consists of up to six 36-inch diameter wells installed in the overburden inside the landfill designed to collect NAPL for subsequent destruction by incineration. The RRT requires that OCC install two initial extraction wells in the landfill and perform pump tests on the system. Depending on the results of these tests (*i.e.*, whether mobile NAPL is being collected, the amount collected, etc.), up to four more extraction wells may be installed. Installation of these two initial Source Control extraction wells was completed in 1990. Pump tests on these wells were completed in June 1993. In conjunction with the source control wells' pump test, OCC also investigated potential NAPL source areas within the landfill. As a result of these tests, four additional source control extraction wells are currently being installed. These additional wells will have two-phase flow pumps installed to facilitate the pumping of NAPL.

The Overburden Barrier Collection System (OBCS), a drain around the entire landfill to contain and collect contaminated groundwater, was installed in 1990 and its pumps are now operating, thereby preventing migration of contaminants through the overburden. The purpose of the OBCS is to contain the lateral migration of the overburden NAPL plume and contain the APL plume, to the extent practicable, as stated in the RRT Stipulation.

The NAPL Plume Containment System, a bedrock RRT consisting of a system of purge and recirculation wells, was designed to prevent the lateral migration of NAPL through the bedrock, to the extent practicable and to create an inward hydraulic gradient. This bedrock remedial system is an extremely important element of the overall remedial program. Available data indicate that a significant portion of the liquid waste disposed of at the landfill may have escaped to the bedrock. If left unmitigated, contaminated ground water, and more importantly NAPL, would continue to migrate slowly towards the Niagara River. The purge wells will contain and collect NAPL and APL in the bedrock. The recirculation wells will operate on the flushing principle developed for secondary oil recovery to enhance NAPL recovery.

The NAPL Plume Containment System is designed to maximize NAPL collection and create an inward hydraulic gradient in the bedrock aquifer surrounding the landfill. The system is to be installed in a phased approach. First, the prototype system consisting of two nests of purge wells, two cluster monitoring wells and two recirculation wells is to be installed and operated. Long-term pump tests are to be performed on these wells. Then, based on the results of these pump tests, more wells are to be installed and operated. The prototype system will be determined to be complete by EPA and New York State when the objectives of the bedrock remedial program are met.

Phase I, consisting of six purge wells (2 well nests with 3 wells each) was installed by OCC in 1990. 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. EPA is currently reviewing OCC's assessment of these pumps tests to determine if the Phase II system will meet the criteria set forth in the RRT Stipulation. If these performance criteria are not met, additional wells will be necessary.

The APL Plume Containment System, consisting of two to three purge wells to be installed at the Niagara Gorge Face, was designed to collect a significant portion (60-88%) of the contaminated ground water outside the NAPL plume. These wells were installed this summer. The portion of the APL plume not collected will be 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.

A risk assessment was performed by EPA's health effects consultant using the EPA risk assessment procedures that were in effect at the time of the RRT negotiations. There were insufficient data to conclusively determine the risk, therefore, worst-case assumptions were used. The total potential cancer risk from the site was found to be dependent on TCDD exposure from eating fish. The TCDD level in fish is in turn dependent on the concentration of TCDD in 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, additional wells, etc.) to reduce these contaminant levels.

APL is treated on-site at the Leachate Storage and Treatment Facility which began operating in April 1990. The APL/NAPL mixture is pumped from the wells through forcemains 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). Then the APL is pre-treated in biological reactors, and finally treated in an activated carbon system.

During the spring snow melt, excess ground water enters the OBCS at higher rates than OCC anticipated (much of it clean water entering from the northwest); as a result, the treatment facility rated at 70 gallons per minute does not provide enough capacity. A clay barrier wall has been installed to the north and west of the OBCS in an attempt to eliminate some of the excess water. OCC is performing a study to determine the effectiveness of the clay barrier wall and what additional remedial actions may be taken to reduce the amount of water. OCC has made some design changes to the treatment facility to allow more throughput. When final improvements are finished this year, the treatment capacity will be increased to a total of 110 gallons per minute. This capacity should be sufficient to treat leachate and groundwater from all the remedial systems, however, further design changes may be necessary.

Once it has been collected in the Leachate Storage Facility, NAPL is transferred by tanker truck to the OCC's Buffalo Avenue Plant in Niagara Falls for incineration. All remedial actions that yield NAPL were dependent on the issuance of a permit modification for OCC's Niagara Plant incinerator. Obtaining the permit modification took OCC five years. This delay in obtaining a permit modification significantly impacted 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.

As previously stated, the APL Plume Flux Action Level for TCDD 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.

The draft Lake Ontario TCDD Bioaccumulation Study was completed in July, 1989 and distributed for scientific peer review. The final TCDD Study report was released to the public in September, 1991. Fish and sediment samples from Lake Ontario were collected and analyzed for TCDD and lab studies were performed. The study 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 remains protective.

The perimeter cap of the landfill was completed in 1991, preventing ground-water infiltration from entering the landfill. The entire landfill will be capped by October 1994, as per the Settlement Agreement. The final cap will consist of the following: low-permeability clay; a synthetic membrane; a drainage layer and topsoil seeded with native vegetation for barrier protection. Currently, an interim clay cap has been placed on the landfill.

The Community Monitoring Wells, a system of wells placed in the community to provide early warning of the presence of Hyde Park contaminants in the ground water, were installed in 1987. The purpose of these ground-water monitoring wells is to provide early warning and trigger further action in the unlikely event that chemicals migrate into nearby residential areas. No chemicals have been detected in these wells, as was expected, since they were installed beyond the leachate plume. The data collected have demonstrated that the ground-water flow is vertically downward in the nearby community. EPA reviews the analytical results from sampling of these wells to ensure the community is being protected.

