TABLE OF CONTENTS

I. Executive Summary 1

II. Site and Parcel Location 3

III. Site Summary 4

1. Site and Contaminant History 4
2. Summary of Cleanup Activities 5
3. Redevelopment/Reuse History 7

IV. U.S. EPA's Basis for Ready for Reuse Determination (RfR) 7

1. Background 7
2. Description of Risks 8

V. Ongoing Limitations and Responsibilities Previously Established by U.S. EPA 10

1. Engineering and Institutional Controls 10
2. Operation and Maintenance Requirements 10

VI. Provisos 11

Appendix A: Risk Assessments Summary
Appendix B: Abbreviations and Acronyms
Appendix C: Glossary
Appendix D: *Exposure Pathway Analysis and Risk Assessment for the H.O.D. Landfill Final End Use Plan*
Appendix E: Explanation of Significant Differences

LIST OF EXHIBITS

1. H.O.D. Landfill Aerial Photograph with Tax Parcel Overlay 3

2. H.O.D. Landfill Aerial Photograph Showing Land Uses 5

3. Time Line of U.S. EPA Activities Performed to Date at the H.O.D. Landfill 6

4. Possible Exposure Pathways Evaluated by the Risk Assessment for Human Health 9

I. Executive Summary

This Ready for Reuse Determination (RfR) is for the H.O.D. Landfill Superfund site ("Site") which comprises Lake County, Illinois tax parcels 02-08-400-005, 02-08-400-006, 02-08-400-007, 02-09-300-011, and 02-09-300-012. The Site covers approximately 51 acres of the land area within these tax parcels.

The conditions summarized in this RfR are based on limitations and requirements established in U.S. EPA decision documents for the Site including the Record of Decision (ROD) and Explanation of Significant Differences (ESD). U.S. EPA has made a technical determination that the Site, located in the Village of Antioch, Lake County, IL, is ready for limited recreational use and that the Site's remedy will remain protective of human health and the environment, subject to operation and maintenance of the remedy and the limitations identified below, as specified in the ROD and ESD:

1. The Site is presently ready for limited recreational use, including recreational fields, playgrounds, off-leash dog areas, walking and biking trails (not to be used by motorized vehicles), an archery range, model airplane flying areas, a golf driving range, nature area/interpretive walking areas, a picnic area (excluding cooking), and special events like concerts or festivals, subject to the conditions below.

2. Presently and for the foreseeable future, the Site's remedy will remain protective for the uses mentioned above, subject to the following limitations specified in the ROD and ESD:
   a. There should be no displacement of soil, either direct or incidental, beyond 12 inches underneath the ground's surface; this limitation may be waived, on a case-by-case basis, if an appropriate engineering study is conducted that justifies non-compliance with this limitation, and U.S. EPA approves the engineering study and provides approval to modify the limitation for that particular instance.
   b. The gas and leachate[1] well head vaults existing on-site should remain locked at all times, except during operation and maintenance activities, in order to maintain their security.
   c. The security of the flare building and remedial components existing on-site should be maintained with the installation and ongoing maintenance of fencing, gates that are to be locked at all times except during operation and maintenance activities, and posting and maintaining no trespassing signs.

3. The components of the remedy requiring ongoing operation and maintenance are the landfill cap, the landfill gas collection system, the leachate collection system, and groundwater monitoring. Waste Management of Illinois, Inc. (Waste Management) is

[1] Leachate is the result of runoff that comes in contact with decomposing waste. Leachate seeps refer to the escape of leachate from the landfill into the Site's groundwater or onto the surface of the Site.

responsible for the operation and maintenance of the remedy at the Site.

This RfR remains valid only as long as the requirements and use limitations specified in the ROD and ESD continue to be met.

U.S. EPA has assessed the risks to human health and the environment resulting from contamination at the Site. During U.S. EPA's investigation of the Site in August 1994, an assessment was conducted of the human and environmental risks associated with: 1) nearby residents using groundwater contaminated by the Site and inhaling fugitive landfill gas from the Site and 2) trespassers on the Site being exposed to contaminated soil, surface water, air and sediments.

The potential risks that were identified in the baseline risk assessment of the Site in 1994 were human exposure to vinyl chloride, manganese, beryllium, and arsenic through groundwater. In its ROD, U.S. EPA selected response actions to manage and eliminate these risks to human health and the environment. With the completion of the response actions required by the ROD, the risk-based cleanup goals and remedial action objectives for the Site were satisfied by Waste Management. In August 2003, a second risk assessment entitled *Exposure Pathway Analysis and Risk Assessment for the H.O.D. Landfill Final End Use Plan* was conducted for the Site to confirm that the cleanup goals would be protective of the future use, and it was found that remedial action objectives had been met by the remedy as implemented. The 2003 revised risk assessment calculated that the cancer risks associated with the soils on Site are currently 9×10^{-9} (nine in a billion), much lower than U.S. EPA's threshold for concern. There were no non-cancer risks associated with the Site.

As a result, U.S. EPA has determined that the unacceptable levels of risk to current and future users of the Site have been abated. The Site is ready for limited recreational use and the Site's remedy will remain protective of human health and the environment, subject to operation and maintenance of the remedy and limitations as specified in the ROD and ESD.

U.S. EPA Region 5 issued this Ready for Reuse determination, effective November 12, 2003.

By: Wm. E. Muno

William E. Muno, Director
Superfund Division
United States Environmental Protection Agency
Region 5

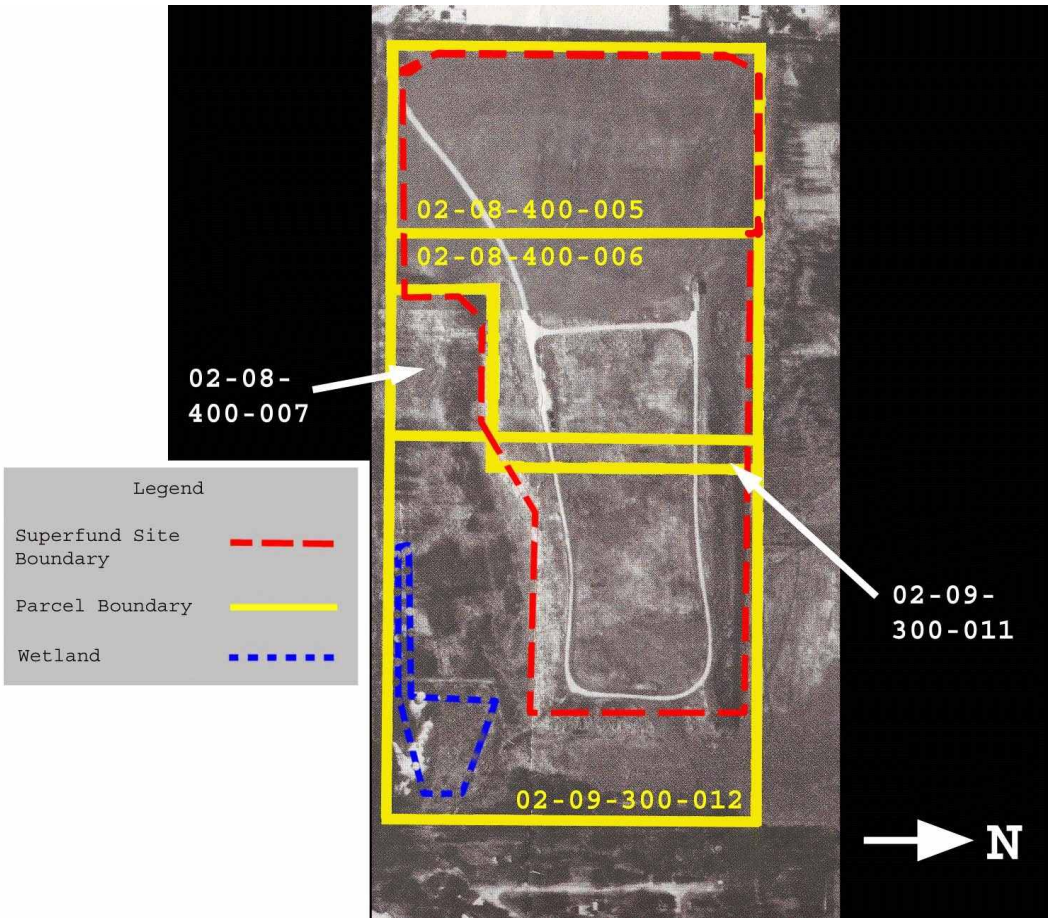
Documents pertaining to the Site and the RfR are part of the Administrative Record for the Site, which is available for review at the Antioch Public District Library in Antioch, IL, and at U.S. EPA Region 5 offices in Chicago, IL. Additional information can be obtained from Thomas Bloom, the Site's Remedial Project Manager (RPM), who can be reached at 312.886.1967 or bloom.thomas@epa.gov.

II. Site and Parcel Location

The following text provides a geographical description of the H.O.D. Landfill Superfund site in Antioch, IL.[2] The Site borders McMillen Road to the southwest. Depot Street runs parallel to the Site's northern border. Lakeview Drive runs parallel to the Site's eastern border. A seasonal wetland begins 250 feet to the southeast of the Site's southeastern border.

The aerial photograph presented in Exhibit 1 shows the five Lake County, IL tax parcels that are included, in whole or in part, in the H.O.D. Landfill Superfund site. The Site is outlined in red; the tax parcels' boundaries are shown in yellow. The western group of parcels, 02-08-400-005, 02-08-400-006, and 02-09-300-011, is owned by Waste Management of Illinois, Inc. (Waste Management); the eastern group of parcels, 02-08-400-007 and 02-09-300-012, is owned by the Village of Antioch. A nearby seasonal wetland area, outlined in blue and located to the southeast of the Site, is also shown. The wetland is outside of the Site's boundaries.

Exhibit 1. H.O.D. Landfill Aerial Photograph with Tax Parcel Overlay



[2] Distances are approximate.

III. Site Summary

Site and Contaminant History

The H.O.D. Landfill Superfund site is located within the Village of Antioch, Lake County, IL. The Site consists of approximately 51 acres of landfilled area out of the total 121.5 acres comprising the facility. Waste Management operated the landfill from 1973 until 1984, when the Site stopped accepting waste. Wastes disposed of at the Site included municipal, commercial, and industrial wastes. The primary contaminants of concern identified during the remedial investigation (RI) were vinyl chloride, beryllium, manganese and arsenic in the groundwater. Although the landfill area is continuous, it consists of two separate landfill areas, identified as the "old landfill" and the "new landfill." The "old landfill" covers the 24.2 acres situated on the western third of the property. The "new landfill" covers the 26.8 acres located immediately east of the "old landfill." Based on borings performed during the Site's RI, the landfill cap, which is one continuous cover, ranged in thickness from 49 inches to 87 inches.

Contamination at the Site resulted from municipal landfill activities and unknown quantities of illegally deposited wastes. Municipal landfill activities began in 1963 and ended in 1984. The Site was closed and capped under Illinois EPA permitting in 1989. After the closure and capping of the Site, erosional rills and gullies developed in some areas of the landfill cover, and several areas of differential settlement and stressed vegetation developed. Minor leachate seeps, animal burrows, and fugitive landfill gas emission areas were also observed.

The Site came to U.S. EPA's attention in 1981 when Waste Management submitted a Hazardous Waste Site Notification Form. The form indicated solvents, heavy metals, and cutting and hydraulic oils were disposed of at the Site, in addition to municipal waste. The Site was listed on the National Priorities List (NPL) in 1990.

The Site is bordered on the south and west by Sequoit Creek. Silver Lake is located approximately 800 feet southeast of the Site. A large seasonal wetland area extends south of the Site from Sequoit Creek. Surface drainage around the Site is generally toward Sequoit Creek, which flows into the Fox River, approximately five miles west of the Site. The Little Silver Lake Subdivision is east of the Site in unincorporated Lake County, and is not a part of the Village of Antioch. Agricultural land, scattered residential areas, and undeveloped land are located to the north. A large industrial park area (Sequoit Acres Industrial Park), which was built on former landfill and fill areas, is located west of the Site, bordering Sequoit Creek. The landfill underneath the Industrial Park is not part of the H.O.D. Landfill. Exhibit 2 shows a labeled aerial photograph of the Site and the surrounding areas.

The Site is currently located within the Village of Antioch's "M2" zoning district. This designation covers special use manufacturing and industrial purposes, and includes landfills. Sequoit Acres Industrial Park is west of the Site, within the Village of Antioch's "M1" (light industrial) zoning district. Waste Management currently owns the western portions of the landfill and the Village of Antioch owns the eastern half.

Exhibit 2. H.O.D. Landfill Aerial Photograph Showing Land Uses

The southwest corner of the Site lies 150 feet east of McMillen Road, at the point where northbound McMillen Road changes direction from north/south to east/west. The Site's western boundary continues north for 1,500 feet, where it turns east and extends for 600 feet. The Site boundary heads southeast for 100 feet, and continues to extend east again for another 1,500 feet. The boundary then stretches south for 700 feet. The Site boundary then extends west for 600 feet, at the end of which it begins to curve to the south and west at a ratio of about 100 feet south for every 400 feet west. The boundary then again heads directly west for 400 feet, then turns southwest for 150 feet, followed by a run of 350 feet to the south. The boundary then extends 650 feet to the west and 100 feet to the northwest to return to its original position. Depot Street runs parallel to the Site's northern border 1,200 feet north of the Site. To the east, Lakeview Drive runs parallel to the Site's eastern border 600 feet away. A seasonal wetland begins 250 feet to the southeast of the Site's southeastern border.

Summary of Cleanup Activities

Exhibit 3 shows a time line of U.S. EPA activities performed to date at the H.O.D. Landfill Superfund site.

Exhibit 3. Time Line of U.S. EPA Activities Performed to Date at the H.O.D. Landfill[3]

06/1981	Site brought to attention of U.S. EPA
02/1983	Preliminary Assessment
12/1984	Site Inspection
09/1985	Site proposed for listing on U.S. EPA's National Priorities List (NPL)
09/1985	Hazard Ranking System (HRS) Scoring Package
05/1988	Expanded Site Inspection
02/1990	Site listed on NPL
08/1994	Baseline Risk Assessment
06/1998	Remedial Investigation and Feasibility Study
09/1998	Record of Decision
08/2000	Remedial Design Report
09/2001	Preliminary Closeout Report
10/2001	Interim Remedial Action Report
08/2003	Risk Assessment: *Exposure Pathway Analysis and Risk Assessment for the H.O.D. Landfill Final End Use Plan*
09/2003	Explanation of Significant Differences

The following cleanup activities were performed for the remediation of the Site, consistent with U.S. EPA presumptive remedy guidance.

1. The landfill cap was repaired using existing cap materials and off-site clay to restore the cap to its original grade. Part of this restoration included adding a foot of clean soil on top of the restored cap.
2. The landfill gas system was upgraded for active gas collection and treatment.
3. The leachate extraction system was upgraded to enhance leachate removal. Leachate

[3] Documents can be found at the U.S. EPA Records Center in the Region 5 offices, Chicago, IL. Appendix C provides a glossary of terms.

continues to be collected and hauled to a treatment works facility.

4. Monitored natural attenuation continues for the remediation of contaminated groundwater.
5. Institutional controls and deed restrictions have been selected for the Site.

Waste Management, one of the Site's potentially responsible parties (PRPs), began construction of the remedy in August 2000 and finished in June 2001. A Preliminary Closeout Report (PCOR), which documents that the PRP has completed remedial action construction activities at the Site, was issued in June 2001. To facilitate the use of the Site for limited recreation, leachate and gas extraction well heads on the Site were placed in below-ground vaults that, if desired, can be covered with synthetic turf to allow recreational users to participate in activities over the wells.

Redevelopment/Reuse History

The Site is currently idle, and has been since the closing of the landfill.

IV. U.S. EPA's Basis for Ready for Reuse Determination (RfR)

Background

The H.O.D. Landfill Superfund site RfR is based on U.S. EPA documents produced during the course of the Site's remedial activities. These documents provide evidence that the Site is ready for limited recreational use and that the Site's remedy will remain protective of human health and the environment, subject to operation and maintenance of the remedy and limitations as specified in the ROD and ESD. The RfR is based primarily on a revised risk assessment completed in August of 2003. Additional documents providing information about the Site's remedy, operation and maintenance requirements, and limitations include: the Interim Remedial Action Report, the Preliminary Closeout Report (PCOR), the Operation and Maintenance Progress Reports, and the Explanation of Significant Differences (ESD). These reports can be found in the Site's Administrative Record, which is available for review at the Antioch Public District Library in Antioch, IL, and at U.S. EPA's Region 5 offices in Chicago, IL.

The revised risk assessment analyzed the risks associated with using the H.O.D. Landfill Superfund site for limited recreational purposes, under the assumption that groundwater would not be used, and determined that the Site did not pose an unacceptable risk so long as the reuse activities do not negatively affect the remedy. Potential uses evaluated for the Site include recreational fields, playgrounds, off-leash dog areas, walking and biking trails (not to be used by motorized vehicles), an archery range, model airplane flying areas, a golf driving range, nature area/interpretive walking areas, a picnic area (excluding cooking), and special events such as concerts or festivals.

U.S. EPA's post-construction completion reports confirm the successful remediation of the H.O.D. Landfill Superfund site. The Interim Remedial Action Report describes the construction of the remedy and the operation and maintenance requirements. The Site's PCOR states that the

remedy has reached "construction completion," meaning that all components of the remedy have been built and are operational. U.S. EPA asserts that the Site's remedy is functioning according to expectations. In addition, the Site's first Operation and Maintenance Progress Report, produced in May 2002, states that maintenance issues associated with the final cover system, landfill gas perimeter probes, dual leachate/gas extraction wells, condensate sumps, extraction system piping, blower facility and flare system, groundwater monitoring wells, fencing, signs, and the access roads for the facility have been identified and addressed. The ESD revises the ROD to allow for recreational reuse of the Site, and updates institutional controls for the Site.

