DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION
Interim Final 2/5/99
RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA750)

Migration of Contaminated Groundwater Under Control

Facility Name: **Ashland, Inc.**
Facility Address: **1800 Glenrose Avenue, Lansing, Michigan**
Facility EPA ID #: **MID 047 173 653**

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

   X If yes - check here and continue with #2 below.

   _____ If no - re-evaluate existing data, or

   _____ if data are not available, skip to #8 and enter "IN" (more information needed) status code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, (GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated groundwater and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration/Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

2. Is **groundwater** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective "levels" (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

__X__ If yes - continue after identifying key contaminants, citing appropriate "levels," and referencing supporting documentation.

_____ If no - skip to #8 and enter "YE" status code, after citing appropriate "levels," and referencing supporting documentation to demonstrate that groundwater is not "contaminated."

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

The historical groundwater monitoring data collected through January 2005 (CMS, 2003 and Interim Measures Quarterly Monitoring Data from March and January 2005) show volatile organic compounds (VOCs) in groundwater above Maximum Contaminant Levels (MCLs) and/or Michigan Part 201 Residential Groundwater Criteria. The following compounds exceed either the MCL or Michigan Part 201 Residential Groundwater standard: vinyl chloride 130 micrograms per liter (µg/L), chloroethane 2,000 µg/L, 1,1-Dichloroethane (1,1-DCA) 13 µg/L, cis-1,2-Dichloroethene (cis-1,2-DCE) 930 µg/L, 1,1,1-Trichloroethane (1,1,1-TCA) 120 µg/L, benzene 600 µg/L, toluene 2,000 µg/L, ethylbenzene 250 µg/L, and xylenes 2,400 µg/L. All of this data was collected from the Glacial Aquifer and the Upper Saginaw Sandstone Aquifer, which lie closer to the ground surface than the Lower Saginaw Sandstone Aquifer.

The most recent Lower Saginaw Sandstone aquifer data (2003) indicate that vinyl chloride, at 2.6 ug/L, was the only exceedance of either the MCL or Michigan Part 201 Residential Groundwater standard in the Lower Saginaw Sandstone aquifer. The groundwater sample was collected from the Lansing Board of Water and Light (LBWL) public supply well 10-9 on April 30, 2003. Regional groundwater flow modeling indicates that the capture zone or zone of recharge for LBWL public supply well 10-9 is to the south, which is a considerable distance upgradient of the site, indicating a source other than the Ashland site. Groundwater flow in the Glacial and Upper Saginaw Aquifers is to the south southwest.

Footnotes:

[1] "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved vapors or solids, that are subject to RCRA) in concentrations in excess of appropriate "levels" (appropriate for the protection of the groundwater resource and its beneficial uses).

3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within "existing area of contaminated groundwater"[2] as defined by the monitoring locations designated at the time of this determination)?

__X__ If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the "existing area of groundwater contamination"[2]).

_____ If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"[2]) - skip to #8 and enter "NO" status code, after providing an explanation.

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

Site and regional stratigraphic and water level data provided in the RFI (Ashland 1994), Supplemental RFI (Fluor Daniel 1997) and CMS (URS 2003) reports demonstrate the Glacial Aquifer and Upper Saginaw Sqndstone are separated from the Lower Saginaw Sandstone aquifer by the Saginaw Shale Aquitard.

Pump tests demonstrate the upper aquifer and the Lower Saginaw Sandstone Aquifer are not in direct hydraulic communication. Extended pump testing of the Lower Saginaw Sandstone aquifer has been conducted with continuous water level monitoring of both aquifers to assess the response of the Glacial Aquifer to pumping stress (Fluor Daniel GTI, Inc. 1997, URS 2003). The Supplemental RFI Report (Fluor Daniel GTI, Inc. 1997) and CMS (URS 2003) demonstrated that there was virtually no change in Glacial Aquifer water levels in response to pumping in the deep aquifer. Therefore, the two aquifers are not in direct hydraulic communication in the area of the Site.

