

**Documentation of Environmental Indicator Determination
in accordance with EPA Interim Final Guidance 2/5/99**

**RCRA Corrective Action
Environmental Indicator (EI) RCRA Info Code (CA750)**

Migration of Contaminated Groundwater Under Control

Facility Name: 3M Company
Facility Address: Route B, Columbia, Missouri
Facility EPA ID #: MOD054950670

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 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 EIs 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 EIs 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 Determination status codes should remain in RCRA Info national database ONLY as long as they remain true (i.e., RCRA Info 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 [e.g., Maximum Contaminant Levels (MCLs), the maximum permissible level of a contaminant in water delivered to any user of a public water system under the Safe Drinking Water Act], 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): 1,1 dichloroethylene (1,1 DCE), and 1,1,1 trichloroethane (1,1,1 TCA) have consistently been detected above MCLs in some on-site wells while trichloroethylene (TCE) and carbon tetrachloride (CCl₄) have been sporadically detected above MCLs. See 3M 1999, 2000, and 2001 Annual Groundwater Monitoring Reports and Table 1 – Highest Measured Groundwater Contaminant Concentrations and Groundwater Protection Standards (attached). Table 1 lists the highest measured concentrations in groundwater of all contaminants detected at the site and various regulatory criteria for the constituents, including the Final Groundwater Protection Standards.

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): Initially, the eastern area Wells 2, 5, 10, 11, 30S and Well 44 were to be used as sentinel wells to semi-annually monitor the VOC plume in the area of the eastern impoundment. If VOC levels in the groundwater at these wells exceeded the Groundwater Protection Standards (GPS), then the sampling frequency would be increased to quarterly. If the GPS were exceeded in the same well for three consecutive quarters, then three new wells would be installed downgradient of the plume to act as sentinel wells. Since the GPS for 1,1-DCE was exceeded at Well 10 for three consecutive quarters, Wells 45, 46, and 47 were installed at the outwash margin. These wells have been sampled on three separate occasions and were nondetect for VOCs on each occasion. If a chemical listed in Table I is detected above the proposed final GPS in one sampling round at Well 45, 46 or 47 then 3M will immediately collect another sample to confirm the result. Within 30 days of a positive confirmation, 3M will submit to MDNR/EPA an action plan for the installation of a groundwater interceptor trench to address plume migration or will propose an appropriate alternate technology to contain/control the contaminated groundwater.

The December 1994 RFI indicated that groundwater contamination in the area of the former municipal wastewater treatment ponds was localized. As a result, groundwater will be monitored biennially for VOCs at monitoring wells that have yet to be installed. One new monitoring well will be installed west of the impoundment and one new monitoring well will be installed to the south to monitor plume migration. These wells will be located in the projected path of contaminant migration and will function as sentinel wells. If the proposed final GPS are exceeded at either of these sentinel wells, then the sampling frequency will be increased to semi-annual. If the same chemical is detected above the proposed final GPS for three consecutive semi-annual sampling events in the same well, 3M will submit to MDNR a plan for evaluating and implementing further corrective action, including groundwater and/or soil remediation in the area of the former municipal wastewater

treatment ponds.

The two groundwater VOC plumes are located entirely on-site and are well defined with respect to vertical and horizontal extent. The RFI indicated that the hydrostratigraphic unit within which the groundwater contamination is moving progressively thins then disappears in the direction of groundwater migration, grading into a less permeable clay-rich saturated unit. Because of this gradational change in lithology, further migration of the groundwater plume is expected to be significantly limited.

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 is a wet weather creek. Weston personnel have inspected the creek area in the past and found no seeps. Personnel from 3M, Weston, EPA, and the Missouri Department of Natural Resources walked the creek in May 2002 and found no areas where groundwater was discharging to the creek.

5. Is the **discharge** of "contaminated" groundwater into surface water likely to be "**insignificant**" (i.e., the maximum concentration³ of each contaminant discharging into surface water is less than 10 times the appropriate groundwater "level," and there are no other conditions (e.g., the nature or 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)?

_____ If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration³ 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 concentration³ 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 concentrations³ greater than 100 times the 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): _____

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 implemented⁴)?

_____ 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 specialist(s), 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 cannot 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): _____

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.

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.

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Rationale and Reference(s): The Final Remedy Decision issued by the department in March 2001 requires 3M to monitor groundwater for VOCs on the eastern portion of the property on a quarterly basis at wells 5, 10, 11 30s, and 44 and on a semi-annual basis at sentinel wells 45, 46, and 47. In the area of the former municipal wastewater treatment ponds, groundwater will be monitored for VOCs biennially at two monitoring wells that have yet to be installed. 3M's groundwater corrective action program shall continue until the GPS maximum concentration limits established in Table 1 have not been exceeded for a period of three consecutive years. The corrective action program shall address any hazardous constituents above the GPS maximum concentration limits listed in Table 1 that are reasonably expected to be in or derived from waste disposed of at the facility.