Description of Risks

A baseline risk assessment (BLRA) was prepared for the H.O.D. Landfill Superfund site in 1994 as part of the remedial investigation. The BLRA indicated unacceptable levels of risk (based on either cancer risk or an index of other health effects from long-term exposure) for nearby residents if they used groundwater containing contaminants of potential concern (COPCs) for drinking water and/or showering. The risks associated with contaminants found in other potential exposure pathways[4] were within acceptable levels established by U.S. EPA.

A revised risk assessment entitled *Exposure Pathway Analysis and Risk Assessment for the H.O.D. Landfill Final End Use Plan* was performed in 2003, following the construction of the Site's remedy, in anticipation of possible reuse activities. The revised risk assessment calculated that the cancer risks associated with soils on the Site are currently 9×10^{-9} (nine in a billion), much lower than U.S. EPA's threshold for concern. There were no non-cancer risks associated with the Site.

Exhibit 4 shows the media, exposure pathways, contaminants of concern, and relative risk for the Site under a limited recreational use scenario. The revised risk assessment concludes that the H.O.D. Landfill Superfund site is ready for use in a limited recreational capacity, with risks being hundreds to thousands of times lower than U.S. EPA's levels of unacceptable risk. The revised risk assessment has demonstrated that the Site poses no unacceptable risks for the proposed recreational uses, as long as the Site's remedy remains protective of human health and the environment. Contaminants in the surface soil at the Site, which were below levels of concern before the remedy was implemented, are further reduced because of the cap and layer of clean soil required in the ROD. The revised risk assessment concludes that even if the cap were to be breached and direct contact with contaminated soils were to occur, risk levels would still be acceptable.[5]

Fugitive landfill gas is not expected to be encountered because the Site's landfill gas extraction

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[4] Exposure pathways are means by which contaminants can reach populations of people, plants, or animals and include groundwater, surface water, soil, and air.

[5] "If exposure to contaminated soil did occur, risks from chemicals in soil would be below levels of concern." *Exposure Pathway Analysis and Risk Assessment for the H.O.D. Landfill Final End Use Plan*, p.23.

system prevents landfill gas from escaping from the landfill in any way other than via the extraction wells. Leachate seeps are not expected to occur as a result of the operation of the Site's leachate collection system.

Chemical concentrations at the Site are such that potential risks to plants, aquatic life, and terrestrial wildlife are estimated to be minimal. Observations of the character and composition of the terrestrial and aquatic communities of the Site suggest that the Site is not affecting the surrounding ecosystems.

Exhibit 4. Possible Exposure Pathways Evaluated by the Risk Assessment for Human Health[6]

Media	Exposure Pathway	Contaminants Posing Unacceptable Risks in the 1994 BLRA	Risk Conclusions from the 2003 *Exposure Pathway Analysis and Risk Assessment for the H.O.D. Landfill Final End Use Plan*
Air	Inhalation of chemicals from landfill gas; inhalation of airborne chemicals volatized from surface water; inhalation of vapors or fugitive dust from soil	None	None: Remedy controls fugitive landfill gas and combust VOCs; VOC concentrations above the landfill pose no risk
Surface Soil	Dermal absorption of chemicals in surface soil; incidental ingestion of chemicals in surface soil	None	None: Surface soil, which is covered by the cap and a foot of clean soil, poses no risk
Surface Water	Dermal absorption of chemicals in surface water; incidental ingestion of chemicals in surface water; ingestion of fish contaminated with chemicals from surface water	None	None: Chemicals at low concentrations and pose no risk
Sediment	Dermal absorption of chemicals in sediment; incidental ingestion of chemicals in sediment	None	None: Chemicals at low concentrations and pose no risk
Groundwater and Leachate	No direct pathways for contact with affected groundwater, although groundwater could serve as a possible source to the creek	Arsenic, Vinyl Chloride, Beryllium, Manganese	None: Use of groundwater prohibited; leachate collected and treated

[6] Information taken from the revised risk assessment, available in Appendix D.

V. Ongoing Limitations and Responsibilities Previously Established by U.S. EPA

Engineering and Institutional Controls

The Explanation of Significant Differences (ESD), issued in September of 2003, describes the current remedial components for the H.O.D. Landfill Superfund site. The ESD requires that there be no displacement of soil below one foot of the surface without an engineering study that justifies displacement of the soil in excess of the limit and that has been approved by U.S. EPA. The ESD requires that all gas and leachate well head vaults should remain locked and the flare building and remedial components shall be maintained and secured with fencing, locking gates, locking mechanisms and warning signs. The ESD also requires restrictive covenants for the Site to provide additional protection against disturbance of the remedy.

The Record of Decision (ROD) requires deed restrictions for the Site which would notify a potential purchaser of the property's past landfill activities, and restrict its subsequent land uses in order to ensure the continued integrity of the waste containment remedy. It is the intent of this RfR to reaffirm the importance of such restrictions.

As noted in the ROD, use of groundwater on the Site and in its vicinity is prohibited by Village of Antioch ordinance (Antioch Water Works and Sewage Ordinance Sections 50.008, 52.009, and 52.011) and restricted in the ROD. The local ordinance requires that properties within the Village that abut the public water works and sewerage system must be connected to the municipal water supply system. The ordinance also prohibits the installation of private wells within the Village. The Village of Antioch is responsible for implementing and enforcing these restrictions.

Operation and Maintenance Requirements

Operation and maintenance activities are designed to ensure that the remedy is operating and continues to operate properly. The components of the remedy requiring ongoing operation and maintenance are the landfill cap, the landfill gas collection system, the leachate collection system, and groundwater monitoring.

Waste Management is responsible for continuing operation and maintenance of the remedy at the Site. Specific information relating to ongoing operation and maintenance activities can be found in the Site's ROD, remedial design reports, and operation and maintenance progress reports.

Reviews will be performed at the Site every five years to ensure that the remedy remains protective of human health and the environment. The first report is due in August 2005.

VI. Provisos

This Ready for Reuse Determination is a technical decision document and does not have any legally binding effect, nor does it expressly or implicitly create, expand, or limit any legal rights, obligations, responsibilities, expectations, or benefits of any party. U.S. EPA assumes no responsibility for reuse activities or for any possible or potential harm that might result from reuse activities. U.S. EPA retains any and all rights and authorities it has, including but not limited to legal, equitable, or administrative rights. U.S. EPA specifically retains any and all rights and authorities it has to conduct, direct, oversee, and/or require environmental response actions in connection with the Site, including instances when new or additional information has been discovered regarding the contamination or conditions at the Site that indicate that the remedy and/or the conditions at the Site are no longer protective of human health or the environment for the uses identified in the Ready for Reuse determination.

This RfR remains valid only as long as the requirements and limitations specified in the ROD and ESD are met.

The parcels addressed in the RfR are subject to local land use regulations.

APPENDIX A

Risk Assessments Summary

A risk assessment is defined by U.S. EPA as a qualitative and quantitative evaluation of the risk posed to human health and/or the environment by the actual or potential presence and/or use of specific pollutants. A risk assessment characterizes the current or potential threat to public health and the environment that may be posed by contaminants originating at or migrating from a contaminated site. Information used in the risk assessment is gathered during the remedial investigation, a process that involves sampling different media at various locations to determine levels of contamination at a site.

The 1994 BLRA evaluated Excess Lifetime Cancer Risks (ELCRs), which describe whether exposure to carcinogenic (cancer-causing) contaminants at a site poses an unacceptable health risk to humans. ELCRs are expressed numerically, e.g., 1×10^{-4} or 1×10^{-6}. Carcinogenic risk expressed as 1×10^{-4} means that one out of 10,000 people exposed to contamination over a 70-year lifetime could potentially develop cancer as a result of the exposure. A carcinogenic risk of 1×10^{-6} means that one out of 1,000,000 people exposed over a 70-year lifetime could potentially develop cancer as a result of the exposure. The carcinogenic risk range established under CERCLA designates risks less than 1×10^{-4} to 1×10^{-6} as acceptable and protective of human health. Risks greater than this range indicate that the risks pose an unacceptable carcinogenic risk to human health.

Non-cancer risks are expressed in terms of a hazard index, which adds the risks associated with non-carcinogenic contaminants. Hazard indices are the sum of hazards for substances that affect the same target organ or organ system. A hazard index below one will likely not result in adverse non-cancer health effects, while a hazard index greater than one indicates there is potential for adverse health effects.

The BLRA indicated unacceptable levels of risk (based on either cancer risk or an index of other health effects from long-term exposure) for nearby residents if they used groundwater containing contaminants of potential concern (COPCs) for drinking water and/or showering. The risks associated with contaminants found in other potential exposure pathways[7] were within acceptable levels established by U.S. EPA.

In August 2003, a revised risk assessment was completed following the construction of the Site's remedy in anticipation of possible reuse activities. The 2003 revised risk assessment used data from the 1994 BLRA and monitoring data collected since the remedy was implemented. The purpose of the revised risk assessment, entitled *Exposure Pathway Analysis and Risk Assessment for the H.O.D. Landfill Final End Use Plan*, was to assess potential human health and environmental exposures and risks associated with proposed recreational site uses under current

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[7] Exposure pathways are means by which contaminants can reach populations of people, plants, or animals and include groundwater, surface water, soil, and air.

(remediated) site conditions. Proposed recreational uses included recreational fields, playgrounds, an off-leash dog area, walking and binking trails (no motorized vehicles) non-motorized trails, an archery range, model airplane flying areas, a golf driving range, nature area, picnic area (excluding cooking), and special events such as concerts or festivals.

The revised risk assessment considers post-remediation site conditions and proposed final end uses that could affect site users through exposure pathways. The 2003 revised risk assessment:

- Re-evaluated the exposure pathways for human and ecological receptors that were included in the 1994 BLRA to determine if they are still potential pathways. The exposure pathways posing unacceptable risks to human health and the environment, leachate and groundwater, are no longer of concern because exposure pathways to these media have been eliminated.

- Evaluated the 1994 BLRA to ensure that its conclusions for soil, sediment, and surface water are valid under current (remediated) site conditions, and considered any changes to toxicity data since 1994. The 2003 risk assessment determined that the 1994 BLRA conclusions for these exposure pathways would still be valid.

- Screened chemicals associated with potentially complete soil and surface water exposure pathways, and found no chemicals which exceeded those screening levels. This was also true when considering surface water and sediment concentrations and their potential effect on aquatic life.

APPENDIX B

ABBREVIATIONS AND ACRONYMS

AR - Administrative Record
BLRA/BRA - Baseline Risk Assessment
BOD - Biological Oxygen Demand
CC - Construction Completion
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (Superfund)
CERCLIS - Comprehensive Environmental Response, Compensation, and Liability Information System
DOD - U.S. Department of Defense
DOE - U.S. Department of Energy
DOI - U.S. Department of Interior
ELCR - Excess Lifetime Cancer Risks
ESD - Explanation of Significant Differences
ESI - Expanded Site Inspection
FCOR - Final Closeout Report
GIS - Geographic Information System
HRS - Hazard Ranking System
HWS - Hazardous Waste Sites
IEPA - Illinois Environmental Protection Agency
MCB - Monochlorobenzene
NER - National Exposure Registry
NIH - National Institutes of Health
NOID - Notice of Intent to Delete
NOD - Notice of Deletion
NPL - (N)ational (P)riorities (L)ist of Superfund Hazardous Waste Sites
O&M - Operations and Maintenance
OSRTI - Office of Superfund Remediation and technological Innovation
OU - Operable Unit
PA - Preliminary Assessment
PAH - Polynuclear Aromatic Hydrocarbons
PCOR - Preliminary Closeout Report
PHA - Public Health Assessment
PRP - Potentially Responsible Party
RA - Remedial Action
RCRA - Resource Conservation and Recovery Act of 1976
RD - Remedial Design
RfR - Ready for Reuse Determination
RI/FS - Remedial Investigation/Feasibility Study
ROD - Record of Decision
RPM - Remedial Project Manager
SARA - Superfund Amendments and Reauthorization Act of 1986
SI - Site Inspection
SRI - Superfund Redevelopment Initiative
SVOC - Semi-Volatile Organic Compound
TCE - Trichloroethylene
TEAM - Total Exposure Assessment Methodology
TRI - Toxic Release Inventory
TSDF - Treatment, Storage, and Disposal Facility
U.S. EPA - United States Environmental Protection Agency
VOC - Volatile Organic Compound
Waste Management - Waste Management of Illinois, Inc.

APPENDIX C

GLOSSARY

Baseline Risk Assessment (BLRA): A qualitative and quantitative evaluation of the risk posed to human health and/or the environment by the actual or potential presence and/or use of specific pollutants. A risk assessment characterizes the current or potential threat to public health and the environment that may be posed by chemicals originating at or migrating from a contaminated site.

Carcinogenic: A carcinogenic chemical is one which is believed to be capable of causing cancer.

Closeout report: A report submitted by the Remedial Program Manager (RPM) verifying that the conditions of the site comply with the Record of Decision (ROD) findings and design specifications and that activities performed at the site are sufficient to achieve protection of public health and the environment. This is a Remedial Action (RA) or ROD sub-event.

Construction Completion (CC): The CCL is a compilation of sites presently or formerly on the NPL. Sites qualify for the CCL when: any necessary physical construction is complete; EPA has determined that the response action should be limited to measures that do not involve construction; or the site qualifies for deletion from the NPL.

Deed restrictions: Restrictions placed within a deed that control the use of the property. Restrictions travel with the deed, and cannot generally be removed by new owners.

Dermal absorption: Absorption through the skin.

Discovery: The process by which a potential hazardous waste site is brought to the attention of the U.S. EPA. The process can occur through the use of several mechanisms such as a phone call or referral by another government agency.

Ecological risk assessment: Assessment of the risks posed by the site to ecological receptors.

Engineering controls: Engineering controls eliminate or reduce exposure to a chemical or physical hazard through the use or substitution of engineered machinery or equipment. An example of an engineering control is a protective cover over waste left on site.

Expanded Site Inspection (ESI): Functions performed to collect additional data, beyond that required for Hazard Ranking System scoring, in order to expedite the Remedial Investigation/Feasibility Study (RI/FS) project planning phase for National Priorities List (NPL) sites. The site inspection focus on pathways and receptors has been expanded to include site and source characterization. The information facilitates the development of RI/FS workplan and sampling and analysis plan.

Explanation of Significant Differences (ESD): A significant change to a Record of Decision (ROD) that does not fundamentally alter the remedy. An ESD may be initiated by U.S. EPA.

Exposure pathways: Exposure pathways are means by which contaminants can reach populations of people, plants, or animals. Exposure pathways include groundwater, surface water, soil, and air.

Feasibility Study (FS): A study of a hazardous waste site intended to (1) evaluate alternative remedial actions from technical, environmental, and cost-effectiveness perspectives; (2) recommend the cost-effective remedial action; and (3) prepare a conceptual design, a cost estimate for budgetary purposes, and a preliminary construction schedule.

Fugitive landfill gas: Fugitive landfill gas is formed in landfills and could reasonably pass through a stack, chimney, vent or other functionally equivalent opening.

Hazard Index (HI): The sum of hazard quotients for substances that affect the same target organ or organ system. Because different pollutants may cause similar adverse health effects, it is often appropriate to combine hazard quotients associated with different substances. As with the hazard quotient, aggregate exposures below a HI of 1.0 will likely not result in adverse non-cancer health effects over a lifetime of exposure.

Hazard Ranking System (HRS) Scoring: The HRS is a screening mechanism used to place sites on the NPL. In order for a site to be listed, it must have: 1) contaminants listed on U.S. EPA's Target Compound List of sufficient concentration to warrant concern; 2) a sensitive receptor population that would be negatively affected by the contaminants; and 3) pathways of exposure that would introduce the contaminant into the sensitive receptor population. Theoretically, a site meeting these conditions would score 28.5 or higher on the HRS, the threshold for placement on the NPL. The report detailing the findings of the scoring is referred to as the *HRS Scoring Package*.

Institutional controls: Institutional controls (ICs) are non-engineered instruments, such as administrative and/or legal controls, that help minimize the potential for human exposure to contamination and/or protect the integrity of a remedy by limiting land or resource use.

National Priorities List (NPL): Sites are listed on the National Priorities List (NPL) upon completion of Hazard Ranking System (HRS) screening, public solicitation of comments about the proposed site, and consideration of all comments. The NPL primarily serves as an information and management tool. The identification of a site for the NPL is intended primarily to guide U.S. EPA in: determining which sites warrant further investigation to assess the nature and extent of the human health and environmental risks associated with a site; identifying what CERCLA-financed remedial actions may be appropriate; notifying the public of sites U.S. EPA believes warrant further investigation; and serving notice to potentially responsible parties that U.S. EPA may initiate CERCLA-financed remedial action.

NPL site deletions: With state concurrence, the U.S. EPA determines when no further response is required at a site to protect human health or the environment. U.S. EPA approves a close out report verifying that response actions have been taken or that no action is required. U.S. EPA then publishes a deletion notice in the *Federal Register*.

NPL site listing process: The NPL is a list of the most serious sites identified for possible long-term remediation. A proposed NPL site is listed when U.S. EPA issues a final rule in the *Federal Register*, which enables U.S. EPA to use federal monies to pay for long-term remedial actions. U.S. EPA issues a proposed rule in the *Federal Register* to solicit comments on proposed NPL sites. U.S. EPA responds to comments and adds sites to the NPL that continue to meet requirements for listing.

Operation and Maintenance (O&M): O&M activities are conducted after remedial actions are complete in order to ensure that remedies are operational and effective.

Potentially Responsible Parties (PRPs): The Superfund law (CERCLA) allows U.S. EPA to respond to releases or threatened releases of hazardous substances into the environment. Under CERCLA, potentially responsible parties (PRPs) are expected to conduct or pay for the cleanup. The Superfund enforcement program identifies the PRPs at the site; negotiates with PRPs to do the cleanup; and recovers from PRPs the costs spent by U.S. EPA at Superfund cleanups.

