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:	Solutia Inc.
Facility Address:	500 Monsanto Ave., Sauget, IL 62206-1198
Facility EPA ID #:	ILD 000 802 702

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 following information is presented in the *Description of Current Conditions (August 1, 2000*), *CA750 Migration of Contaminated Groundwater Under Control, W.G. Krummrich Plant, Sauget, IL* (December 2002), and a September 30, 2003, letter from Solutia to EPA:

A large groundwater contaminant plume containing VOCs and SVOCs is present beneath the entire facility and extends beyond the western facility boundary to the Mississippi River, a distance of approximately 2800-feet. The size of the facility plume was determined to be approximately 3,900-feet wide and 6,900-feet long. It is controlled at its westernmost extent, before it can wholly discharge to the Mississippi River, by a slurry barrier wall and three-well extraction system (groundwater barrier/control system). Collected groundwater is routed to the American Bottoms Regional Treatment Facility. Maximum contaminant concentrations detected in the plume at and from the facility and corresponding Illinois EPA TACO groundwater remediation objectives are:

[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).

Groundwater Contaminant	Maximum Concentration (ppb)	Illinois EPA TACO Groundwater Remediation Objective (ppb)
Volatile Organics		
Acetone	22,000	700
Benzene	1,600,000	5
Chlorobenzene	350,000	100
1,2-DCA	14,000	5
1,2-DCE	420	70
Ethylbenzene	29,000	700
Methylene chloride	680	5
4-methyl-2-pentanone	3,100	560
1,1,1-TCA	560	200
Toluene	71,000	100
Xylenes	150,000	10,000
Vinyl chloride	350	2
Semi-volatile Organics		
Aniline	62,000	23
4-chloroaniline	25,000	28
2-chlorophenol	540,000	35
Dichlorobenzenes	23,000,000	75
2,4-dichlorophenol	340,000	21
Methylphenols	280,000	350
2-nitroaniline	1,100	6.3
Nitrobenzene	14,000	3.5
Naphthalene	86,000	140
Pentachlorophenol	18,000	1
Phenol	1,100,000	100
1,2,4-trichlorobenzene	1,400	70
2,4,6-trichlorophenol	2,700	10

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):

The contaminant plume is present in the shallow (20-feet thick), middle (30-feet thick), and deep (40-feet thick) hydrogeologic units (sand and gravel). The plume migrates westward to the Mississippi River where it is effectively captured by a groundwater barrier/control system. The groundwater barrier/control system currently captures most contaminants in all three units before they discharge to the Mississippi River and maintains hydraulic control of the core of the plume (*CA 750 Groundwater Migration Control Addendum, W.G. Krummrich Plant, Sauget, Illinois*. April 19, 2004. Solutia Inc.) The deep hydrogeologic unit is underlain by bedrock which restricts any downward migration.

The facility contaminant plume commingles with other contaminant plumes originating from surrounding industries and historical disposal areas (CERCLA Sauget Area Sites 1 and 2). Therefore, it is difficult to map the exact extent of the subject facility plume. However, area monitoring wells and a geoprobe study were used to generate VOC and SVOC plume boundary maps (Letter from Solutia to EPA, September 30, 2003). Contaminated groundwater is expected to remain within this defined existing area of contamination because groundwater flow and discharge patterns are controlled by the Mississippi River and Solutia has installed a groundwater barrier/control system to capture the core of the plume before it discharges to the river.

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

[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.

"contamination" does not enter surface water bodies.

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

Rationale and Reference(s):

With the construction of the groundwater barrier/control system, the core of the contaminant plume that previously discharged to the Mississippi River and impacted surface water and sediment has been effectively cut-off. Solutia demonstrated hydraulic control of the plume in its *CA 750 Groundwater Migration Control Addendum, W.G. Krummrich Plant, Sauget, Illinois* (April 19, 2004).

However, in its September 30, 2003, letter to EPA, Solutia predicts that a portion of the plume (the northern, less-contaminated area) still discharges up to 2100-feet north of the groundwater barrier/control system. No monitoring wells are installed at the river to confirm this prediction due to access restrictions. This northern portion of the plume likely commingles with source areas being addressed in the CERCLA Sauget Area 2 Sites (e.g., Site P).

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 <u>key</u> 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 <u>each</u> 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.

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

Rationale and Reference(s):

An interpretation of the VOC and SVOC plume boundary maps (Solutia letter to EPA, September 30, 2003) shows that VOCs north of the assumed capture zone of the groundwater barrier/control system are less than 10 ppm (VOCs captured in the core of the plume are typically 100 to 1000 ppm). SVOCs north of the assumed capture zone of the groundwater barrier/control system are typically in the hundred-ppb range (SVOCs captured in the core of the plume are typically in the 300 to 1100 ppm range). These concentrations, although much lower than those captured by the groundwater barrier/control system, generally exceed 10 times their appropriate groundwater "level" (Illinois EPA TACO groundwater remediation objective).