Subsequent downhole video investigation of several off-site deep water supply wells showed leakage at the bottom of the well casing set at the base of Glacial Aquifer. The water supply wells closest to and immediately downgradient of the site were sealed in 2001. Based on these findings, there is no indication that vertical migration of contaminants in the Glacial Aquifer is presently occurring, and Site contaminants are expected to remain within their current vertical extent. Other water supply wells in the site area are constructed in the same manner as the closed wells. The leakage into these water supply wells is not expected to significantly affect the drinking water quality. The water supply wells are blended and treated prior to distribution. The water supply wells are tested regularly.

Implementation of the Interim Measures (IM) groundwater recovery/treatment system in the Glacial Aquifer began in 1989 and was upgraded in 2001. Ongoing groundwater sampling has demonstrated significant decreases in the concentrations of VOCs over time in source and downgradient areas indicating that the zone of affected groundwater has stabilized at the site. Decreases in the concentrations of VOCs over time in the nested wells indicate that the vertical migration of contaminated groundwater has stabilized at the site. Anaerobic degradation products of chlorinated solvents, including vinyl chloride and 1,2 –DCE are present at concentrations greater than their parent VOCs, indicating that reductive dehalogenation is occurring.

Natural attenuation of the contaminants in the Glacial Aquifer is augmented by on-site groundwater extraction being performed as part of the IM. In 1989, Ashland installed four groundwater extraction wells to hydraulically contain the contaminated groundwater, and to reduce the contaminant mass present in the Glacial Aquifer as part of the IM. Capture zone analysis performed as part of the CMS found that pumping of the IM wells had induced an inward gradient within the Glacial aquifer, and that the radius of influence of the IM wells extends to the

southwest (downgradient) edge of the property. Water sampling results conducted in 2003 from IM wells demonstrates that the IM wells continue to remove contaminants from Glacial aquifer groundwater and that the on-site contaminant mass is contained. A soil vapor extraction pilot study was initiated in August 2004 to augment source removal on-site.

Footnotes:

[2] "existing area of contaminated groundwater" is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of "contamination" that can and will be sampled/tested in the future to physically verify that all "contaminated" groundwater remains within this area, and that the further migration of "contaminated" groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

4. Does "contaminated" groundwater **discharge** into **surface water** bodies?

_____ If yes - continue after identifying potentially affected surface water bodies.

__X__ If no - skip to #7 (and enter a "YE" status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater "contamination" does not enter surface water bodies.

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

The nearest surface water body is the Grand River, which runs immediately adjacent to the northern property boundary of the Ashland Inc. Site (Ashland Chemical Company 1994). There is no indication that site groundwater is presently discharging into the Grand River. An extended river stage and adjacent groundwater elevation study was performed during the CMS (URS 2003). Results from this study demonstrate that river stage elevations were consistently above adjacent groundwater elevation even during a seasonal period of low flow. It was also noted in the CMS that the river elevation is maintained at a relatively constant level by flood control structures above and below the Site. The documented losing stream condition and southwesterly flow gradient will prevent the migration of contamination toward the Grand River. The ground water extraction system for the shallow aquifer installed as part of the IM is likely to increase the existing natural gradient away from the river locally, further preventing the likelihood of any release of contaminants to the Grand River. IM activities were initiated in 1989 and upgraded in 2001 (URS 2003).

Historical ground water quality results for the four monitoring well locations (MW-4, MW-8, MW-9A, and MW-10) closest to the Grand River summarized in Table 1 demonstrate orders of magnitude reductions in contaminant concentrations between 1990 to 2003 (URS 2003). As of April 2003, vinyl chloride, 1,1-DCA and benzene concentrations were just above their respective MCLs at MW-08, and none of the analyzed constituents at the on-site MW-4, MW-9A and MW-10 locations exceeded MCLs or Part 201 Residential Groundwater criteria.

5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (i.e., the maximum concentration[3] of each contaminant discharging into surface water is less than 10 times their appropriate groundwater "level," and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

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____ If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration[3] of key contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.