Preliminary Assessment (PA): Preliminary assessments are investigations of site conditions to ascertain the source, nature, extent, and magnitude of the contamination.

Preliminary Closeout Report (PCOR): A precursor to the close out report, it is a report submitted by the Remedial Program Manager (RPM) verifying that the conditions of the site comply with the Record of Decision (ROD)

findings and design specifications and that activities performed at the site are sufficient to achieve protection of public health and the environment.

Remedial Action (RA): The implementation of a permanent resolution to address a release or potential release of a hazardous substance from a site.

Remedial Design (RD): The process of fully detailing and specifying the selected remedy identified in the Record of Decision.

Remedial Investigation (RI): An investigation intended to gather the data necessary to: (1) determine the nature and extent of problems at the site; (2) establish cleanup criteria for the site; (3) identify preliminary alternative remedial actions; and (4) support the technical and cost analyses of the alternatives.

Record of Decision (ROD): The ROD documents the cleanup alternatives that will be used at NPL sites, and the supporting analyses.

Restrictive covenants: Restrictive covenants are deed restrictions that apply to a specific real estate parcel.

Site Inspection (SI): The process of collecting site data and samples to characterize the severity of the hazard for the hazard ranking score and/or enforcement support.

APPENDIX D

EXPOSURE PATHWAY ANALYSIS AND RISK ASSESSMENT FOR THE H.O.D. LANDFILL FINAL END USE PLAN

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Exposure Pathway Analysis and Risk Assessment for the HOD Landfill Final End Use Plan

August 2003

Prepared For
Waste Management of Illinois

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Table of Contents

List of Acronyms and Abbreviations iii

Executive Summary v

1. Background and Objectives 1
   - 1.1 Site History and Description 1
   - 1.2 Summary of the 1994 Baseline Risk Assessment 2
   - 1.3 Site Remedy 4
   - 1.4 Objectives of the Final End Use Plan Exposure Pathway Analysis and Risk Assessment 5
   - 1.5 Report Organization 6

2. Exposure Pathway Screening 7
   - 2.1 Exposure Pathway Screening for Human Health 7
   - 2.2 Ecological Exposures 11

3. Chemical Risk Screening 13
   - 3.1 Selecting Chemicals for Risk Screening 13
   - 3.2 Exposure Point Concentrations 14
   - 3.3 Screening Chemicals Based on BLRA Results 15
     - 3.3.1 Incidental Ingestion and Dermal Contact with Surface Soil 15
     - 3.3.2 Contact with Sequoit Creek Surface Water and Sediment 16
   - 3.4 Screening Chemicals Based on Health-Protective Risk–Based Levels 17
   - 3.5 Ecological Risk Screening 18

4. Uncertainty Analysis 20

5. Conclusions and Recommendations 23

6. References 25

List of Tables

Table 1	(RAGS Part D Table 0) Site Risk Assessment Identification Information
Table 2	(RAGS Part D Table 1) Selection of Human Exposure Pathways
Table 3	Summary of Potentially Complete Exposure Pathways for Proposed Site Uses
Table 4	Chemicals Selected for Risk Screening and Rationale for Selection
Table 5	(RAGS Part D Table 2.1) Occurrence, Distribution, and Evaluation of Chemicals Selected for Risk Screening (Surface Soil, Human Health)
Table 6	(RAGS Part D Table 2.1) Occurrence, Distribution, and Evaluation of Chemicals Selected for Risk Screening (Surface Water, Human Health)
Table 7	(RAGS Part D Table 2.1) Occurrence, Distribution, and Evaluation of Chemicals Selected for Risk Screening (Sediment, Human Health)
Table 8	Significant Changes to Chemical Toxicity Data Since the 1994 BLRA
Table 9	Comparison of Surface Water Concentrations to Water Quality Criteria for Protection of Aquatic Life
Table 10	Comparison of Sediment Concentrations to Available Sediment Quality Criteria/Guidelines for Protection of Aquatic Life

List of Figures

Figure 1	Monitoring Locations and Existing Conditions

List of Acronyms and Abbreviations

AET-H	apparent effects threshold - high
AET-L	apparent effects threshold - low
AWQC	Ambient Water Quality Criteria
BLRA	baseline human health and ecological risk assessment
CCC	Criteria Continuous Concentration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CMC	Criteria Maximum Concentration
COC	chemical of concern
COPC	chemical of potential concern
FR	Federal Register
FS	feasibility study
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index
HQ	Hazard Quotient
IEPA	Illinois Environmental Protection Agency
IRIS	Integrated Risk Information System database
LFG	landfill gas
ND	not detected
NMOC	nonmethane organic compound
NPL	National Priorities List
ORNL	Oak Ridge National Laboratory
PEL	probable effect level
PRG	preliminary remediation goal
RAGS	Risk Assessment Guidance for Superfund
RAIS	Risk Assessment Information System
RfD	reference dose
RI	remedial investigation

RME	reasonable maximum exposure
ROD	Record of Decision
STV	screening toxicity value
SVOC	semivolatile organic compound
TAL	Target Analyte List
TCL	Target Compound List
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WMII	Waste Management, Inc., of Illinois
WOE	cancer weight-of-evidence classification

Executive Summary

This exposure pathway analysis and risk assessment was performed on behalf of Waste Management, Inc., of Illinois (WMII) and in cooperation with the United States Environmental Protection Agency (USEPA), to assess potential human health and environmental exposures and risks associated with the proposed recreational use of the HOD Landfill site. Site risk assessment identification information is provided in Table 1. Results of this final end use plan risk assessment indicate that the potential final end uses will not pose unacceptable risks, provided that the integrity of the existing remedy and groundwater use restrictions are maintained.

The potential final end uses for the HOD Landfill site include facilities such as recreational fields, playgrounds, an off-leash dog area, nonmotorized trails, an archery range, model airplane flying, a golf driving range, a nature/interpretive walking area, a picnic area (tables only), and special events for concerts or festivals.

This exposure pathway analysis and risk assessment included the following steps:

- Evaluating potentially complete exposure pathways for human and ecological receptors.
- Screening chemicals associated with potentially complete exposure pathways for human or ecological exposure to determine which chemicals, if any, should be considered chemicals of concern (COCs) for further risk assessment. This process includes the following:
  - Evaluating the results from the baseline risk assessment (BLRA; ICF Kaiser, 1994)
  - Screening chemical concentrations associated with the potentially complete post-remediation exposure pathways against published human health risk–based levels
  - Screening chemical concentrations associated with the potentially complete post-remediation exposure pathways against current published ecological toxicity screening levels
- Evaluating uncertainties of the exposure pathway analysis and risk screening process.

The results of this risk assessment indicate that no chemicals are associated with potential exposure pathways under the contemplated future land use(s) that pose unacceptable risks to site users or ecological receptors.

This risk assessment assumes that redevelopment activities will not compromise the existing site remedy. Significant factors mitigating future exposures include maintaining the soil cover to isolate the waste, maintaining slopes to minimize infiltration into the waste while minimizing

erosion, and maintaining vegetative cover to minimize cover erosion, as required under the September 28, 1998, USEPA-issued Record of Decision (ROD).

Once detailed development plans and designs are completed, we recommend that the plans and designs be reviewed to ensure that the integrity of the remedy is maintained. Health and safety of on-site construction workers involved with preparation of the facility for end use will be addressed in a future health and safety plan specific to the redevelopment activity.

Section 1
Background and Objectives

The United States Environmental Protection Agency (USEPA) Region 5 is coordinating a stakeholder planning process for potential future uses of the HOD Landfill site. A number of recreational and other site uses are being considered for redevelopment of the site. This document is intended to assist the community of Antioch, the USEPA, and Waste Management of Illinois, Inc. (WMII), in determining if the site uses being contemplated in the final end use plan are acceptable in terms of human health and environmental risk.

In recent years, public policy regarding reuse/redevelopment of impaired properties has changed. The USEPA and the state regulatory agencies are encouraging redevelopment and reuse of formerly contaminated sites where possible, making funds available for site redevelopment at the state and local level through brownfields programs and the Superfund Redevelopment Initiative. The USEPA's Superfund Redevelopment Program provides grants and in-kind services to communities in a coordinated national effort to help return impaired waste sites to productive use (USEPA, 2002a).

1.1 Site History and Description

The HOD Landfill received waste from about 1963 to 1984. A landfill cap, leachate collection wells, and landfill gas vents were installed at the site between 1984 and 1989. The HOD Landfill site was added to the National Priorities List (NPL) in 1990. The listing followed two initial site inspections. The first, in 1985, found a high concentration of zinc in a groundwater sample. Zinc was determined later, in the remedial investigation (RI), to be at levels similar to upgradient off-site conditions. The NPL listing was based on the findings of a second, expanded site inspection completed in 1989. The listing was due primarily to contaminants found in the surficial (shallow) aquifer. The deep sand and gravel aquifer beneath the site serves as a drinking water source for the surrounding area. Following NPL listing, an RI (Montgomery Watson, 1997), a baseline human health and ecological risk assessment (BLRA; ICF Kaiser, 1994), and a feasibility study (FS; Montgomery Watson, 1998a and 1998b) were performed. A summary of the BLRA is presented in Subsection 1.2. A Record of Decision (ROD), which included site-specific remedial actions to be implemented, was issued by the USEPA in 1998 (USEPA, 1998). Implementation of the remedy selected in the ROD is described in Subsection 1.3. The long-term post-remediation monitoring of groundwater, surface water, leachate, and landfill gas began in February 2002, in accordance with the USEPA-approved Performance Standards Verification Plan (RMT, 2001b).

The 121-acre site contains a capped 51-acre solid waste landfill, with vegetated land in the remaining 70 acres. Some seasonal wetlands exist in lower-lying areas of the site. The area surrounding the site is a mix of agricultural, undeveloped, industrial, and residential land uses. A residential subdivision lies to the east of the site, and an industrial park lies to the west. Sequoit Creek runs along the southern and western site boundaries. To the south of the site is a wetland, and 200 feet southeast of the site property is Silver Lake. The site is shown on Figure 1.

1.2 Summary of the 1994 Baseline Risk Assessment

The BLRA was performed in 1994 and was based on data collected for the site remedial investigation (RI) from 1993 to 1994. The BLRA evaluated potential risks under conditions as they existed in 1994 and under hypothetical future land use conditions. At the time the BLRA was prepared, the site did not include the institutional controls, or the current remedial action control systems (i.e., the existing landfill gas, leachate, final cover, and surface water control systems) that have been implemented as part of the remedial action.

As part of the BLRA, site characterization data from the remedial investigation were evaluated to identify chemicals of potential concern (COPCs) in air, groundwater, surface soil, leachate, and Sequoit Creek water and sediment. The populations considered as potentially being exposed to COPCs included a site trespasser (a child or teenager); a nearby resident; and ecological receptors, including aquatic life and wildlife living at or near the site.

The following key assumptions were made in the BLRA:

- The BLRA exposure assumptions reflect a reasonable maximum exposure (RME) associated with each pathway of concern, in accordance with USEPA guidance, where RME is defined as “the highest exposure that is reasonably expected to occur at a site” (USEPA, 1989).
- The BLRA estimates for groundwater exposure assumed that an individual would be exposed to the maximum detected concentration of each COPC, 350 days per year for 30 years.
- Inorganic chemicals detected in site sampling for which sufficient background data were unavailable were automatically selected as COPCs. Some of the COPCs may not have been site related.
- Based on USEPA guidance for CERCLA municipal landfill sites (USEPA, 1993), the BLRA assumed no future residential development directly on the site. Therefore, potential exposure pathways were not considered for future on-site residential use.

The following human exposure pathways were evaluated in the BLRA:

- A nearby resident inhaling fugitive landfill gas in the air
- A trespasser inhaling fugitive landfill gas in the air

- A nearby resident using groundwater for drinking water
- A nearby resident using groundwater for showering (resulting in skin contact, with dermal absorption of COPCs, and the inhalation of volatile COPCs)
- A trespasser accidentally ingesting surface soil (incidental ingestion—generally through hand-to-mouth contact)
- A trespasser's skin coming in contact with surface soil, with dermal absorption of COPCs
- A trespasser's skin coming in contact with surface water in Sequoit Creek while wading (swimming and fishing activities were not expected in the Creek)
- A trespasser's skin coming in contact with sediment in Sequoit Creek
- A trespasser accidentally ingesting Sequoit Creek sediment

A quantitative exposure and risk assessment was performed for all of these pathways in the BLRA. The results of the BLRA identified unacceptable risk (based on either cancer risk or an index of other health effects from long-term exposure) for nearby residents if they used groundwater containing COPCs for drinking water and/or showering. The risks associated with all of the other potential exposure pathways were within acceptable levels established by the USEPA.

For groundwater, the chemicals and groundwater sources resulting in unacceptable risks identified in the BLRA include the following:

- Vinyl chloride in the deep sand and gravel aquifer in an off-site downgradient location, just west of the southwestern corner of the site. Vinyl chloride was not detected in samples from private or municipal water supply wells.[1]
- Beryllium and manganese in the upper (surficial) sand aquifer in an off-site downgradient location. Groundwater from that location was not then, and is not now, used as a water supply source. Beryllium is naturally occurring, and it could not clearly be determined if the beryllium observed in the aquifer was related to the site.
- Arsenic in two municipal wells (VW03 and VW05). Although the risks indicated some concern, arsenic in these wells was considered to be within naturally-occurring background concentrations and its presence unrelated to the landfill.

Ecological exposures evaluated in the BLRA were as follows:

- Aquatic life and other wildlife exposed to surface water and sediment in Sequoit Creek

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[1] While vinyl chloride was detected in the deep sand and gravel aquifer, this portion of the aquifer was not then, and is not now, used. Subsequent studies (RMT, 1999) found that the contaminant plume in the deep sand and gravel aquifer appeared to be stable and would not adversely affect existing water supply wells. Continued monitoring of the groundwater is included in the ROD to verify the stability of the plume.

- Terrestrial wildlife exposed to leachate seeps and on-site soil in areas of leachate seeps
- Terrestrial wildlife exposed to landfill gas in on-site air

The BLRA ecological risk evaluation concluded that, although aquatic and terrestrial wildlife may be exposed to site contaminants, overall, "chemical concentrations are such that potential ecological risks are estimated to be minimal."

1.3 Site Remedy

The USEPA issued a ROD for the site, with concurrence from the Illinois Environmental Protection Agency (IEPA) on September 28, 1998. Following completion and approval of the predesign investigation (RMT, 1999) and the final design (RMT, 2000a), construction activities began at the site in August 2000 and were substantially completed by July 2001. The site remedy consisted of final cover improvements, gas collection, leachate collection, off-site leachate treatment, institutional controls at the landfill, and monitored natural attenuation for groundwater. The main activities that were carried out as part of the remedial action are as follows:

- A predesign investigation was carried out to supplement the RI/FS to further define the nature and extent of contamination, the direction of groundwater flow, and the condition of landfill gas and leachate control systems.
- A minimum of 12 inches of vegetative soil cover was removed. This soil cover was later used for regrading the site.
- The existing cover was regraded to provide controlled surface water drainage.
- Waste found beyond the HOD property line was relocated to the waste reconsolidation areas on the site. In the off-property areas where waste was removed, clean soil was used to fill the excavation to blend it in with the existing grade.
- Final cover soil was placed over the landfill area. This cover consisted of a minimum 2-foot–thick compacted low-permeability layer followed by a 1-foot–thick vegetative soil layer.
- The active landfill gas management system was installed, which consists of 35 extraction wells and a flare to combust the collected landfill gas.
- Thirty-five leachate extraction pumps were installed into the extraction wells to remove leachate from the landfill. The leachate is collected in a 30,000-gallon tank and sent off-site for treatment and disposal.
- Access roads were constructed around the perimeter of the site.
- A 6-foot–high chain-link fence was installed around the area of the landfill, including a buffer area.

In addition to these actions, a municipal well (Village Well 4) near the HOD Landfill was taken off line, and a new municipal well (Village Well 7) was installed on the western side of the Village of Antioch.

1.4 Objectives of the Final End Use Plan Exposure Pathway Analysis and Risk Assessment

This document was prepared to assist the community of Antioch, the USEPA, and WMII in developing plans for appropriate and beneficial redevelopment of the HOD Landfill site. The objective is to evaluate whether the remedy that was selected and implemented at the site in accordance with the ROD (USEPA, 1998) would also be protective of human health and the environment under certain potential site uses.

This exposure and risk evaluation is presented in the context of site history, changes to the site since declaration of the ROD in 1998, and what is currently known about site conditions. This includes changes to the site as a result of the remedial actions that have been taken. Recent site data, such as those data collected under long-term monitoring (RMT 2002a, b, and c), are incorporated into the risk assessment. This risk assessment also considers changes to toxicity data and potential exposure that have occurred since the BLRA was completed. These changes include different assumptions about the type and/or amount of potential exposure to people and ecological receptors at the site. For example, the BLRA considered people coming on-site through a trespassing scenario, while a recreational scenario is considered here. These changes also include revisions to human health toxicity data, some of which has been revised since 1994 in light of new knowledge and/or procedures used to develop these values since 1994, and human health and ecological screening toxicity values that have been developed since 1994.

As part of this final end use plan risk assessment, available site information was reviewed, including the RI report (Montgomery Watson, 1997), the BLRA, the FS (Montgomery Watson, 1998a and b), the Predesign Investigation (RMT, 1999) and the first three rounds of long-term monitoring data (RMT, 2002a, b, and c). This risk assessment was performed in accordance with the USEPA's current Risk Assessment Guidance for Superfund (USEPA, 1989) and the Ecological Risk Assessment Guidance for Superfund (USEPA, 1997a), and supplementary and supporting guidance, as applicable. The site uses included in this document were compiled by RMT with input from WMII and USEPA Region 5 to provide a basis for completing the risk assessment. The exposure pathway analysis was based on the assumption that redevelopment activity would not compromise the existing site remedy with the possibility of creating new exposure pathways.