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.

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[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.

Rationale and Reference(s):

The following information is presented in an EPA letter to Solutia dated February 9, 2001, and the *Human Health Risk Assessment, Sauget Area 2, Sauget, Illinois, Volumes I and II* (August 31, 2003).

Sampling events for Mississippi River water and sediment were conducted in November 2000 and November 2002. River levels at the time of each sampling event were relatively low (approx. 382 to 383-feet) and the groundwater barrier/control system was not installed. These conditions are representative of a worse-case scenario when groundwater discharge impacts to the river would be expected to be more significant. The sample area in November 2000 was 500-feet north of the current groundwater barrier/control system. Three locations were sampled along a transect 50, 150, and 300-feet from the riverbank. The sample area in November 2002 was 1200 to 1900-feet north of the current groundwater barrier/control system. Two or three locations were sampled along three transects that were 50 and 150-feet, or 50, 150, and 300-feet from the riverbank. No VOCs, SVOCs, pesticides, and herbicides were detected at any of the sample locations during these worse-case sampling events. This is contrary to areas sampled further downstream in the vicinity of the groundwater barrier/control system where significant concentrations of VOCs, SVOCs, pesticides, and herbicides were detected in surface water and sediment. This area is now protected by the groundwater barrier/control system. The absence of detectable contaminant concentrations in Mississippi River water and sediment north of the groundwater barrier/control system demonstrates that the discharge of potentially contaminated groundwater not captured by the groundwater barrier/control system is currently acceptable.

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):

The following information is presented in the *Groundwater Migration Control System, Sauget Area 2 Superfund Site, Remedial Design/Remedial Action Workplan* (URS, July 3, 2003) and *DNAPL Characterization and Site Corrective Measures Study Workplan, Solutia Inc., W.G. Krummrich Plant, Sauget, Illinois* (Groundwater Services, Inc., February 18, 2004).

Numerous monitoring programs are in place to verify that contaminated groundwater remains within its existing dimensions. For the groundwater barrier/control system that captures the majority of contaminants at the river, piezometer, monitoring well, and river level measurements are made to ensure that hydraulic control is maintained (i.e., groundwater flow is inward across the slurry wall). Four monitoring well nests between the slurry wall and the river will also be sampled to determine the amount of contaminant mass discharging to the river. In addition, upon completion of the slurry wall this year, Solutia is required to monitor river water and sediment to determine impacts to the river.

The possibility for DNAPL exists at the facility. Solutia has implemented a workplan to characterize DNAPL and conduct a corrective measures study. The work includes measurement of DNAPL in monitoring wells, a geophysical survey to define the bedrock valley, and additional borings/wells installed at preferential DNAPL migration areas down to the bedrock. The investigations will be completed in the summer of 2004. At that time, the data will be evaluated to determine if DNAPL is present and if it is stabilized within the existing area of groundwater contamination.

The facility contaminant plume commingles with other contaminant plumes originating from surrounding industries and historical disposal areas (CERCLA Sauget Area Sites 1 and 2). Therefore, it is difficult to map and monitor the exact extent of the subject plume. Area monitoring wells and a geoprobe study were used to generate VOC and SVOC plume boundary maps (Letter from Solutia to EPA, September 30, 2003). Numerous wells exist on the facility property and additional wells have been installed at the facility plume perimeter and within the off-site portion of the facility plume as part of the CERCLA investigations. Specific monitoring wells screened in all three hydraulic units at the perimeter of the facility boundary and apparent perimeter (north and south) of the facility plume will be chosen to monitor the contaminant plume. Because of the likelihood of commingling with other plumes, the purpose of this program will be to ensure that contamination at the defined edges of the facility contaminant plume remain within a certain range. The groundwater barrier/control system, along with hydraulic and chemical monitoring of groundwater and surface water/sediment will be used to effectively monitor the western extent of the plume.

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 Solutia Inc. facility, EPA ID Number ILD 000 802 702, located at Sauget, Illinois. 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 May 26, 2004
(print) Kenneth S. Bardo
(title) Environmental Scientist

Supervisor (signature) _____ Date _____
(print) George Hamper
(title) Section Chief
(EPA Region or State) Region 5

Locations where References may be found:

RCRA 7th Floor File room - Administrative Record for RCRA 3008(h) Consent Order.

Contact telephone and e-mail numbers

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