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:	Morton International, Inc.
Facility Address:	2000 West Street, Reading, Hamilton County, Ohio
Facility EPA ID #:	OHD 000 724 138

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 #6 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 ground water 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 facility is located adjacent to the east bank of Mill Creek and immediately south/downgradient from the Superfund Pristine site. There are two aquifers extending over a bedrock valley beneath the facility. The upper aquifer is comprised of a shallow sand and multiple deep sands alternating with clays tills. The lower aquifer consisting of sand through out its entire thickness serves as a source of drinking water. Boring and well log information indicates that the sands from the upper and lower aquifers are partially continuous through out the site and are subject to some varying degree of hydraulic communication depending on the extent and thickness of the sands and clay tills. In the upper aquifer, the shallow sand extends through out most of the site. The deep sands in the upper aquifer show more continuity at the southwestern portion of the site. Information available from the Morton's investigation indicates that the shallow and deep upper aquifer sands extend off-site beyond the facility's southwestern boundary. The site information also indicates that Mill Creek, at the western downgradient boundary of Morton's property, is wholly within the upper 8 feet (ft) of the shallow upper aquifer sand.

Based on the results from the facility investigation, several volatile and semivolatiles organic constituents (VOCs and SVOCs) as well as pesticides, polychlorinated biphenyls (PCBs) and metals have been detected in groundwater from the upper and lower aquifers beneath the facility. According to a Superfund Record of Decision for the Pristine facility, investigations conducted by Pristine at and downgradient from the Morton facility have indicated that contamination in the lower aquifer is related to former operations at Pristine. EPA continues to evaluate whether some contamination from the upper aquifer at the Morton facility may have migrated from Pristine.

Groundwater contamination found in the upper aquifer at Morton shows localized areas where constituents have been detected at relatively high concentrations at or in the vicinity of various solid waste management units such as the former surface impoundments, former swale disposal area, the combined sewer system and the french drain. Major constituents of concern in groundwater in the vicinity of Mill Creek are benzene, chlorobenzene, toluene, 1,2-dichlorobenzene, heptachlor, heptachlor epoxide, aroclor 1242, aniline and arsenic.

Refer to attached figures with information on the facility.

[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):

Based on site-specific hydraulic gradient conditions, the contamination present in groundwater at the Morton facility has migrated as follows: in the shallow upper aquifer sand, groundwater flows towards Mill Creek; in the deep upper aquifer sands, flow is partly towards Mill Creek and partly towards the south under the influence of Pristine's pumping system; and in the lower aquifer, the groundwater gradient is to the south. Information from boring and well logs and site-specific hydrogeology indicates that Mill Creek is a gaining stream serving as a hydraulic barrier with respect to groundwater in the shallow upper aquifer sand. In addition, constituents detected in groundwater from the deep upper aquifer sands at the southwestern portion of the site (well UAW01-80) do not exceed maximum contaminant levels (MCLs). Therefore, groundwater contamination in the upper aquifer has been stabilized.

In addition, the Superfund Record of Decision for the Pristine site addresses the remediation of contamination from the lower aquifer. The on-going remedy for the Pristine site has stabilized groundwater contamination in the lower aquifer.

[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?

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

____ 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):

Groundwater from the shallow upper aquifer sand discharges to surface water from Mill Creek along the western boundary of the Morton facility. Based on information from a June 2002 draft of the Facility Investigation Report, the following discharges of contamination from VOCs, SVOCs and metals exist: a discharge of benzene at well UAW07-20, UAW08-20 and MW-EPA-1;a discharge of chlorobenzene at wells MW-EPA-1and UAW05-20; a discharge of toluene at wells UAW04-20 and UAW08-20; a discharge of aniline at well UAW08-20; and a discharge of arsenic at wells MW-EPA-1, UAW03-20, UAW04-20, UAW05-20,UAW06-20 and UAW08-20. It is noted that all discharges occur within the northwest corner of the facility's property along Mill Creek and no further south of well UAW04-20.

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.

__X__ 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):

Based on the results of groundwater monitoring conducted on May and October/November of 2001 during the facility investigation, some constituents concentrations in groundwater from the shallow upper aquifer sand exceed MCLs or Preliminary Remediation Goals (PRG) for tap water at Mill Creek. When a dilution factor of 10 is applied, these constituent concentrations no longer exceed MCLs or designated PRGs with the exception of benzene, chorobenzene, toluene, aniline, and arsenic. Therefore, the discharge of shallow groundwater into Mill Creek is considered insignificant with the exception of discharges of contamination from benzene, chlorobenzene, toluene, aniline, and arsenic.