1.5 Report Organization

In this risk assessment for the final end use plan, possible exposure pathways were identified by developing a conceptual site exposure model for specific uses and activities. The possible pathways were screened to focus the assessment on potentially complete exposure pathways, as described in Section 2. Chemicals detected in the potential exposure media were then selected for screening. The selected chemicals were evaluated by considering applicable results from the BLRA, and by comparing chemical concentrations to health-protective risk–based levels, as described in Section 3. Uncertainties regarding this risk assessment are discussed qualitatively in Section 4. Conclusions and recommendations are presented in Section 5. References are provided in Section 6.

Section 2
Exposure Pathway Screening

The objectives of the exposure pathway screening are to identify possible exposure pathways that could be present under proposed future land uses and to identify those pathways that may be complete, for both human health and ecological exposure.

The exposure assessment considered whether proposed site end uses could result in exposure to a particular environmental medium, regardless of whether this exposure poses any risk. The concentrations of chemicals in those media associated with potential exposure pathways are considered as part of the chemical risk screening (Section 3). The exposure pathway screening was based on the assumption that the integrity of the existing site remedy (i.e., cap, grading, vegetative cover, gas and leachate control) would be maintained throughout site redevelopment and end use activities, and that groundwater use restrictions would be maintained for all of the redevelopment options, as required by the ROD (USEPA, 1998).

A preliminary list of potential final end uses for the HOD Landfill site was developed in conjunction with USEPA Region 5 and through community involvement, which included two public meetings held in Antioch on July 11 and August 15, 2002. Potential final end uses include the following:

- Recreational fields, such as baseball, softball, football, soccer, lacrosse, track, or a combination of these
- Playgrounds
- An off-leash dog area
- Trails for nonmotorized activities (biking, walking, cross-country skiing)
- An archery range
- Model airplane flying
- A golf driving range
- A nature/Interpretive walking area
- A picnic area (tables only)
- Special events for concerts or festivals (using portable facilities only)

2.1 Exposure Pathway Screening for Human Health

The selection of human exposure pathways (Table 2) is an evaluation of whether an exposure pathway could be complete (whether exposure is likely) under the proposed final end uses.

This table provides an overview of the mechanisms of constituent release/migration and affected media; identifies potentially exposed populations, including sensitive subpopulations; and identifies potentially complete exposure pathways for general on-site use. This evaluation indicated that there may be complete exposure pathways for air, surface soil, surface water, and sediment. Contact with groundwater or leachate was not expected under the proposed end uses.

Table 3 provides an overview of potentially exposed populations and potentially complete exposure pathways specifically for the proposed land uses, based on expected site-related activities. This exposure pathway analysis also assumes that the general public would have free access to the site, whether the perimeter fence is removed or remains in place, with the exception of the small fenced area containing the active remediation system. This exposure pathway analysis indicates a number of pathways for maintenance workers and recreational users at the site, depending on site use. Some of the uses were grouped together: recreational fields, playgrounds, an off-leash dog area, trails for nonmotorized activities, an archery range, model airplane flying, a nature/interpretive walking area, and picnic areas. These were grouped because the site preparation and maintenance activities and the types of recreational users and activities would be similar in terms of exposure. The golf driving range and special events were each addressed separately.

A number of possible exposure pathways were considered in terms of their likelihood of being complete. All of the exposure pathways that were identified as potentially complete pathways in the BLRA (ICF Kaiser, 1994) were re-evaluated in this final end use plan risk assessment, considering post-remediation site conditions and proposed site final end use. These pathways are discussed, by exposure medium, as follows.

Air:

- *Inhalation of airborne chemicals from the landfill.* Anyone spending time on or near the landfill area potentially could be exposed to low concentrations of chemicals in landfill gas (LFG) that diffuses through the cover or low concentrations of chemicals from the LFG flare. Exposure to fugitive LFG emissions without the gas extraction system and flare was evaluated in the BLRA for nearby residents using modeled air concentrations for off-site locations. These results showed no unacceptable risks. The current remedy mitigates fugitive emissions of LFG resulting from diffusion through the cover because the gas/leachate extraction system maintains negative pressure (vacuum) within the landfill. The vacuum generated by the extraction system draws LFG from the waste mass to the flare. The newly installed LFG collection system currently collects and combusts the collected LFG, thereby further reducing potential off-site exposures to fugitive LFG emissions. The flare has been designed to exceed the requirements of federal regulations (FR, 1996; and CFR, 1996), which require a minimum 98 percent destruction efficiency of nonmethane organic compounds (NMOCs). Therefore, we believe the emissions from the

flare to be negligible. The gas and leachate extraction system is designed with failsafe measures that minimize the potential for unanticipated exposures in the event of a system shutdown. This system includes automatic notification that contacts operations and maintenance personnel who will respond in a timely fashion, in accordance with the approved operation and maintenance plans (RMT, 2001a).

- *Inhalation of airborne chemicals volatilized from surface water.* Inhalation of airborne volatile organic compounds (VOCs) could occur for recreational users spending time near, or playing in, Sequoit Creek. However, exposure is not expected to be significant because of the extremely low levels of VOCs found in the creek and the low frequency and short duration of visits to the creek. This pathway was therefore not evaluated further.
- *Inhalation of airborne chemicals from surface soil VOCs or fugitive dust.* Areas of known surface soil contamination were covered with soil from the borrow area as part of the remedial action. This soil was approved for use as cover material by the USEPA. In addition, maintaining a vegetative cover is required as part of the site remedy. Therefore, volatilization or fugitive dust generation is not expected from the current surface soil under recreational site use or routine maintenance activities.

  Despite the lack of potentially complete exposure pathways, surface soil is evaluated to address possible stakeholder concerns about exposure to contaminants in landfill soil resulting from unforeseen excavation or other unspecified processes that may expose contaminants at the soil's surface. Under this hypothetical worst-case scenario, some types of recreational users (for example, those using the recreational fields, driving range, and playgrounds) and maintenance workers would be the potentially exposed populations (potential receptors). People attending special events or special events staff are not considered as potential receptors. Preventing exposure to construction workers during any site redevelopment activities will be addressed in a future health and safety plan specific to the redevelopment activity. The Remedial Action Health and Safety Plan (RMT, 1999 and 2000b) addressed many of the same issues for remedial construction activities.

Surface soil:

- *Dermal absorption of chemicals in surface soil*. Areas of surface soil contamination were covered with soil from the borrow area as part of the remedial action. This soil was approved for use as cover material by the USEPA. In addition, maintaining a vegetative cover is required as part of the site remedy. Therefore, skin contact with impacted soil is not expected under recreational site use or routine maintenance activities.

  Despite this, surface soil is evaluated to address possible stakeholder concerns about exposure to contaminants in landfill soil resulting from unforeseen excavation or other unspecified processes that may expose contaminants at the soil's surface. Under this hypothetical worst-case scenario, some types of recreational users (for example, those using the recreational fields, driving range, and playgrounds) and maintenance workers are the potentially exposed populations (potential receptors). People attending special events or special events staff are not considered as potential receptors. Preventing exposure to construction workers during any site redevelopment activities will be addressed in a future health and safety plan specific to the redevelopment activity. The Remedial Action Health

and Safety Plan (RMT, 1999 and 2000b) addressed many of the same issues for remedial construction activities.

- *Incidental ingestion of chemicals in surface soil.* Areas of surface soil contamination were covered with soil from the borrow area as part of the original remedy. This soil was approved for use as cover material by the USEPA. Therefore, incidental ingestion of buried impacted soil is not expected under recreational site use or routine maintenance activities.

  Despite this, surface soil is evaluated to address stakeholder concerns about exposure to contaminants in landfill soil resulting from unforeseen excavation or other unspecified processes that may expose contaminants at the soil's surface. Under this hypothetical worst-case scenario, some types of recreational users (for example, those using the recreational fields, driving range, and playgrounds) and maintenance workers are the potentially exposed populations (potential receptors). People attending special events or special events staff are not considered as potential receptors. Preventing exposure to construction workers during any site redevelopment activities will be addressed in a future health and safety plan specific to the redevelopment activity. The Remedial Action Health and Safety Plan (RMT, 1999 and 2000b) addressed many of the same issues for remedial construction activities.

Surface water:

- *Dermal absorption of chemicals in surface water.* Recreational site users, especially children, could wade or play in the creek, resulting in skin contact with surface water in the creek. This exposure pathway is therefore retained for chemical screening.
- *Incidental ingestion of chemicals in surface water.* The creek is not suitable for swimming, so incidental ingestion of surface water is expected to be negligible. This pathway was therefore not evaluated further.
- *Ingestion of fish.* The creek is not used for fishing, and fishing is therefore not expected under the proposed uses. Therefore, this pathway was not evaluated further.

Sediment:

- *Dermal absorption of chemicals in sediment.* Recreational site users, especially children, could wade or play in the creek, resulting in skin contact with sediment. This exposure pathway is therefore retained for chemical screening.
- *Incidental ingestion of chemicals in sediment.* Recreational site users, especially children, could wade or play in the creek. Sediment could adhere to the skin of someone playing or wading in the creek, and some incidental ingestion of sediment could occur. This exposure pathway is therefore retained for chemical screening.

Groundwater:

- There are no direct pathways for contact with impacted groundwater, although it could serve as a possible source to the creek. Sequoit Creek surface water and sediment are

evaluated separately. Potential risks associated with exposure to groundwater affected by the landfill were evaluated as part of the 1994 BLRA. It is not necessary to re-evaluate this exposure pathway because there are no complete exposure pathways for groundwater under current site conditions, and because the use of potentially site-impacted groundwater is not part of the proposed redevelopment plans for the landfill. Moreover, institutional controls are in place to prevent the use of contaminated groundwater. Routine groundwater monitoring is being conducted to identify changes in groundwater flow or quality that affect the status of this exposure pathway.

Leachate:

- There are no direct pathways for contact with leachate, although it could serve as a possible source to the creek. Sequoit Creek surface water and sediment are evaluated separately. Leachate is actively collected and taken off-site for treatment, eliminating the potential for release or direct contact with leachate from the site.

2.2 Ecological Exposures

In addition to potential human exposure at the site, there are pathways by which aquatic and terrestrial wildlife could be exposed to chemicals associated with the landfill. Ecological exposures and risks were addressed in the BLRA. The subsequent remedial actions are expected to decrease surface water and sediment concentrations (and exposures) over time, and prevent wildlife exposure to the leachate. The potential for ecological exposures through air, soil, surface water, sediment, groundwater, and leachate is discussed in this section.

Air (LFG). Terrestrial wildlife on-site could inhale airborne VOCs from LFG. Burrowing and soil-dwelling species are likely to have the greatest exposure. However, fugitive emissions of LFG are not expected under the existing site remedy because the gas/leachate extraction system maintains negative pressure throughout the landfill, drawing LFG to the flare, where it is combusted.

Soil. Areas of surface soil contamination were covered with soil from the borrow area as part of the original site remedy. Burrowing and soil-dwelling species could be exposed to localized areas of affected soil below the existing cover soil. However, for terrestrial wildlife in general, this is expected to be a negligible pathway, given the added cover, the expected routine use of the site by people, and the ongoing maintenance activity that discourages wildlife use.

Surface water. Aquatic life could be exposed to chemicals in surface water through respiration, dermal absorption, and ingestion. Terrestrial wildlife could be exposed through ingestion (drinking water or aquatic prey) and dermal absorption. This pathway is therefore retained for chemical risk screening.

Sediment. Aquatic life could be exposed to chemicals in sediment by ingestion and direct contact; terrestrial wildlife could be exposed through ingestion of aquatic prey. This pathway is therefore retained for chemical risk screening.

Groundwater and leachate. As discussed above for human exposure, there are no direct pathways for wildlife to contact impacted groundwater or leachate, although these may serve as sources to the creek. Sequoit Creek surface water and sediment are evaluated separately.

To incorporate new ecological risk screening levels, which have been revised or developed since the 1994 BLRA, chemical concentrations in the media to which aquatic or terrestrial life may be exposed (i.e., surface water and sediment of Sequoit Creek) are compared with currently available ecological screening levels in Section 3.

Section 3
Chemical Risk Screening

For any potentially complete exposure pathways, the chemicals in that pathway's exposure medium were selected for risk screening. Chemical risks are preliminarily evaluated ("screened") in this section by either

- demonstrating that the risk was addressed in the BLRA (ICF Kaiser, 1994), or
- performing a screening-level risk assessment, done by comparing exposure-point concentrations with relevant human health and ecological risk–based levels, federal criteria, and/or state criteria.

This section describes the rationale for selecting chemicals to include in the risk screening evaluation, presents selected chemicals and their concentrations in the relevant exposure media (i.e., surface soil, surface water, and sediment), the screening toxicity values used for comparison, and the results of human health and ecological risk screening.

3.1 Selecting Chemicals for Risk Screening

The term "chemical of potential concern" (COPC) generally refers to chemicals detected in a site investigation that are selected for detailed evaluation in a baseline human health risk assessment. These are typically the chemicals for which numerical, site-specific risk indicators are calculated (such as risk of cancer expressed as a probability, or risk of noncancer health effects expressed as a Hazard Index) for the potentially complete exposure pathways. In the 1994 BLRA, COPCs were selected based on frequency and level of detection and, in some cases, comparison to applicable background data. These selected COPCs were then included in the BLRA's quantitative risk assessment calculations.

Procedures for selecting COPCs for Superfund human health risk assessment have evolved since the 1994 BLRA was prepared. To avoid confusion, in the context of this final end use plan risk assessment, the term COPC is used only to refer to those chemicals selected for quantitative risk assessment in the 1994 BLRA. Chemicals selected for risk evaluation in this final end use plan risk assessment are called "chemicals selected for risk screening." Chemicals selected for risk screening include all COPCs from the BLRA that are part of the potentially complete exposure pathways identified in Section 2. In addition, some chemicals detected in more recent site monitoring (RMT 2002a, b, and c) were selected for risk screening, as described below.

The chemical risk screening conducted for this final end use plan risk assessment includes the following two types of evaluation:

- Evaluating the 1994 BLRA results in light of current site conditions, the exposure pathway analysis for the proposed final end uses, and changes to relevant toxicity values since 1994.
- Comparing chemical concentrations to applicable human health and ecological toxicity screening values.

Any chemicals present at levels that indicate a potential concern based on chemical risk screening, for which a more detailed and site-specific quantitative risk assessment would be warranted, are here called "chemicals of concern" (COCs). No COCs were identified in the final end use plan risk assessment screening process. (Again, it should be noted that the terms COPC and COC can be used differently in other risk assessments.)

Chemicals selected for this risk screening step are listed in Table 4. These include any chemicals identified as COPCs in surface soil, surface water, and sediment in the BLRA. COPCs from the BLRA include four inorganic chemicals, nine VOCs, 10 semivolatile organic compounds (SVOCs), and two pesticides in soil; three inorganic chemicals and two VOCs in surface water; and two inorganic chemicals and eight SVOCs in sediment. Groundwater and leachate were excluded because none of the proposed site uses would include groundwater or leachate exposure. Air is not included because air data from the BLRA are no longer relevant as a result of the installation of the LFG extraction and treatment system.

Additional chemicals from 2002 monitoring (RMT, 2002a, b, and c) were included in the risk screening (and shown in Table 4) if they were Target Compound List (TCL) organic compounds or Target Analyte List (TAL) inorganic chemicals detected in later sampling, and their measured concentrations exceeded relevant background and blank concentrations. Three VOCs were measured at low levels in surface water in the long-term monitoring program that had not been reported previously in surface water data: 1,2-dichloroethene; trichloroethene; and vinyl chloride. These VOCs are also included in the chemical risk screening. Magnesium was detected at a slightly higher concentration than previously and is also included in the chemical risk screening.

3.2 Exposure Point Concentrations

Chemical concentrations were determined for selected chemicals in the relevant exposure media for potentially complete pathways (soil, surface water, and sediment). These are the maximum detected concentrations determined from site sampling, at the locations where exposure might occur. These exposure-point concentrations, or screening concentrations, are listed in Tables 5 through 7.

Soil. The surface soil that was characterized in the RI (Montgomery Watson, 1997) and the BLRA represented localized contaminated areas (hot spots) around leachate/gas leaks, which

have been covered with additional clean soil as part of the remedial action. These soil COPCs and their concentrations from the BLRA are presented in Table 5. While these concentrations are not currently present in surface soil, we assume that this is the material that may be exposed as a result of unplanned excavation through the added cover soil or other unforeseen processes.

Surface water. Surface water data from the BLRA, in addition to data from the first three rounds of long-term monitoring, are presented in Table 6. (Complete results of the 2002 quarterly monitoring, with an evaluation of data trends, are presented in the first annual monitoring report [RMT, 2003].)

Sediment. Sediment data from the BLRA are presented in Table 7. These represent maximum detected concentrations from RI sampling and analysis.

3.3 Screening Chemicals Based on BLRA Results

Risks for potentially complete exposure pathways involving surface soil, surface water, and sediment were evaluated by demonstrating that the risk was addressed in the BLRA previously completed for the site.

The following relevant pathways were addressed directly in the BLRA for a child/teenage trespasser:

- Incidental ingestion of surface soil
- Dermal contact with surface soil
- Dermal contact with creek surface water
- Dermal contact with sediment
- Incidental ingestion of creek sediment

3.3.1 Incidental Ingestion and Dermal Contact with Surface Soil

The exposure assumptions relied upon in the BLRA were reviewed to determine applicability to expected on-site activities associated with potential end uses of the property. The BLRA exposure assumptions for a child/teenage trespasser exposed to on-site surface soil are as follows:

- Age period: 6-16 years of age
- Incidental soil ingestion rate: 110 mg per day (weighted average of 200 mg per day for a 6 year old, and 100 mg per day for 7 to 16 year olds)
- Fraction of soil ingested from an area containing COPCs: 0.25 (based on 4 hours per day on-site out of a total 16 hours per day that a child could be exposed to soil)

- Skin surface area available for contact: 6,000 cm^2 per event; 1 event per day (assumes that hands, arms, and legs are exposed to soil)
- Exposure frequency: 43 days per year (assumes 1 day per week during the 300 days of the year when maximum average daily air temperatures are above freezing)
- Exposure duration: 10 years
- Body weight: 40 kg (average for 6-16 year age range)

(Details supporting these assumptions are in ICF Kaiser, 1994, Table 4-2.)