____ If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration[3] of each contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations[3] greater than 100 times their appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

_____ If unknown - enter "IN" status code in #8.

Rationale and Reference(s):
See Item #4 skip to Item #7.

[3] As measured in groundwater prior to entry to the groundwater–surface water/sediment interaction (e.g., hyporheic) zone.

6. Can the **discharge** of "contaminated" groundwater into surface water be shown to be "**currently acceptable**" (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented[4])?

____ If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR 2) providing or referencing an interim-assessment,5 appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

_____ If no - (the discharge of "contaminated" groundwater can not be shown to be "**currently acceptable**") - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.

_____ If unknown - skip to 8 and enter "IN" status code.

Rationale and Reference(s):

See Item 5 and skip to Item 7.

[4] Note: Because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, an appropriate specialist (e.g., an ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

[5] The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field, and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface water, sediment, or ecosystem.

7. Will groundwater **monitoring**/measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

__X__ If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."

_____ If no - enter "NO" status code in #8.

_____ If unknown - enter "IN" status code in #8.

Rationale and Reference(s):

Groundwater will be routinely monitored as part of the IM groundwater monitoring program to assess the effectiveness of the implemented remedial measure and to verify that the site groundwater contamination has not migrated beyond its currently delineated extent. Monitoring will include the collection of water levels for groundwater flow gradient determinations and periodic analytical sampling to assess groundwater quality conditions. Surface water elevations will be periodically collected and compared to adjacent site groundwater levels to determine if a surface/groundwater gradient reversal has occurred.

An extensive off-site soil and groundwater investigation was conducted inn August 2004. The investigation delineated the Glacial Aquifer plume. This data will be evaluated to design an off-site groundwater monitoring program to augment the current, on-going IM groundwater monitoring program and delineate/monitor the Glacial Aquifer plume. As part of the IM the following monitoring and recovery wells: MW-1, MW-4, MW-8, MW-9a, MW-10, MW-30, MW-31, MW-32, RW-1 RW-2, and RW-3: are sampled quarterly for volatile organic compounds, which are reported in the Bi-Monthly Report.

8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

X YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the Ashland Inc. Facility, EPA ID # MID 047 173 653, located at 1800 Glenrose Avenue, Lansing, Michigan. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater" This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

____ NO - Unacceptable migration of contaminated groundwater is observed or expected

____ IN - More information is needed to make a determination.

Completed by (signature) _____ Date _____
John Nordine
Geologist)

Supervisor (signature) _____ Date _____
George Hamper
Chief, Corrective Action Section, U.S. EPA Region V

Locations where References may be found:
U. S. EPA Region 5 Records Center
77 W. Jackson Blvd.
Chicago, IL 60604

The references noted in this document are as follows:

Ashland. 1994. RCRA Facility Investigation Report, Revision 1. Ashland Chemical Inc., Industrial Chemical and Solvents Division, Glenrose Avenue, Lansing, Michigan. January, 1994.

Fluor Daniel GTI, Inc. 1997. Supplemental RFI Report, Ashland Chemical Company 1800 Glenrose Avenue, Ingham County, Lansing, Michigan. November 1997.

URS. 2003. Draft Corrective Measures Study (CMS) Glenrose Avenue, Lansing, Michigan. September 2003.

USGS. 1997a. Ground-Water Flow in the Saginaw Aquifer in the Vicinity of the North Lansing Well Field, Lansing, Michigan – Part 1, Simulations with a Regional Model: U.S. Geological Survey Open-File Report 97-569.

USGS. 1997b. Ground-Water Flow in the Saginaw Aquifer in the Vicinity of the North Lansing Well Field, Lansing, Michigan – Part 2, Simulations with a Regional Model Using a Reduced Cell Size: U.S. Geological Survey Open-File Report 97-570.

URS. 2004. Off-Site Groundwater Investigation Work Plan – Revision No. 1 Glenrose Avenue, Lansing, Michigan. May 28, 2004.

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