Refer to table below showing concentrations in shallow groundwater associated with significant and insignificant discharges. Screening exceedances associated with significant discharges are shaded.

Parameters	Maximum Concentration in Groundwater at Mill Creek (ppb)	Estimated Concentration in Groundwater Based on Dilution Factor (10 X) (ppb)	MCLs (ppb)
benzene	110	11	5

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

Parameters	Maximum Concentration in Groundwater at Mill Creek (ppb)	Estimated Concentration in Groundwater Based on Dilution Factor (10 X) (ppb)	MCLs (ppb)
chlorobenzene	3200	320	100
toluene	21,000	2,100	1,000
1,2-dichlorobenzene	1900	190	600
1,4-dichlorobenzene	300	30	75
Aniline	12,000	1,200	12
Heptachlor	0.49	0.049	0.4
Heptachlor epoxide	0.32	0.032	0.2
Aroclor 1242	0.92	0.092	0.5
Arsenic	611	61	10
Lead	126	13	15
Thallium	12	1	2

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])?

X 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)

The concentrations in surface water of benzene, chlorobenzene, toluene, aniline, and arsenic were conservatively estimated and found to be below the applicable State surface water protection criteria for the Ohio River Basin as shown below.

Areas of groundwater discharge associated with current MCL exceedances in groundwater
The cross section for each discharge is determined by the maximum thickness of the shallow sand in the upper aquifer along Mill Creek and the total distance across well areas associated with a discharge. A 20 ft vertical profile is a conservative measure since that value is expected to exceed the thickness of the shallow sand in the northwest corner of the site where discharges are found. Distances across well areas where determined on a well-by-well basis

[4] Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., 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 waters, sediments or eco-systems.

taking into consideration the constituent concentrations from adjacent wells.

A_{VOC} = 80 ft x 20 ft = 1,600 ft^2
A_{SVOC} = 10 ft x 20 ft = 200 ft^2
A_{metals} = 320 ft x 20 ft = 6,400 ft^2

USGS Station at Mill Creek, Reading, Ohio-Mean surface water discharge

(Q_{sw}) = (139 ft^3/sec)(86400 sec/day) = 12,009,600 ft^3/day

Average value of horizontal hydraulic gradient for shallow upper aquifer sand (i)

i = 0.019 ft/ft

Hydraulic conductivity (K) from Step-Test

K = 106 ft/day

Calculated groundwater flux

Q = (K) (i) (A)

Q_{VOC} = (106 ft/day)(0.019)(1,600 ft^2) = 3,222 ft^3/day
Q_{SVOCs} = (106 ft/day)(0.019)(200 ft^2) = 403 ft^3/day
Q_{metals} = (106 ft/day)(0.019)(6,400 ft^2) = 12,890 ft^3/day

Estimated concentrations after discharge and comparison to appropriate screening criteria

$(C_{gw})(Q_{gw}) = (C_{sw})(Q_{gw} + (0.1)(Q_{sw}))$

Parameter	Maximum Concentration at Mill Creek (Ppb)	Estimated Concentration Based on Mixing by 10% of Surface Water Flux	Ohio River Basin Tier I Criteria and Tier II Values	
			Aquatic Life - Outside Mixing Zone Average	Human Health - Drink
Benzene	110	0.3	160	5
Chlorobenzene	3200	8.6	47	100
Toluene	21,000	56.2	62	1,000
Aniline	12,000	4.0	4.1	Not available *
Arsenic	611	6.5	150	10 *

* The MCL for aniline is 12 ppb
* Total recoverable

Therefore, the discharge of groundwater into Mill Creek is likely acceptable within the context of short-term goals

associated with this EI determination.

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):

A french drain extending along the margin of Mill Creek is partially intercepting the shallow upper aquifer sand and exercising some degree of control over the migration of contaminated groundwater into the creek. Improvements to the french drain system and/or other measures to address groundwater contamination in the upper aquifer are expected to be part of the final remedy for the facility. Additional groundwater monitoring will be conducted to monitor the migration of contamination within the upper aquifer as well as between the lower and upper aquifers. Moreover, surface water sampling will be conducted in Mill Creek. These data will be used to support a risk assessment and a final remedy decision for the facility. In addition, it is expected that groundwater monitoring will be a component of the final remedy decision for the facility.

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 Morton International Inc. facility , EPA ID # OHD 000 724 138, located in Reading, Hamilton County, Ohio. 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 _____

(print) Mirtha Capiro

(title) Environmental Scientist

Supervisor (signature) _____ Date _____

(print) George Hamper

(title) Chief, Corrective Action Section

(EPA Region or State) EPA Region 5

Locations where References may be found:
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