Even with an increased exposure frequency (for example 60 days per year rather than 43), these BLRA exposure assumptions are very conservative under current site conditions because the site is now covered with clean soil. The BLRA results are useful, however, to indicate the extremely low level of risk associated with the proposed site use. For all soil COPCs, BLRA risk results for direct contact with surface soil totaled 9×10^{-9}, or more than 100 times below the target risk level (an incremental lifetime cancer risk of 1×10^{-6}), and BLRA results for other health effects totaled 0.00017, or almost 6,000 times below the concern level for noncancer health effects (a Hazard Index [HI] of 1). Therefore, even with the unexpected exposure to localized contaminated soil areas that have been covered with clean cover soil, risks from recreational site use would be very low.

3.3.2 Contact with Sequoit Creek Surface Water and Sediment

Exposure assumptions for a child / teenage trespasser wading or playing in Sequoit Creek are similar to those expected for recreational site use. These assumptions are as follows:

- Age period: 6–16 years of age
- Skin surface area available for contact: 5,300 cm^2 (assumes that hands, legs, and feet are exposed during wading)
- Exposure time of 1 hour per day
- Exposure frequency of 35 days per year (assumes wading 2 days per week for the months of June–September, when average daily maximum air temperatures are above 70°F)
- Exposure duration of 10 years
- Body weight of 40 kg (average for a child / teenager 6 to 16 year age range)

(Details supporting these assumptions are in ICF Kaiser, 1994, Table 4-7.)

For surface water, none of the COPCs were potential carcinogens, so no cancer risk could be calculated. BLRA risk results for direct contact with surface water for other (noncancer) health effects totaled 0.005, or almost 200 times below the concern level for noncancer health effects (HI of 1). For all sediment COPCs, BLRA risk results for direct contact (incidental ingestion and dermal contact) with sediment totaled 1×10^{-8}, or 100 times below the concern level (an incremental lifetime cancer risk of 1×10^{-6}), and BLRA results for other health effects totaled 0.00021, or almost 5,000 times below the concern level for noncancer health effects (HI of 1). Therefore, risks from exposure to surface water or sediment in Sequoit Creek, which could coincide with recreational site use, would also be very low.

For pathways that were directly addressed in the BLRA, some of the available toxicity data have been revised since the original risk assessment in 1994. If data are now available to fill previous toxicity data gaps, or if a toxicity value has been lowered, indicating that a chemical is more potent than previously thought, this could result in risks that are higher than those previously estimated. Toxicity data were reviewed for any chemicals with new or revised toxicity data since the BLRA, and the impacts of any changes are presented in Table 8. While there were small decreases in the toxicity values for several chemicals, the changes do no substantively increase the risks or hazard posed by potential exposures.

3.4 Screening Chemicals Based on Health-Protective Risk–Based Levels

Risks for potentially complete exposure pathways involving surface soil and surface water were also evaluated by performing a screening-level risk assessment by comparing site data with relevant risk-based criteria. This was done for all chemicals selected for risk screening in surface soil because the trespassing exposure scenario evaluated in the BLRA could differ somewhat from the exposure expected for recreational land use. For surface soil, screening levels that have been developed for a residential exposure setting were used for comparison (IEPA, 2002). This comparison is protective of health because the amount of exposure to surface soil would be greater in a residential setting than the amount of exposure expected for potential recreational uses. Surface water chemicals selected for risk screening that were not evaluated as COPCs in the BLRA were also compared with risk-based levels. Chemical risk screening for potential human health risks is presented in Tables 5, 6, and 7.

Soil. For soil, chemical concentrations are compared with State of Illinois Tier 1 screening levels (IEPA, 2002) for incidental soil ingestion and inhalation of VOCs or fugitive dust from surface soil in a residential setting. Because of the greater amount of exposure in a residential setting, residential values are more health-protective than those for recreational users and maintenance

workers. These soil concentrations, screening levels, and risk-screening data and results are presented in Table 5. None of the soil chemicals exceeded the IEPA Tier 1 screening values. Based on the chemical risk screening, comparability to background, and BLRA results, risks to recreational site users and on-site maintenance workers are not of concern.

Surface water. All COPCs from the BLRA were shown to be of no concern, with the exception of 2-hexanone, for which no toxicity data were available. 2-Hexanone was detected at a low level in one out of six samples in the RI (Montgomery Watson, 1997), and was not detected in the first three quarters of 2002 monitoring (RMT, 2002a, b, c).

Screening toxicity values were not available for dermal absorption from surface water from the State of Illinois or the USEPA. Instead, Preliminary Remediation Goals from Oak Ridge National Laboratory's Risk Assessment Information System (RAIS; ORNL, 2002) were used to determine risk-based levels for dermal contact with surface water for the additional chemicals selected for screening: 1,2-dichloroethene, trichloroethene, and vinyl chloride. (No toxicity data were available at the time of this evaluation with which to calculate screening values for 2-hexanone.) Values were calculated using target risk levels of 1×10^{-6} for cancer risk, and a Hazard Quotient (HQ) = 0.1 for other health effects, using the same exposure assumptions for wading or playing in the creek that were used in the BLRA (see Subsection 3.3). Measured surface water concentrations of 1,2-dichloroethene, trichloroethene, and vinyl chloride are well below the risk-based screening values (Table 6) indicating no concern for skin contact with water in the creek.

3.5 Ecological Risk Screening

For ecological risks, the BLRA made the following conclusion:

> "Pathways exist by which aquatic and terrestrial wildlife might be exposed to chemicals of potential concern present at or migrating from the HOD Landfill. Overall, however, chemical concentrations are such that potential risks to plants, aquatic life, and terrestrial wildlife are estimated to be minimal. Visual observations of the character and composition of the terrestrial and aquatic communities of the site suggest a relatively "healthy" community. These observations combined with predictions of low exposure and risk support the conclusion that biological populations and communities of the area have not been adversely affected by chemicals present at or migrating from the HOD Landfill site."

Although redevelopment of the site is not expected to affect exposures or risks to aquatic life in Sequoit Creek in either a positive or negative way, these media were evaluated to incorporate any new information available since the 1994 BLRA. Surface water and sediment

concentrations were screened against currently available ecological criteria, presented in Tables 9 and 10, respectively. Results of this screening again indicate that ecological risks are expected to be minimal. Maximum surface water concentrations downstream of the site are below the screening levels, with the exception of barium. Although barium meets the acute (short-term) screening value and exceeds the chronic (long-term) value, it was not measured at levels that exceed background (upstream) levels. All maximum sediment levels are below the available probable effect screening levels.

The remedy is expected to decrease concentrations of landfill gas, prevent exposure to leachate, and significantly reduce exposure to localized contaminated areas of surface soil.

There may be some minor negative impacts from site redevelopment and increased human use of the area to birds and other animals that use the landfill as part of their habitat. These impacts may be offset by improvements to the vegetation, especially the topsoil and grass cover over the landfill area. In addition, improvements to the adjacent wetlands are planned as a separate project, which would positively impact the ecology.

Section 4
Uncertainty Analysis

An important component of any risk characterization is the identification and discussion of uncertainties. The primary goal of the uncertainty analysis is to discuss key assumptions made in the risk assessment that may influence the resulting risk estimates or conclusions. Uncertainties are inherent to all components of the risk assessment process: in evaluating potential exposure associated with activities in the future, in selecting chemicals to include in the evaluation, and in the toxicity data used to develop human health and ecotoxicity screening levels. In addition, uncertainties in the BLRA (ICF Kaiser, 1994) apply to this risk assessment wherever BLRA results are used. These are discussed by ICF Kaiser (1994; Section 7). Additional sources of uncertainty and their associated effects (i.e., overestimating or underestimating concern from site use) are discussed in this section. Any use of the risk assessment should include consideration of these uncertainties.

Uncertainties in the exposure pathway analysis include the following:

- The uncertainty of exposure pathways actually occurring in the future
- The uncertainty in equating trespassers with recreational users when using BLRA results could over- or underestimate risk. The amount of time spent on-site can vary for different recreational activities.

Uncertainty in the amount of exposure from future activities is addressed, in part, by the use of conservative (health-protective) assumptions in the BLRA; by including 1994 soil, surface water, and sediment data in this risk assessment (data collected prior to site remediation); and by screening against IEPA soil values for on-site residential land use.

Uncertainties in selecting chemicals for risk screening include the following:

- Changing conditions from those characterized for the BLRA could result in over- or underestimating risk. For instance, clean soil was added to the cover making direct contact with localized areas of contaminated soil unlikely.
- Although the absence of data for on-site air quality makes the assessment of risk from LFG uncertain, that risk is expected to be very small. Future emissions of LFG are not expected under the existing site remedy because the gas/leachate extraction system draws LFG to the flare, where it is combusted. The flare was designed to exceed a 98 percent destruction efficiency of NMOCs. (This assumes that the extraction system remains in place and in operation.)

Toxicity data used in the BLRA and used to develop risk-based screening levels for human health include uncertainties typical to any human health toxicity assessment, as follows:

- Using dose-response data from high dose studies to predict effects that may occur at low levels may overestimate risk.
- Using data from short-term studies to predict the effects of long-term exposures may underestimate risk.
- Using dose-response data from laboratory animals to predict effects in humans may over- or underestimate risk, depending on differences in sensitivity between humans and the animal models used in the laboratory tests.
- Using data from homogeneous populations of laboratory animals or healthy human populations to predict the effects on the general human population, with a wide range of sensitivities, may underestimate risk to sensitive groups of people, such as children, the elderly, or the health-compromised.
- Possible effects on toxicity from exposure to chemical mixtures may result in overestimating or underestimating risk (effects may be independent, additive, synergistic, or antagonistic).
- Missing or incomplete toxicity data may result in underestimating risk. Neither toxicity data nor screening toxicity values were available for aluminum (in soil), or for 2-hexanone and lead (in surface water). This uncertainty is mitigated by the following: aluminum was measured at concentrations within naturally-occurring levels in soil, lead is not expected to absorb through skin upon contact with surface water, and 2-hexanone and lead were not detected in any of the 2002 monitoring samples (RMT, 2002 a, b, and c).
- Changes to established toxicity values since the 1994 BLRA was conducted (these are addressed in Subsection 3.3).
- Finally, there is uncertainty in the model used to calculate cancer risk, and the human health screening levels based on cancer risk, from assuming a linear dose-response relationship that may overestimate risk.

The use of ecological screening levels, which are based on ecotoxicity data, also include the following uncertainties:

- Using laboratory toxicity data to evaluate the effects of exposure in a stream or on-site may over- or underestimate risk.
- Variation in species sensitivity may over- or underestimate risk to different species.
- Possible effects of substances not evaluated because of a lack of toxicity data and/or screening levels may underestimate risk. Screening values were not available for thallium in sediment and vinyl chloride in surface water.
- Because much new information has been made available in the area of ecological risk assessment since 1994, the most recently available ecological toxicity screening values were

used. Even so, use of these values may over- or underestimate risk, depending on specific site conditions.

Also note that the exposure and risk assessment are based on the assumption that any site development will maintain the integrity and operation of the remedy. This assumption has the largest potential to impact the results of this risk assessment.

In conclusion, given the estimated 100- to 200-fold lower risks and 200- to more than 1,000-fold lower hazards than targets in soil, surface water, and sediment calculated in the 1994 BLRA; the magnitude of the changes that might be expected as a result of the uncertainties; and counter-balancing of potentials to over- and underestimate risk, we can be reasonably confident that the uncertainties will not result in risks or hazards above target values.

Section 5
Conclusions and Recommendations

The objective of this exposure pathway analysis and risk assessment is to assess potential human health and environmental exposures and risks associated with proposed recreational site uses under current (remediated) site conditions. This document is intended to assist the community of Antioch, WMII, and the USEPA in determining if the site uses being developed in a final end use plan are acceptable in terms of human health and environmental risk.

Remedial actions at the site were driven by the presence of contaminants in groundwater and the potential risk those contaminants posed to people potentially using the groundwater. Remedial actions completed to date, including modifications to the Antioch municipal well system, have largely mitigated those risks and have begun the process of reducing future contaminant migration to the groundwater.

Potential redevelopment of the landfill raises questions of potential exposure at the surface of the landfill, but does not affect the potential risks associated with groundwater use. Results of this exposure and risk assessment indicate that the existing remedy (capping, landfill gas control and destruction, and leachate collection, treatment and disposal) is protective under the potential conditions of reuse—there are no potential exposure pathways or site-related chemicals that pose unacceptable risks to site users or that warrant further quantitative risk evaluation. This is based on the following:

- Past quantitative risk assessment that addressed preremedial action conditions
- Screening known chemical concentrations against health-protective human health and ecological risk–based values for any media where there may be a potential for human or ecological exposure
- Assuming that the general public has free access to the site for potential recreational uses
- Assuming that redevelopment does not result in the creation of new exposures.

The clean cover soil that was added as part of the remedial action limits exposure to site-related chemicals from contact with surface soil. From a risk standpoint, there is no significant difference in exposure intensity between trespassing, as considered in the BLRA (ICF Kaiser, 1994), and recreational use considered in this final end use plan risk assessment. If exposure to contaminated soil did occur, risks from chemicals in soil would be below levels of concern. Although on-site air concentrations are not available for evaluation, the current remediation system controls fugitive LFG and destroys VOCs through combustion. Based on the performance of similar gas management systems, VOC concentrations above the landfill are

expected to be very low. Chemicals detected in Sequoit Creek are at low concentrations and would not pose a risk to a child or teenager occasionally wading in the creek.

This risk assessment assumes that, for any redevelopment activities, the integrity of the existing site remedy will be maintained, and that the existing landfill gas and leachate collection systems will remain in operation. This includes maintaining a minimum 3 feet of cover soil, not penetrating the 2-foot compacted clay layer under the cover soil, and maintaining vegetative cover. Also, it is necessary to maintain grading of the landfill cover to promote controlled surface water runoff and to limit infiltration of water through the cover. All redevelopment activities must be specifically designed for compatibility with the existing remedy. Critical design parameters associated with the future land uses include, for example, grading modifications, extent of slab-on-grade foundations, paving, signage, fencing, etc.

Health and safety of on-site construction workers will be addressed in a future health and safety plan specific to the redevelopment activity.

Section 6
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Figure 1 Monitoring Locations and Existing Conditions

Table 1
(RAGS Part D Table 0)[1]
Site Risk Assessment Identification Information
HOD Landfill Final End Use Risk Assessment

Site Name/OU:	HOD Landfill, Antioch, Illinois
Region:	5
EPA ID Number:	ILD980605836
State:	Illinois
Status:	Post-Closure
Federal Facility (Y/N):	N
EPA Project Manager:	Tom Bloom
EPA Risk Assessor:	Andrew Podowski
Prepared by (Organization):	RMT, Inc.
Prepared for (Organization):	Waste Management of Illinois, Inc
Document Title:	Exposure Pathway Analysis and Risk Assessment for the HOD Landfill Final End Use Plan
Document Date:	August 2003
Probabilistic Risk Assessment (Y/N):	N
Comments:	Post-closure risk assessment for proposed site redevelopment

Note:
(1) This table format is based on Table 0 of the Risk Assessment Guidance for Superfund (RAGS) Part D guidance (USEPA, 2001).

Table 2
(RAGS Part D Table 1)[1]
Selection of Human Exposure Pathways
HOD Landfill Final End Use Risk Assessment

SCENARIO TIME FRAME	MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	RECEPTOR POPULATION[2]	RECEPTOR AGE	EXPOSURE ROUTE	TYPE OF ANALYSIS[3]	RATIONALE FOR SELECTION OR EXCLUSION OF EXPOSURE PATHWAY
Current / Future	Landfill gas	Air	Chemicals in landfill gas may migrate through soil to on-site air; landfill gas flare may emit chemicals to on-site air	Recreational user, maintenance worker, special events staff	Child / Adult	***Inhalation***[4]	Uncertainty	Inhalation of VOCs on-site was not evaluated in the BLRA. Current on-site air data are not available; however, concentrations are expected to be very low.
	Surface water	Air	Groundwater discharge to creek; VOCs in Sequoit Creek may evaporate to air on-site	Recreational user	Child / Adolescent	Inhalation	None	Possible exposure from activities near Sequoit Creek are not expected to be significant.
	Surface soil	Air	Chemicals in surface soil on-site may volatilize or become airborne through fugitive dust generation	Recreational user, maintenance worker	Child / Adult	***Inhalation***[4]	Screen	Fugitive dust is not expected for grassed areas. Approved soil was brought in to improve the cap and to cover contaminant hot spots. Under a hypothetical worst-case scenario, unplanned excavation or other unforeseen processes may expose soil contaminants at the surface.
	Surface soil	Surface soil	Direct contact with chemicals in on-site surface soil	Recreational user, maintenance worker	Child / Adult	***Dermal***[4]	BLRA	Approved soil was brought in to improve cap and to cover contaminant hot spots. Under a hypothetical worst-case scenario, unplanned excavation or other unforeseen processes may expose soil contaminants at the surface.
	Surface soil	Surface soil	Direct contact with chemicals in on-site surface soil	Recreational user, maintenance worker	Child / Adult	***Ingestion***[4]	BLRA and Screen	Approved soil was brought in to improve cap and to cover contaminant hot spots. Under a hypothetical worst-case scenario, unplanned excavation or other unforeseen processes may expose soil contaminants at the surface.
	Surface water	Surface water	Groundwater discharge to Sequoit Creek; direct contact with surface water adjacent to site	Recreational user	Child / Adolescent	***Dermal***[4]	BLRA and Screen	Creek could be used for wading. Skin contact is a possible pathway.
	Surface water	Surface water	Groundwater discharge to Sequoit Creek; direct contact with surface water adjacent to site	Recreational user	Child / Adolescent	Ingestion	None	Creek is not suitable for swimming. Incidental ingestion is expected to be negligible.
	Sediment	Sediment	Groundwater discharge to Sequoit Creek; direct contact with sediment adjacent to site	Recreational user	Child / Adolescent	***Dermal***[4]	BLRA	Creek could be used for wading. Skin contact is a possible pathway.
	Sediment	Sediment	Groundwater discharge to Sequoit Creek; direct contact with sediment adjacent to site	Recreational user	Child / Adolescent	***Ingestion***[4]	BLRA	Creek could be used for wading. Incidental ingestion is a possible pathway.