The Industrial Protection Program, consisting of engineering controls, was developed to eliminate the exposure of nearby workers to contaminants that are present in the NAPL and APL plumes. The Industrial Protection Program was implemented in 1987. Sumps in neighboring industries have been sealed, as well as some manholes, thereby eliminating workers' exposure to contaminants in the ground water whose vapors may migrate into the sump. Annual inspections are conducted by representatives of EPA, New York State and OCC.

The Settlement Agreement set forth two possibilities for remedial action at the Bloody Run: excavation or capping. At the time of the RRT negotiations, not enough information was available for all parties to reach consensus regarding the fate of the Bloody Run. EPA and New York State favored excavation of the drainage area since it would remove contaminants present in the soils and result in a permanent remedy and restoration of the area. EPA performed a risk assessment in April 1992 that determined that the excavation of the Bloody Run did not pose a risk exceeding 10^{-6} (due to fugitive dust emissions) and therefore was protective of human health. Excavation was completed in January 1993.

The Gorge Face Seeps were remediated in 1988, except for the Bloody Run portion, which will be remediated this summer. TCDD was detected once in one seep at 0.2 ppt. EPA determined that humans must be isolated from the seeps to prevent an exposure pathway

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

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

Remedial actions in addition to those previously discussed have been completed by OCC at the site. The Waste Disposal Plan was implemented in 1988. Waste disposal cells lined with clay were constructed on top of the landfill to consolidate wastes resulting from remedial actions at the site. Contaminated soils from survey activities and the Bloody Run remediation were consolidated in the landfill.

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 the four railroad tank cars, which resided on-site for years as storage for NAPL generated from survey activities and remedial investigations. These tank cars were used because there was no place permitted to destroy dioxin. In 1991, the cars were placed in the waste disposal cells.

In addition to the above-mentioned remedial activities, OCC redefined the extent of the APL/NAPL plumes in the bedrock and relocated a sewer at TAM Ceramics (a neighboring industry) in 1989. The College Heights sewer was remediated in 1990. The remediation of the University Drive 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.

IV. SCOPE AND NATURE OF THE FIVE-YEAR REVIEW

As previously discussed, EPA guidance for Five-Year Reviews contemplates three levels of review. Level I is the lowest level of evaluation of protectiveness, Level II is the intermediate level, and Level III is the highest level of evaluation of protectiveness. Levels II and III were not considered for this Five-Year Review because the ground water containment and collection remedies designed for the bedrock are not yet completed. The remedy is not yet final. Even though both the source control and bedrock remedies are not operational, OCC is pumping those wells already installed to collect as much NAPL and APL as possible at this time. However, many remedial actions have been completed at the site. The OBCS has been completed and is operating, containing and collecting the ground water 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 ground water. 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 24-hour guard at the site, as well as a fenced perimeter, preventing access by potential trespassers.

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, 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*

- 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)

- OCC's monthly status reports

- TAMS' monthly oversight reports

- Current land use restrictions

- Historical and current analytical data on ground water and soil at the site

- OSWER Directive 9355.7-02, *Structure and Components of Five-Year Reviews*

V. RESULTS OF THE FIVE-YEAR REVIEW

As previously stated, the ground-water containment and collection remedial system has not yet been completed at the site. The completion date for remedial action is scheduled for March 1995. However, many associated components of the remedy have been completed and are operating satisfactorily. Those components of the remedy which have been completed are as follows: Containment and collection of leachates in the overburden; Treatment of collected leachates; Community Monitoring Program; Intermediate Formations Study; Industrial Protection Program; Perimeter Capping; Gorge Face Seeps remediation; TCDD Bioaccumulation Study in Lake Ontario; and the Bloody Run excavation.

Two Source Control wells, Phase I and Phase II of the bedrock RRT purge wells have been installed and are operating. Phase II wells are currently being pump tested. OCC must demonstrate to EPA and New York State that the bedrock remedial system meets the criteria set forth in the RRT Stipulation before the prototype system is determined to be operational by EPA and New York State.

There is some concern that the Source Control wells are not recovering as much mobile NAPL as had been anticipated. At this time, there is less overall collection of NAPL than had been predicted. However, EPA believes that the new two-phase pumps will be more effective at pumping the viscous NAPL. Even if there is less source reduction than anticipated, the well systems in the overburden and the bedrock will contain and collect contaminated ground water, therefore the plume will be under control.

The lagoons have been closed and the NAPL contained in them destroyed. The NAPL in the four railroad tank cars was destroyed. The removal of contaminated soil from the Bloody Run was a permanent remedy which eliminated a source of contamination and therefore is fully protective of human health and the environment. Nearby sewers have been cleaned, replaced or sliplined. The remedies devised to prevent exposure to humans

by preventing access are in place. EPA still considers the remedies designed for the Hyde Park Landfill to be protective of human health and the environment.

In summary, although the ground-water containment remedial actions at the Hyde Park Landfill are not complete, EPA believes that these remedial actions will be protective of human health and the environment. The remedies completed at the site prevent access to contaminants, and are thereby protective. There is a fence around the site and a 24-hour security guard to prevent access. In addition, 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 ground-water pump and treat system operation for an indefinite period of time. The exposure reduction and ground-water containment, collection and treatment remedies, together with site-access prevention, are protective of human health. EPA will conduct another Five-Year Review of the remedial action at the Hyde Park Landfill by June 30, 1999.