Table 2 (continued)
(RAGS Part D Table 1)[1]
Selection of Human Exposure Pathways
HOD Landfill Final End Use Risk Assessment

SCENARIO TIME FRAME	MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	RECEPTOR POPULATION[2]	RECEPTOR AGE	EXPOSURE ROUTE	TYPE OF ANALYSIS[3]	RATIONALE FOR SELECTION OR EXCLUSION OF EXPOSURE PATHWAY
	Surface water, sediment	Fish tissue	Groundwater discharge to Sequoit Creek; chemicals in surface water and sediment may be transferred to fish tissue	Recreational user (fishing)	Child / Adult	Ingestion	None	Creek is not used for fishing; fishing is not expected under proposed uses.
	Leachate	Leachate	Leaching from landfill; direct contact with chemicals in leachate on-site	Recreational user	Child / Adult	Ingestion	None	Leachate is not released or accessible with current extraction and treatment controls in place.
	Leachate	Leachate	Leaching from landfill; direct contact with chemicals in leachate on-site	Recreational user	Child / Adult	Dermal	None	Leachate is not released or accessible with current extraction and treatment controls in place.
	Leachate	Air	Leaching from landfill; VOCs in leachate may evaporate to on-site air	Recreational user, maintenance worker	Child / Adult	Inhalation	None	Leachate is not released or accessible with current extraction and treatment controls in place.
	Groundwater	Groundwater	Leaching from landfill to groundwater; groundwater used for drinking water	Recreational user, maintenance worker, special events staff	Child / Adult	Ingestion	None	Site-impacted groundwater is not currently used; groundwater use is not associated with any of the proposed site uses.
	Groundwater	Groundwater	Leaching from landfill to groundwater; groundwater used showering or bathing	Recreational user	Child / Adult	Dermal	None	Site-impacted groundwater is not currently used; groundwater use is not associated with any of the proposed site uses.
	Groundwater	Groundwater	Leaching from landfill to groundwater; groundwater used showering or bathing	Recreational user	Child / Adult	Inhalation	None	Site-impacted groundwater is not currently used; groundwater use is not associated with any of the proposed site uses.

Notes:
(1) This table format is based on Table 1 of the Risk Assessment Guidance for Superfund (RAGS) Part D guidance (USEPA, 2001).
(2) USEPA (2001) guidance prescribes specific terms to describe receptor populations for use in this table. The terms used to describe potential receptors in this exposure pathway analysis and risk assessment for the final end use plan correspond to the prescribed terms from USEPA guidance as follows: facility worker (i.e., bus maintenance facility) = "*Industrial Worker;*" special events staff, and maintenance worker = "*Other Worker;*" recreational user = "*Other Recreational Person;*" Recreational user (fishing) = "*Fisher*." Site-related activities expected for these receptor populations are described, for the different types of proposed site uses, in Table 3.
(3) BLRA: Pathway was evaluated quantitatively in the baseline risk assessment (BLRA; ICF Kaiser, 1994).
Screen: Chemical concentrations in exposure medium compared to risk-based toxicity screening values.
(4) Potentially complete exposure pathways shown in bold italics.

By: MBS
Approved by: MJT

Table 3
Summary of Potentially Complete Exposure Pathways for Proposed Site Uses
HOD Landfill Final End Use Risk Assessment

PROPOSED LAND USES	POTENTIALLY-EXPOSED POPULATIONS	SITE-RELATED ACTIVITIES	POTENTIALLY-COMPLETE EXPOSURE PATHWAY(S)
Recreational fields[1] Playgrounds An off-leash dog area Trails for nonmotorized activities[2] An archery range Model airplane flying Nature/Interpretive walking area Picnic area (tables only)	Maintenance workers	Site maintenance such as collecting trash, mowing grass, landscaping, etc.	Inhalation of airborne contaminants from landfill gas (LFG) or flare Inhalation of airborne contaminants from surface soil Dermal absorption of contaminants in surface soil Incidental ingestion of contaminants in surface soil
	Recreational users (adults, children)	Scheduled/Structured recreational activities for some uses, as well as informal park use for nonstructured uses during nonevent times. Activities could include playing or wading in Sequoit Creek (child or teenager).	Inhalation of airborne contaminants from LFG or flare Inhalation of airborne contaminants from surface soil Dermal absorption of contaminants in surface soil Incidental ingestion of contaminants in surface soil Dermal absorption of contaminants in surface water Dermal absorption of contaminants in sediment Incidental ingestion of contaminants in sediment
Golf driving range	Maintenance workers	Turf maintenance, etc.	Inhalation of airborne contaminants from LFG or flare Inhalation of airborne contaminants from surface soil Dermal absorption of contaminants in surface soil Incidental ingestion of contaminants in surface soil
	Recreational users (primarily adults)	Use of driving range	Inhalation of airborne contaminants from LFG or flare Inhalation of airborne contaminants from surface soil Dermal absorption of contaminants in surface soil Incidental ingestion of contaminants in surface soil

Table 3 (continued)
Potentially Complete Exposure Pathways for Proposed Site Uses
HOD Landfill Final End Use Risk Assessment

PROPOSED LAND USES	POTENTIALLY-EXPOSED POPULATIONS	SITE-RELATED ACTIVITIES	POTENTIALLY-COMPLETE EXPOSURE PATHWAY(S)
Special public events[3]	Maintenance workers	Landscaping, mowing grass, trash collection, etc	Inhalation of airborne contaminants from LFG or flare Inhalation of airborne contaminants from surface soil Dermal absorption of contaminants in surface soil Incidental ingestion of contaminants in surface soil
	Special events staff	Stage, concession setup	Inhalation of airborne contaminants from LFG or flare
	Recreational users (adults, children)	Attending special events	Inhalation of airborne contaminants from LFG or flare

Notes:
(1) Such as baseball, softball, football, soccer, lacrosse, track, or a combination of these.
(2) Such as biking, walking, cross-country skiing.
(3) Concerts or festivals (using portable facilities only).

By: MBS
Approved by: MJT

Table 4
Chemicals Selected for Risk Screening and Rationale for Selection
HOD Landfill Final End Use Risk Assessment

ENVIRONMENTAL MEDIA	CHEMICAL			RATIONALE
Soil	**Inorganic Chemicals**	**VOCs**	**Other Organic Compounds**	Identified as COPCs in surface soil in the BLRA
	Aluminum	Acetone	Acenaphthene	
	Beryllium	Benzene	Anthracene	
	Cadmium	Carbon disulfide	Benzo(a)fluoranthene	
	Chromium (total)	Dibenzofuran	Bis(2-Ethylhexyl)phthalate	
		1,4-Dichlorobenzene	Carbazole	
		Ethylbenzene	4,4'-DDD	
		Methylene chloride	Fluoranthene	
		Toluene	Fluorene	
		Xylenes (total)	2-Methylnaphthalene	
			Naphthalene	
			Phenanthrene	
			Pyrene	

Table 4 (continued)
Chemicals Selected for Risk Screening and Rationale for Selection
HOD Landfill Final End Use Risk Assessment

ENVIRONMENTAL MEDIA	CHEMICAL		RATIONALE
Surface water	**Inorganic Chemicals** Antimony Barium Lead	**VOCs** 2-Hexanone 4-Methyl-2-pentanone	Identified as COPCs in surface water in the BLRA
	Magnesium	1,2-Dichloroethene Trichloroethene Vinyl chloride	VOCs were detected in 2002 monitoring and not previously reported; magnesium was detected at a higher concentration than previously reported.
Sediment	**Inorganics** Arsenic Thallium	**Other Organics** Benzo(a)anthracene Benzo(a)fluoranthene Benzo(a)pyrene bis(2-Ethylhexyl)phthalate Chrysene Fluoranthene Phenanthrene Pyrene	Identified as COPCs in sediment in the BLRA

Notes:
BLRA: baseline risk assessment (ICF Kaiser, 1994).
COPC = chemical of potential concern (as selected in the 1994 BLRA).
VOC = volatile organic compound.

By: MBS
Approved by: MJT

Table 5
(RAGS Part D Table 2.1)[1]
Occurrence, Distribution, and Evaluation of Chemicals Selected for Risk Screening
(Surface Soil, Human Health)
HOD Landfill Final End Use Risk Assessment

SCENARIO TIME FRAME:		CURRENT/FUTURE											
MEDIUM:		SURFACE SOIL											
EXPOSURE MEDIUM:		SURFACE SOIL											
EXPOSURE POINT	CAS NUMBER	CHEMICAL	MINIMUM CONCENTRATION (QUALIFIER)[2]	MAXIMUM CONCENTRATION (QUALIFIER)[2]	UNITS	LOCATION OF MAXIMUM CONCENTRATION[3]	DETECTION FREQUENCY	RANGE OF DETECTION LIMITS	CONCENTRATION USED FOR SCREENING[4]	BACKGROUND VALUE[5]	SCREENING TOXICITY VALUE (N/C)[6]	CHEMICAL OF CONCERN? (Y/N)[7]	RATIONALE[7]
Surface soil	83-32-9	Acenaphthene	0.12 (J)	1.0	mg/kg	SU02	2 / 5	0.41 - 0.43	1.0	N/A	4,700 (N)	N	<STV, BLRA
	67-64-1	Acetone	0.008 (J)	0.14	mg/kg	SU01	4 / 5	0.012	0.14	N/A	7,800 (N)	N	<STV, BLRA
	7429-90-5	Aluminum	6,300	8,700	mg/kg	SU04	5 / 5	Not reported	8,700	30,000*	Not available	N	BKGD
	120-12-7	Anthracene	0.046 (J)	0.046 (J)	mg/kg	SU01	1 / 5	Not reported	0.046	N/A	23,000 (N)	N	<STV, BLRA
	71-43-2	Benzene	0.007 (J)	0.007 (J)	mg/kg	SU01	1 / 5	0.012 - 0.013	0.007	N/A	0.8 (C)	N	<STV, BLRA
	205-99-2	Benzo(b)fluroanthene	0.11 (J)	0.11 (J)	mg/kg	SU03	1 / 5	Not reported	0.11	N/A	0.9 (C)	N	<STV, BLRA
	7440-41-7	Beryllium	0.54 (B)	0.74 (B)	mg/kg	SU05	5 / 5	Not reported	0.70	1.2 - 2.1*	160 (N)	N	<STV, BLRA, BKGD
	117-81-7	Bis(2-ethylhexyl)phthalate	0.16 (J)	9.6	mg/kg	SU05	5 / 5	Not reported	9.6	N/A	46 (C)	N	<STV, BLRA
	7440-43-9	Cadmium	1.0	1.3	mg/kg	SU05	2 / 5	0.74 - 0.81	1.3	0.41 - 1.5 *	78 (N)	N	<STV, BLRA, BKGD
	86-74-8	Carbazole	0.13 (J)	0.13 (J)	mg/kg	SU01	1 / 5	Not reported	0.13	N/A	32 (C)	N	<STV, BLRA
	75-15-0	Carbon disulfide	0.006 (J)	0.006	mg/kg	SU02	1 / 5	Not reported	0.006	N/A	720 (N)	N	<STV, BLRA
	7440-47-3	Chromium (total)	10	16	mg/kg	SU05	5 / 5	Not reported	16.1	50*	230 (N)	N	<STV, BLRA, BKGD
	72-54-8	4,4'-DDD	0.0043	0.0043	mg/kg	SU01	1 / 5	0.0041 - 0.0045	0.004	N/A	3 (C)	N	<STV, BLRA
	132-64-9	Dibenzofuran	0.059 (J)	0.62	mg/kg	SU01	2 / 5	0.41 - 0.43	0.62	N/A	Not available	N	BLRA
	106-46-7	1,4-Dichlorobenzene	0.13 (J)	0.13 (J)	mg/kg	SU01	1 / 5	Not reported	0.13	N/A	11,000 (N)	N	<STV, BLRA
	100-41-4	Ethylbenzene	0.012 (J)	0.24	mg/kg	SU01	2 / 5	0.012 - 0.39	0.24	N/A	400 (N)	N	<STV, BLRA
	206-44-0	Fluoranthene	0.059 (J)	0.16 (J)	mg/kg	SU03	4 / 5	Not reported	0.16	N/A	3,100 (N)	N	<STV, BLRA
	86-73-7	Fluorene	0.068 (J)	0.50	mg/kg	SU02	2 / 5	0.41 - 0.43	0.50	N/A	3,100 (N)	N	<STV, BLRA
	75-09-2	Methylene chloride	0.048 (B)	1.2 (B)	mg/kg	SU04	4 / 5	0.033	1.2	N/A	13 (C)	N	<STV, BLRA

Table 5 (continued)
(RAGS Part D Table 2.1)[1]
Occurrence, Distribution, and Evaluation of Chemicals Selected for Risk Screening
(Surface Soil, Human Health)
HOD Landfill Final End Use Risk Assessment

SCENARIO TIME FRAME:		CURRENT/FUTURE											
MEDIUM:		SURFACE SOIL											
EXPOSURE MEDIUM:		SURFACE SOIL											
EXPOSURE POINT	CAS NUMBER	CHEMICAL	MINIMUM CONCENTRATION (QUALIFIER)[2]	MAXIMUM CONCENTRATION (QUALIFIER)[2]	UNITS	LOCATION OF MAXIMUM CONCENTRATION[3]	DETECTION FREQUENCY	RANGE OF DETECTION LIMITS	CONCENTRATION USED FOR SCREENING[4]	BACKGROUND VALUE[5]	SCREENING TOXICITY VALUE (N/C)[6]	CHEMICAL OF CONCERN? (Y/N)[7]	RATIONALE[7]
Surface soil	91-57-6	2-Methylnaphthalene	0.061 (J)	0.39 (J)	mg/kg	SU02	2 / 5	0.41 - 0.43	0.39	N / A	Not available	N	BLRA
	91-20-3	Naphthalene	0.32 (J)	0.63	mg/kg	SU02	2 / 5	0.41 - 0.43	0.64	N / A	170 (N)	N	<STV, BLRA
	85-01-8	Phenanthrene	0.051 (J)	0.25 (J)	mg/kg	SU01	5 / 5	Not reported	0.25	N / A	Not available	N	BLRA
	129-00-0	Pyrene	0.052 (J)	0.11 (J)	mg/kg	SU03	4 / 5	Not reported	0.11	N / A	2,300 (N)	N	<STV, BLRA
	108-88-3	Toluene	0.003 (J)	0.055 (J)	mg/kg	SU01	3 / 5	0.012 - 0.013	0.055	N / A	650 (N)	N	<STV, BLRA
	1330-20-7	Xylenes (total)	0.037	0.28	mg/kg	SU01	2 / 5	0.012 - 0.39	0.28	N / A	320 (N)	N	<STV, BLRA

Notes:

By: MBS
Approved by: MJT

(1) This table format is based on Table 2.1 of the Risk Assessment Guidance for Superfund (RAGS) Part D guidance (USEPA, 2001).

(2) Qualifier codes used for the "Minimum Concentration" and "Maximum Concentration":
- J = estimated value (below detection limit)
- B = also detected in associated blank (may be a false positive)

(3) Location(s) of maximum concentration (from Montgomery Watson, 1997):
- SU01: Leachate seep on southern slope of the new landfill
- SU02: Area of landfill gas seepage on southern slope of the new landfill
- SU03: Near the southeastern corner of the old landfill in the wetland area
- SU04: New landfill, discolored area or standing water
- SU05: New landfill, discolored area or standing water

(4) Source(s) for the "Concentration Used for Screening":
- Exposure point concentrations for all chemicals in soil were the maximum detected concentrations

(5) Source(s) for the "Background Value":
- * selected as COPC in BLRA because of lack of site-specific background data
- Al, Cr: Boerngen and Shacklette (1981) as referenced in ICF Kaiser, 1994
- Be, Cd: Kabata-Pendias and Pendias (1985), averages (Be) or range (Cd) for a variety of soil types
- N / A: Not applicable. Background was not considered for organic compounds.

(6) Source(s) for the "Screening Toxicity Value":
- IEPA (2002) Tier 1 Soil Remediation Objectives for residential properties, exposure route specific values for soils (ingestion and inhalation).
- For separate soil values for ingestion and inhalation, the lower of the two values was used.
- Screening level for chromium is based on the more toxic hexavalent form of chromium
- (N) indicates that the screening toxicity value is based on a target Hazard Quotient of 1 for noncancer health effects
- (C) indicates that the screening toxicity values is based on a target cancer risk level of 1 in 1,000,000

(7) A chemical of concern is defined in this final end use plan risk assessment as any chemical with a screening concentration that exceeds background and its screening toxicity value, or was evaluated in the BLRA with risk results exceeding acceptable levels.
Codes used for the "Rationale":
- <STV: less than screening toxicity value
- BKGD: not elevated above background levels
- BLRA: risk evaluated in BLRA and found not to be of concern.

(8) Screening value is for hexavalent chromium.

Table 6
(RAGS Part D Table 2.1)[1]
Occurrence, Distribution, and Evaluation of Chemicals Selected for Risk Screening
(Surface Water, Human Health)
HOD Landfill Final End Use Risk Assessment

SCENARIO TIMEFRAME:	CURRENT/FUTURE													
MEDIUM:	SURFACE WATER													
EXPOSURE MEDIUM:	SURFACE WATER													
EXPOSURE POINT	CAS NUMBER	CHEMICAL	MINIMUM CONCENTRATION (QUALIFIER)[2]	MAXIMUM CONCENTRATION (QUALIFIER)[2]	UNITS	LOCATION OF MAXIMUM CONCENTRATION[3]	DETECTION FREQUENCY	RANGE OF DETECTION LIMITS	CONCENTRATION USED FOR SCREENING[4]	BACKGROUND VALUE[5]	SCREENING TOXICITY VALUE (N/C)[6]	CHEMICAL OF CONCERN? (Y/N)[7]	RATIONALE[7]
Selected as COPC in BLRA													
Surface water	7440-36-0	Antimony	20	20	µg/L	S301-DUP	1 / 6	24 - 27.6	20	<24	N/A	N	BLRA, no derm
	7440-39-3	Barium	18	23	µg/L	S301	6 / 6	n/a	23	17 - 22	N/A	N	BLRA, no derm
	591-78-6	2-Hexanone	3 (J)	3 (J)	µg/L	S301	1 / 6	Not reported	3.0	<10	N/A	N	Not detected in 2002 monitoring
	7439-92-1	Lead	1.5	1.5	µg/L	S301	1 / 6	1.6 - 2.0	1.5	<2.0	N/A	N	No derm
	108-10-1	4-Methyl-2-pentanone	2 (J)	2 (J)	µg/L	S301	1 / 6	Not reported	2.0	<10	N/A	N	BLRA
2002 Monitoring[8]													
Surface water	7439-95-4	Magnesium, total	30	42	mg/L	SW-02	3 / 3	5	42	30.1 - 31	N/A	N	No derm
	540-59-0	1,2-Dichloroethene (total)	1.2	5.2	µg/L	SW-02	2 / 3	1	5.2	Not available	3,800(N)	N	<STV
	79-01-6	Trichloroethylene	0.24 (J)	0.24 (J)	µg/L	SW-02	1 / 3	1	0.24	Not available	13 (C)[9]	N	<STV
	75-01-4	Vinyl chloride[10]	0.26 (J)	0.26 (J)	µg/L	SW-02	1 / 3	2	0.26	<2	35 (C)	N	<STV

By: MBS
Approved by: MJT

Notes:
(1) This table format is based on Table 2.1 of the Risk Assessment Guidance for Superfund (RAGS) Part D guidance (USEPA, 2001).
(2) Qualifier codes used for the "Minimum Concentration" and "Maximum Concentration":
J = estimated value (below detection limit)
(3) Location(s) of maximum concentration:
S301: collected from Sequoit Creek near the northwestern corner of the HOD site (Montgomery Watson, 1997)
SW-02: collected from Sequoit Creek near the northwestern corner of the HOD site (RMT 2002 a, b, and c)
(4) Source(s) for the "Concentration Used for Screening" maximum detected value.
(5) Source(s) for the "Background Value":
Background data for the BLRA are from four upstream sampling locations (S101, S401, S501, and S601)
Background data for 2002 monitoring is from one sample upstream of the site (SW-01)
(6) Source(s) for the "Screening Toxicity Value":
RAIS-calculated risk-based "preliminary remediation goal" based on dermal absorption, 1 x 10^{-6} risk (C) or 0.1 HQ (N) (calculated January 31, 2003).
N/A: BLRA results used instead of screening toxicity values
(N) indicates that the screening toxicity value is based on a target hazard quotient of 0.1 for non-cancer health effects
(C) indicates that the screening toxicity values is based on a target cancer risk level of 1 in 1,000,000
(7) A chemical of concern is defined in this final end use plan risk assessment as any chemical with a screening concentration that exceeds background and its screening toxicity value, or was evaluated in the BLRA with risk results exceeding acceptable levels.
Codes used for the "Rationale":
<STV: less than screening toxicity value
BLRA: risk evaluated in BLRA and found not to be of concern
No derm: negligible dermal absorption
(8) TCL/TAL chemicals detected at levels above those in BLRA or not previously detected.
(9) The RAIS-calculated value was corrected to reflect a revised oral cancer slope factor of 0.4 $(mg/kg\text{-}day)^{-1}$ (Cogliano and Cogliano, 2001).
(10) Also detected in SW-02 field dup at 0.25 (J) µg/L.

Table 7
(RAGS Part D Table 2.1)[1]
Occurrence, Distribution, and Evaluation of Chemicals Selected for Risk Screening
(Sediment, Human Health)
HOD Landfill Final End Use Risk Assessment

SCENARIO TIMEFRAME:	CURRENT/FUTURE												
MEDIUM:	SEDIMENT												
EXPOSURE MEDIUM:	SEDIMENT												
EXPOSURE POINT	CAS NUMBER	CHEMICAL	MINIMUM CONCENTRATION (QUALIFIER)[2]	MAXIMUM CONCENTRATION (QUALIFIER)[2]	UNITS	LOCATION OF MAXIMUM CONCENTRATION[3]	DETECTION FREQUENCY	RANGE OF DETECTION LIMITS	CONCENTRATION USED FOR SCREENING[4]	BACKGROUND VALUE[5]	HUMAN HEALTH SCREENING TOXICITY VALUE (N/C)[6]	CHEMICAL OF CONCERN? (Y/N)[7]	RATIONALE[7]
Sediment	56-55-3	Benzo(a)anthracene	0.25 (J)	0.25 (J)	mg/kg	S301	1 / 4	Not reported	0.25	ND (<0.49 - <1.1)	N/A	N	BLRA
	50-32-8	Benzo(a)pyrene	0.29 (J)	0.29 (J)	mg/kg	S301	1 / 4	Not reported	0.29	ND (<0.49 - <1.1)	N/A	N	BLRA
	205-99-2	Benzo(b)fluoranthene	0.43 (J)	0.43 (J)	mg/kg	S301	1 / 4	Not reported	0.43	ND (<0.49 - <1.1)	N/A	N	BLRA
	218-01-9	Bis(2-ethylhexyl)phthalate	0.94 (J)	1.5	mg/kg	S301	2 / 4	2.1 - 2.5	1.5	ND (<0.49 - <1.1)	N/A	N	BLRA
	117-81-7	Chrysene	0.3 (J)	0.3 (J)	mg/kg	S301	1 / 4	Not reported	0.30	ND (<0.49 - <1.1)	N/A	N	BLRA
	206-44-0	Fluoranthene	0.38 (J)	0.68 (J)	mg/kg	S301	2 / 4	Not reported	0.68	ND (<0.49 - <1.1)	N/A	N	BLRA
	85-01-8	Phenanthrene	0.31 (J)	0.31 (J)	mg/kg	S301	1 / 4	Not reported	0.31	ND (<0.49 - <1.1)	N/A	N	BLRA
	129-00-0	Pyrene	0.37 (J)	0.58 (J)	mg/kg	S301	2 / 4	Not reported	0.58	ND (<0.49 - <1.1)	N/A	N	BLRA
	7440-38-2	Arsenic	5.5	7.2	mg/kg	PSG1	4 / 4	Not reported	7.2	2.4 - 4.2	N/A	N	BLRA
	7440-28-0	Thallium	1.3	3.9	mg/kg	Not available	4 / 4	Not reported	3.9	ND (<0.76 - <1.75)	N/A	N	BLRA

Notes:

By: MBS
Approved by: MJT

(1) This table format is based on Table 2.1 of the Risk Assessment Guidance for Superfund (RAGS) Part D guidance (USEPA, 2001).
(2) Qualifier codes used for the "Minimum Concentration" and "Maximum Concentration":
J = estimated value (below detection limit)
(3) Location(s) of maximum concentration:
S201: Sequoit Creek near the southwestern corner of the site
S301: Sequoit Creek near the northwestern corner of the site
PSG1: Sequoit Creek at site boundary, south of the new landfill
(4) Source(s) for the "Concentration Used for Screening":
Exposure point concentrations for all chemicals in sediment were the maximum detected concentrations (from the BLRA)
(5) Source(s) for the "Background Value":
Background data for the BLRA are from four upstream sampling locations (S101, S401, S501, and S601)
ND = not detected
(6) Source(s) for the "Screening Toxicity Value":
N/A: BLRA results used instead of screening toxicity values
(7) A chemical of concern is defined in this final end use plan risk assessment as any chemical with a screening concentration that exceeds background and its screening toxicity value, or was evaluated in the BLRA with risk results exceeding acceptable levels.
Codes used for the "Rationale":
BLRA: risk evaluated in BLRA and found not to be of concern

Table 8
Significant Changes to Chemical Toxicity Data Since the 1994 BLRA
HOD Landfill Final End Use Risk Assessment

CONSTITUENT OF POTENTIAL CONCERN(1)	MEDIA			NOTES ABOUT TOXICITY DATA	SIGNIFICANCE OF CHEMICAL TOXICITY DATA CHANGES TO THE BLRA RESULTS
	SW	SED.	SOIL		
Inorganics					
Arsenic		X		Oral slope factor lowered slightly, from 1.75 to 1.5 per mg/kg-day (IRIS)	Current cancer risk estimate would be slightly lower.
Beryllium			X	RfD lowered from 0.005 to 0.002 mg/kg-day; WOE upgraded from B2 to B1 (IRIS)	Current Hazard Quotient (HQ) would be 2.5x higher. HQ was 3.2×10^{-7}, revised: 8×10^{-7}—still no concern.
Barium	X			WOE classification of D added	None
Cadmium			X	WOE classification of B1 added (IRIS)	None
Chromium (total)			X	RfD for Cr+6 lowered from 0.005 to 0.003 mg/kg-day (IRIS)	Current HQ would be 1.7x higher. HQ was 7.6×10^{-6}, revised: 1.3×10^{-5}—still no concern.
Organics					
Benzene			X	Oral slope factor changed from 0.029 $(mg/kg\text{-}day)^{-1}$ to 0.015 - 0.055 $(mg/kg\text{-}day)^{-1}$ (IRIS)	Current cancer risk estimate would be up to 2x higher. Risk was 1×10^{-11}, revised: 2×10^{-11}—still no concern.
2-Hexanone	X			Oral data gap; no new data available in IRIS or HEAST.	None
Naphthalene			X	RfD 0.02 (mg/kg-day) added, resulting in a lower RfD (the RfD for pyrene, 0.03 mg/kg-day, had been used); WOE upgraded from D to C (IRIS).	Current HQ would be 1.5x higher. HQ was 3.9×10^{-6}, revised: 5.8×10^{-6}—still no concern.
Trichloro-ethylene	X			Oral RfD 25x lower: changed from 0.00735 mg/kg-day to 0.0003 mg/kg-day (Cogliano and Cogliano, 2001); oral slope factor up to 36x higher: changed from 0.011 $(mg/kg\text{-}day)^{-1}$ to 0.4 $(mg/kg\text{-}day)^{-1}$ (higher value of range; Cogliano and Cogliano, 2001).	Trichloroethylene was not previously detected in surface water and was not evaluated for surface water contact in the BLRA(2).

Table 8 (continued)
Review of Chemical Toxicity Data and Significant Changes Since 1994 BLRA
HOD Landfill Final End Use Risk Assessment

CONSTITUENT OF POTENTIAL CONCERN[1]	MEDIA			NOTES ABOUT TOXICITY DATA	SIGNIFICANCE OF CHANGES TO CHEMICAL TOXICITY DATA
	SW	SED.	SOIL		
Vinyl chloride	X			Oral RfD added (0.003); slope factor 2.6x lower: changed from 1.9 (HEAST) to 0.72 (IRIS).	Vinyl chloride was not previously detected in surface water and was not evaluated for surface water contact in the BLRA.[2]

Notes:
(1) Only those COPCs with toxicity data gaps, changes, or additions are listed.
(2) Surface water concentrations measured since the BLRA was conducted are below screening toxicity values for trichloroethylene and vinyl chloride (see Table 6).
RfD: reference dose (for noncancer health effects)
WOE: USEPA cancer weight of evidence classification.
IRIS: USEPA's (2002) on-line *Integrated Risk Information System* database.
HEAST: Health Effects Summary Tables (USEPA, 1995, 1997b).

By: MBS
Approved by: MJT

Table 9
Comparison of Surface Water Concentrations to Water Quality Criteria for Protection of Aquatic Life
HOD Landfill Final End Use Risk Assessment

CHEMICAL	MAXIMUM SURFACE WATER CONCENTRATION (mg/L)	SURFACE WATER QUALITY CRITERIA/ GUIDANCE (mg/L)	SOURCE	RISK SCREENING RESULTS
1,2-Dichloroethene	5.2	1,100(1) 590(2)	Suter and Tsao, 1996	Maximum concentration meets screening levels.
2-Hexanone	3	1,800(1) 99(2) 32,783(3)	Suter and Tsao, 1996	Maximum concentration meets screening levels.
4-Methyl-2-pentanone	2	2,200(1) 170(2) 77,400(3)	Suter and Tsao, 1996	Maximum concentration meets screening levels.
Trichloroethene	0.24	440(1) 47(2)	Suter and Tsao, 1996	Maximum concentration meets screening levels.
Vinyl chloride	0.26	Not available		
Antimony	17	180(1) 30(2) 1,600(3) 5,400(4) 610(5)	Suter and Tsao, 1996	Maximum concentration meets screening levels.
Barium	23	110(1) 4.0(2)	Suter and Tsao, 1996	Meets acute value, exceeds chronic value. Not elevated above background (upstream) levels.

Table 9 (continued)
Comparison of Surface Water Concentrations to Water Quality Criteria for Protection of Aquatic Life
HOD Landfill Final End Use Risk Assessment

CHEMICAL	MAXIMUM SURFACE WATER CONCENTRATION (mg/L)	SURFACE WATER QUALITY CRITERIA/ GUIDANCE (mg/L)	SOURCE	RISK SCREENING RESULTS
Lead	1.5	CMC = 65 CCC = 2.5	AWQC based on hardness of 100 mg/L. AWQC currently under revision.	Maximum concentration meets screening levels.
		19(3) 12(4) 25(6) 500(5)	Suter and Tsao, 1996	

Notes:
(1) Tier II Value; secondary acute value.
(2) Tier II Value; secondary chronic value.
(3) ORNL, lowest chronic value for fish.
(4) ORNL, lowest chronic value for daphnids.
(5) ORNL, lowest chronic value for aquatic plants.
(6) ORNL, lowest chronic value for non-daphnid invertebrates.

By: MBS
Approved by: MJT

AWQC = Ambient Water Quality Criteria (USEPA, 1999).
CMC = Criteria Maximum Concentration. CMC is the highest concentration of a pollutant to which aquatic life can be exposed for a short period of time (1 hour average) (acute).
CCC = Criteria Continuous Concentration. CCC is the highest concentration of a pollutant to which aquatic life can be exposed for an extended period of time (4 days) without deleterious effects.

Table 10
Comparison of Sediment Concentrations to Available Sediment Quality Criteria/Guidelines for Protection of Aquatic Life
HOD Landfill Final End Use Risk Assessment

CHEMICAL	SEDIMENT CONCENTRATION (mg/kg)[1]	SEDIMENT GUIDELINE CONCENTRATION (mg/kg)[1]	SOURCE	RISK SCREENING RESULTS
Arsenic	7.2	170[2]	Canadian Council of Ministers for the Environment (2001)	Below probable effect level (PEL)
Benzo(a)anthracene	0.25	0.385[2]	Canadian Council of Ministers for the Environment (2001)	Below PEL
Benzo(a)pyrene	0.29	0.782[2]	Canadian Council of Ministers for the Environment (2001)	Below PEL
Benzo(b)fluoranthene	0.43	3.6[3] 9.9[4]	USEPA (2002b)	Below apparent effects thresholds (AET)
Bis(2-ethylhexyl)phthalate	1.5	1.3[3] 1.9[4] 2.65[2]	USEPA (2002b)	Below AET (high) and PEL
Chrysene	0.30	0.862[2]	Canadian Council of Ministers for the Environment (2001)	Below PEL
Fluoranthene	0.68	2.355[2]	Canadian Council of Ministers for the Environment (2001)	Below PEL
Phenanthrene	0.31	0.515[2]	Canadian Council of Ministers for the Environment (2001)	Below PEL
Pyrene	0.58	0.875[2]	Canadian Council of Ministers for the Environment (2001)	Below PEL
Thallium	3.9	Not available		

Notes:
(1) Expressed as dry weight.
(2) PEL = probable effect level.
(3) AET-L = apparent effects threshold - low.
(4) AET-H = apparent effects threshold - high.

By: MBS
Approved by: MJT

APPENDIX E

EXPLANATION OF SIGNIFICANT DIFFERENCES

EXPLANATION OF SIGNIFICANT DIFFERENCES
H.O.D. LANDFILL
ANTIOCH, ILLINOIS
August, 2003

INTRODUCTION

The H.O.D. Landfill Superfund Site (?H.O.D. Landfill Site" or ?the Site") is located within the eastern boundary of the Village of Antioch, Lake County, Illinois. The Site was used as a landfill from approximately 1963 until 1984. Various solid and liquid industrial wastes, including hazardous substances, as well as municipal wastes, were landfilled at the Site. Waste Management of Illinois, Inc. (WMII) and the Village of Antioch are the owners of the Site.

On September 28, 1998, the Regional Administrator of the U.S. Environmental Protection Agency (EPA) signed the Record of Decision (ROD) for the Site. The remedy selected for the Site was based on the remedial investigation/ feasibility study (RI/FS), which was completed in June 1998. The Illinois Environmental Protection Agency (IL EPA) concurred with the remedy selected in the ROD, and supports this Explanation of Significant Differences (ESD) for the H.O.D. Landfill Site. The selected remedy in the ROD required, in part, upgrading existing fencing, adding additional fencing to completely enclose the Site, posting warning signs, and installing locking gates to ensure the continued integrity of the waste containment remedy.

On April 14, 1999, U.S. EPA issued a CERCLA Section 106(a) Unilateral Administrative Order (*UAO*) to five Potentially Responsible Parties (PRPs), including, but not limited to WMII and the Village of Antioch. Pursuant to the UAO, WMII implemented the remedy at the Site, except for the institutional controls and Site access restrictions portions of the remedy.

In August 2003, WMII conducted a post-closure risk assessment, and announced the results in a report entitled Exposure Pathway Analysis and Risk Assessment for the HOD Landfill Final End Use Plan, August 2003. Data in the report revealed that a portion of the original remedy from the 1998 ROD, requiring Site access restrictions, could be modified and still be protective of human health, welfare and the environment. The report further presented several potential reuse scenarios and concluded that the potential final end uses would not pose unacceptable risks, provided that the integrity of the existing remedy and groundwater use restrictions are maintained. Potential reuse scenarios for the Site include recreational fields, playgrounds, off-leash dog areas, non-motorized trails, an archery range, model airplane flying areas, a golf driving range, nature area/interpretive walking areas, a picnic area (tables only), special events for concerts or festivals. By modifying the original remedy regarding fencing, gates and signs, through this ESD, the Site can be put into productive reuse while the integrity of the remedy is upheld to remain protective of human health and the environment.

The purpose of this ESD is to modify only that part of the original remedy from the ROD, involving fencing, signs, and gates. The requirement for restrictive convenants on the Site deed, as articulated in the original ROD, will be maintained to protect the integrity of the remedy, as well as limit certain Site use and development. Such restrictive covenants will notify a potential

purchaser of the property of the past landfill activities and will assert that the land use must be restricted to ensure the continued integrity of the waste containment remedy. The original ROD noted that use of the groundwater in the vicinity of the Site is prohibited by Village of Antioch ordinance; this ESD will not affect the prohibitions on groundwater use, as regulated by the Village's ordinances.

Therefore, pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 117 (c) and the National Contingency Plan (NCP) section 300.435(c)(2)(i), the U.S. EPA is publishing this ESD.

This ESD will become a part of the H.O.D. Landfill Administrative Record (NCP 300.825 (a)(2)), which is available for review at the Antioch Public District Library in Antioch, IL and at U.S. EPA Region 5 offices in Chicago, IL.

I. SUMMARY OF SITE HISTORY, CONTAMINATION, AND SELECTED REMEDY

The H.O.D. Landfill Site consists of approximately 51 acres of landfilled area that is located on a parcel of land that is roughly 121.5 acres in size. Although the landfill area is continuous, it consists of two separate landfill areas, identified as the "old landfill" and the "new landfill." The "old landfill" consists of 24.2 acres situated on the western third of the property. The "new landfill" consists of 26.8 acres located immediately east of the "old landfill." Permitted waste disposal activities began at the Site in approximately 1963 and continued through approximately 1984. According to Waste Management of Illinois, Inc.(WMII), solvents, heavy metals, and cutting and hydraulic oils, in addition to municipal waste, were disposed of at the Site. The types of chemicals and compounds associated with the above-mentioned hazardous wastes generally included hazardous metals, volatile organic compounds (VOCs), pesticides, and polychlorinated biphenyls (PCBs). The primary threat to human health, welfare and the environment, posed by this Site is from vinyl chloride in the groundwater that could potentially be ingested.

Remedial action components of the selected remedy presented in the 1998 ROD include, but are not limited to the following activities:

A. Institutional controls in the form of Village of Antioch ordinances that reduce exposure to Site contaminants by requiring residents to connect to the municipal water supply system, and by prohibiting the installation of private wells within Village limits.

B. Access restrictions that include upgrading the existing fencing, constructing new fencing to completely enclose the Site, posting warning signs, and installing locking gates.

C. Restrictive covenants on deeds to the Site that will ensure the continued integrity of the waste containment remedy by preventing or limiting Site use and development.

D. Waste cap improvements including: removing vegetation; stockpiling topsoil to be reused as vegetation layer soils; consolidating the off-property waste at the northern edge of the "old landfill" onto Site property; regrading, placing and compacting the clay soils; placing the un-compacted, vegetative layer soils; and re-establishing the vegetation. The cap is comprised of two feet of compacted clay with one foot of clean topsoil above to support vegetation.

E. Enhanced gas collection and treatment requiring trenching in areas of the Site for placement of pipe and new wells, placement of backfill around these new features, localized cap reconstruction, and construction of the blower and flare station.

F. Enhanced leachate collection, including removal of the cap in areas of pipe placement, installation of additional leachate/gas extraction wells and header piping, backfilling, relocating of excavated waste, and reconstruction of the cap.

G. Untreated leachate will be pumped directly from the collection system and transported via tanker trucks to the publicly owned treatment works for treatment under an industrial discharge permit for the Site.

H. Monitored natural attenuation for groundwater in surficial sand, and the deep sand and gravel aquifers located beneath the Site, and the installation and monitoring of groundwater wells downgradient of the Site.

In August of 2003, WMII completed an exposure pathway analysis and risk assessment to assess potential human health and environmental exposures and risks associated with potential recreational uses of the H.O.D. Landfill Site. This ESD summarizes the results of the August 2003, exposure pathway analysis and risk assessment and explains the rationale for the refinement of the access restrictions from the 1998 ROD.

II. DIFFERENCES AND THE BASES FOR THE EXPLANATION OF SIGNIFICANT DIFFERENCES

The August 2003, exposure pathway analysis and risk assessment provided the basis for the modification of the access restrictions that were required as a part of the 1998 ROD. The document presents several potential final end uses for the Site, that were identified by U.S. EPA with community involvement. Such end uses include the following: recreational fields, playgrounds, off-leash dog areas, non-motorized trails, an archery range, model airplane flying areas, a golf driving range, nature area/interpretive walking areas, a picnic area (tables only), special events for concerts or festivals. It assessed human health and environmental exposures and quantified risks associated with recreational uses in the H.O.D. Landfill Site by evaluating potential exposure pathways for human and ecological receptors, screening chemicals associated with potential exposure pathways to determine potential chemicals of concern (COCs) for further risk assessment, re-evaluating toxicity levels for COCs identified in the January 1997 RI/FS, and evaluating uncertainties of the exposure pathway analysis and risk screening process. It also

included screening chemicals associated with potential exposure pathways to determine potential chemicals of concern (COCs) for further risk assessment, re-evaluation of toxicity levels for COCs identified in the January 1997 RI/FS, and evaluating uncertainties of the exposure pathway analysis and risk screening process. The exposure pathway analysis and risk assessment revealed results that support and justify modification of the original access restrictions that were set forth in the ROD. The results of the August 2003, exposure pathway analysis and risk assessment are as follows:

A. The existing remedy including landfill cap maintenance, landfill gas control and destruction, and leachate collection, treatment and disposal, prevents potential exposure pathways or site-related chemicals from posing unacceptable risks to Site users. In addition, because existing remedial components prevent potential exposure to ecological populations, a quantitative risk evaluation is not necessary.

B. The clean cover soil that was added as part of the remedial action limits exposure to Site related chemicals from contact with surface soil. If contact did occur, risks from chemicals in soil would be below levels of concern.

C. The landfill gas and the leachate collection system (negative pressure vapor extraction) is operated so that VOC concentrations in on-site air concentrations are expected to be very low and pose no risks to Site users.

D. Chemicals detected in Sequoit Creek are at low concentrations and would not pose a risk to a child or teenager occasionally wading in the creek. Chemical concentrations are monitored periodically and are not expected to increase.

Based on the August 2003, exposure pathway analysis and risk assessment, the following significant differences to the H.O.D. Landfill ROD are proposed:

A. Modifying access restrictions such that the existing fence will be removed from the 120-acre Site, and a fence restricting access to the operation and maintenance areas (including two maintenance buildings, and a leachate collection pad and tank), will be constructed and maintained around the operation and maintenance areas. In addition, warning signs will be placed around the fenced operation and maintenance areas, and locking gates will be installed in the fencing surrounding the areas. The gates will be kept locked when the areas are not being subject to maintenance or inspection activities.

B. Securing any equipment outside of the fenced-in operation and maintenance area which is necessary to maintain the integrity of the existing landfill (flush-mounted gas/leachate collection vaults). In addition, locking mechanisms will be installed on the vault covers and will be kept locked when not being inspected or subject to operation and maintenance activities.

C. Refining the restrictive covenants for the deed~~s~~ to the Site to reflect uses that can be safely supported without affecting the integrity of the remedy, as documented in the

Exposure Pathway Analysis and Risk Assessment for the HOD Landfill End Use Plan, August 2003.

III. RATIONALE FOR DELETING CERTAIN ACCESS RESTRICTIONS

The findings from the August 2003, exposure pathway analysis and risk assessment indicate that not all of the access restrictions, as expressed in the original 1998 ROD are necessary for protecting human health and the environment under certain quantified reuse scenarios.

To make this determination, the following three activities were performed:

A. The results of the original baseline risk assessment for the Site which was originally reviewed and approved by EPA, were re-evaluated by WMII in 2003 and subsequently reviewed, analyzed and approved by U.S. EPA risk assessors in that same year.

B. Post-remediation chemical concentrations associated with the potential exposure pathways were screened against published human health risk-based levels.

C. Post-remediation chemical concentrations associated with the potential ecological exposure pathways were screened against current published ecological toxicity screening levels.

The exposure pathway analysis shows that:

A. The baseline risk assessment identified unacceptable cancer and non-carcinogenic health risks for residents if they used groundwater in the area for drinking and/or showering. The groundwater was contaminated with vinyl chloride (deep sand and gravel aquifer), beryllium and manganese (upper surficial sand aquifer), and arsenic (two municipal wells). The risks for all other potential exposure pathways were within acceptable levels established by U.S. EPA.

B. Exposure to potential exposure pathways identified in the baseline risk assessment were re-evaluated based on proposed uses that have been suggested by members of the community. Possible reuse scenarios included recreational fields (e.g., baseball, soccer, football, lacrosse.), playgrounds, off-leash dog areas, trails for non-motorized activities, an archery range, model airplane flying, golf driving range, nature areas, picnic tables, special events (e.g., concerts, festivals using portable equipment). None of the assessed media (air, surface soil, surface water, sediment, groundwater, or leachate) posed unacceptable risks to exposed populations under the reuse scenarios.

C. Ecological risks based on new screening criteria were minimal, and the one contaminant exceeding short-term and long-term standards, was not detected at levels that exceed background levels.

IV. IMPLICATIONS FOR MODIFYING FENCE, SIGN, AND GATE REQUIREMENTS

While conducting the baseline risk assessment, exposure scenarios to determine risks relied upon assumptions for a child/teenage trespasser experiencing incidental ingestion and dermal contact with surface soil and contact with Sequoit Creek surface water and sediment. A trespasser was considered to be representative of a potential recreational user. Trespassers between the age of 6 and 16 years of age were assumed to ingest 110 mg of soil for 43 days a year over ten years for incidental ingestion and dermal contact with surface soil. For all soil COCs, baseline risk assessment results for direct contact with surface soil totaled 9×10^{-9}, or more than 100 times below the target risk level for cancer, and 6,000 times below risks associated with non-carcinogenic health effects (hazard index of 0.00017). Since the baseline risk assessment, the Site has been covered with clean soil, thereby reducing the risks associated with surface soil contact.

Exposure assumptions for a child/teenager trespasser wading or playing in Sequoit Creek include children age 6 to 16 years of age to be exposed for one hour a day, 35 days a year over ten years. Baseline risk results for all direct contact with sediment COCs totaled 1×10^{-8}, or 100 times below the level of concern, and results for other health effects totaled 0.00021, or almost 5,000 times below the concern level for non-cancer health risks. Direct contact with surface water for non-cancer health effects totaled 0.005, or 200 times below the level of concern.

Present monitoring results indicate that the chemicals present on-site pose no danger to trespassers, and to on-site recreational users. There is no need to put or keep in place remedial measures designed to prevent persons from entering the Site, assuming other remedial measures (e.g., the cap, and leachate and gas collection systems) are operating correctly.

V. IMPACTS OF MODIFYING ACCESS RESTRICTIONS ON OTHER REMEDIAL COMPONENTS

The landfill cap, gas and leachate collection, and leachate treatment will need to be maintained in order for the remedy to be protective of human health and the environment. To ensure the remedy remains protective, no digging will be allowed beneath the one-foot layer of clean topsoil which is now covering the cap of the landfill. The cap beneath the topsoil consists of at least two feet of compacted clay, which must remain undisturbed and unbreached. In addition, access to all leachate and gas extraction wells, vents, flares, and other components of the remedy must be granted at all times, and destruction or impairment of these structures is prohibited.

VI. IMPACTS OF MODIFYING ACCESS RESTRICTIONS ON GROUNDWATER, SURFACE WATER, AND AIR

Deleting certain access restrictions will have no negative impact on groundwater, surface

water, and air affected by the Site. The cap will prevent hazardous waste from entering the air and surface water so long as the cap is not breached and the gas/leachate collection system is maintained in accordance with approved operation and maintenance plans. Modifying access restrictions and allowing for uses approved by EPA on top of the one foot of clean topsoil will not affect the integrity of the cap.

VII. RATIONALE FOR REFINING RESTRICTIVE COVENANTS ON DEEDS

Restrictive covenants for the deed to the Site were selected in the ROD to protect the integrity of the constructed remedy by limiting Site use and development. The covenants would notify a potential purchaser of the property of the past landfill activities, and assert that the land use must be restricted to ensure the continued integrity of the waste containment remedy. The exposure pathway and risk assessment analysis indicate that the Site is safe for uses as approved by EPA so long as the cap, leachate and gas extraction wells, vents, and methane flare are maintained. In addition, the well-heads must stay locked and remain in place and accessible only to landfill maintenance personnel. As such, the restrictive covenants for the deed shall prevent or limit Site uses and development not approved by U.S. EPA. Parties interested in digging into or displacing soil on the Site in excess of the 12 inch limit, must give prior notice to U.S. EPA. Such an interested party will be prohibited from digging into or displacing soil beyond one foot from the surface, unless the interested party prepares an engineering study that documents that the integrity of the landfill cap will not be compromised by such digging or displacement of soil and U.S. EPA approves the study and the request to dig beyond one foot from the surface.

VIII. CONCLUSIONS

The August 2003, exposure pathway analysis and risk assessment for the H.O.D. Landfill Site provided valuable information relating to which remedial components are necessary to protect the integrity of the remedy so that it remains protective of human health and the environment under the proposed final end use plan. Based on this analysis, the modified remedy includes only one significant change from the ROD - modifying the requirements with regard to the access restrictions. This change in the selected remedy will reduce costs associated with the remedy and promote U.S. EPA's agenda to support the successful reuse of Superfund Sites. RMT, Inc. performed the exposure pathway analysis and risk assessment on behalf of the PRP, WMII. The report was carefully reviewed and then approved by U.S. EPA. The significant differences from the ROD include modifying access restrictions regarding the existing fencing, signs, and gates, and refining restrictive covenants on deeds for the Site to reflect appropriate uses for the Site that would not affect the integrity of the remedy. In order for the Site to remain

protective of human health and the environment under reuses supported by the Agency, there shall be no digging or displacement of soil beyond one foot of the surface without an engineering study and request to dig or displace soil beyond the one foot limit shall be approved by U.S. EPA. All gas and leachate well head vaults shall remain locked and the flare building and

remedial components shall be maintained and secured with fencing, locking gates, locking mechanisms and warning signs, as discussed in detail above.

IX. SUPPORT AGENCY COMMENTS

The State of Illinois concurs with this ESD. The Illinois Environmental Protection Agency (IEPA) has participated with EPA to coordinate reuse efforts at the HOD Landfill Site and has participated with the review of the Exposure Pathway Analysis and Risk Assessment for the HOD Landfill Final End Use Plan, August, 2003 and provided its approval of the document.

X. AFFIRMATION OF THE STATUTORY DETERMINATIONS

Based on information collected during the exposure pathway analysis and risk assessment, changes have been made to the remedy selected in the ROD. U.S. EPA and IEPA believe that the remedy remains protective of human health and the environment and complies with Federal and State requirements that are applicable or relevant and appropriate to this remedial action. The modified remedy does not affect the original remedy regarding utilization of permanent solutions and alternate treatment technologies to the maximum extent practicable.

XI. PUBLIC PARTICIPATION ACTIVITIES

Public participation activities at the HOD Landfill have increased since the end of remedial action completion activities. A public meeting was held in June 2002, where EPA officials explained safety factors regarding the Site cleanup and potential reuse. EPA reuse contractors' presented conceptual reuse plans and a followup public meeting was held in July 2002, which included a tour of the Site to demonstrate safety features. In August 2002, EPA published a fact sheet explaining that construction has been completed, what was done, and posed questions and answers related to the goal of Site reuse. A notice has been issued explaining that the ESD has been incorporated in the Administrative Record for the Site which is located at the Antioch Public District Library in Antioch, IL and at U.S. EPA Region 5 offices in Chicago, IL. A public information meeting is scheduled for September 2003, in Antioch, IL, to explain the significant changes to the remedy.

_____ _____

William E. Muno, Director Date
Superfund Division

ATTACH ADMINISTRATIVE RECORD UPDATE #16
August12, 2003

No.	Date	Author	Recipient	Title/Description
1.	April 2002	WWIL	U.S. EPA	Operations, Maintenance, and Monitoring Progress Report No. 1 First Quarter 2002 O & M Period (January 1, to March 30, 2002) HOD Landfill Site, Antioch, Illinois
2.	August 2002	WWIL	U.S. EPA	Operations, Maintenance, and Monitoring Progress Report No.2 Second Quarter 2002 O & M Period (April 1 to March 30, 2002 HOD Landfill Site, Antioch, Illinois
3.	November 2002	WWIL	U.S. EPA	Operations, Maintenance, and Monitoring Progress Report No.3 Third Quarter 2002 O & M Period (July 1 to September 30, 2002 HOD Landfill Site, Antioch, Illinois
4.	August 2003	RMT Inc.	U.S. EPA	Exposure Pathway Analysis and Risk Assessment for the HOD Landfill Final End Use Plan