8. Check the appropriate RCRA Info 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 **3M Company**, facility, EPA ID # **MOD054950670**, located at **Columbia, MO**. 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) Original signed by _____ Date 9/23/02
(Print) William J. Johnson, Ph.D.
(Title) EPA Geologist/Project Manager

Supervisor: (Signature) Original signed by _____ Date 9/23/02
(Print) John Smith
(Title) Chief, RCRA Corrective Action and Permits
(EPA Region or State) EPA Region VII

Completed by: (Signature) Original signed by _____ Date 9/23/02
(Print) Julie Pearson, P.E.
(Title) Project Manager

Supervisor: (Signature) Original signed by _____ Date 9/23/02
(Print) Richard A. Nussburn, P.E., R.G.
(Title) Chief, Corrective Action Unit
(EPA Region or State) Missouri Department of Natural Resources

Locations where References may be found:

**EPA Region VII RCRA Records Center
901 N. 5th St.
Kansas City, KS 66101**

**Missouri Department of Natural Resources
Hazardous Waste Program
1738 East Elm Street (Lower Level)
Jefferson City, Missouri 65101**

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Final Note: The Human Exposures EI is a qualitative screening of exposures and the determinations within this document should not be used as the sole basis for restricting the scope of more detailed (e.g., site-specific) assessments of risk.

ref: **ca750epa.doc**

**Table 1 - Highest Measured Groundwater Contaminant Concentrations
and Groundwater Protection Standards**

Chemical ¹	Highest Measured Contaminant Concentration (µg/l)	CALM GTARC ² (µg/l)	RBC TAP WATER ³ (µg/l)	MWQS ⁵ (µg/l)	MCL ⁶ (µg/l)	FINAL GPS ⁷ (µg/l)
<u>ORGANICS</u>						
Acetone	NA	No GTARC	610	NA	NA	3,700
Benzene	2	5	0.32	5	5	5

Bromodichloromethane	1	80	0.17	NA	100	100
Carbon disulfide	25	No GTARC	1,000	NA	NA	1,000
Chloroethane	3,100	NA	3.6	NA	NA	3.6
Chloroform	140	80	0.15	NA	100	100
1,1-Dichloroethane	10,000	NA	800	NA	NA	800
1,2-Dichloroethane	150	5	0.12	5	5	5
1,1-Dichloroethylene	110,000	7	0.044	7	7	7
Trans-1,2-dichloroethylene	200	100	120	100	100	100
Ethylbenzene	3.1	700	3.3	700	700	NA ⁸
Methylene Chloride	22	5	4.1	5	NA	5
Tetrachloroethene	10	5	0.63	5	5	5
Toluene	8.7	150	750	1,000	1,000	1,000
1,1,1-Trichloroethane	490,000	200	3200	200	200	200
1,1,2-Trichloroethane	35	5	0.19	5	5	5
Trichloroethene	1,000	5	0.026	5	5	5
Vinyl Chloride	42	2	0.015	2	2	2
INORGANICS						
Arsenic	12	50	0.045	50	50	50
Barium	830	2,000	2,600	2,000	2,000	2,000
Cadmium	10	5	18	5	5	5
Chromium	60	100	55,000/110 ⁴	100	100	100
Copper	70	1300	1,500	1,300	NA	1,300
Iron	9,400	NA	11,000	300	300*	2,800 ⁹
Lead	5.7	15	NA	15	NA	15
Manganese	1,700	50	730	50	50*	640 ⁹
Mercury	1.1	2	NA	2	2	2
Nickel	250	100	730	100	100	100
Selenium	285	50	180	50	50	50
Silver	20	100	180	50	100*	50
Zinc	60	2,000	11,000	5,000	5000*	5,000
Sodium	260,000	NA	NA	NA	NA	99,750*
Chloride	1,120,000	NA	NA	250,000	250,000*	250,000
Fluoride	1,100	NA	NA	4,000	4,000	4,000
Nitrogen, Nitrate	5,100	NA	58,000	10,000	10,000	10,000
Sulfate	387,000	NA	NA	250,000	250,000*	250,000

¹ Shaded chemicals have been detected but highest measured concentrations are below proposed Final GPS.

² CALM (GTARC) = Cleanup Levels for Missouri Document, – Groundwater Target Concentration (September 2001).

³ RBC = EPA Region III Risk-Based Concentrations for Tap Water (April 2002).

⁴ Chromium values are trivalent and hexavalent respectively.

⁵ MWQS = Missouri Water Quality Standards for Drinking Water Supply/Groundwater Protection (May 1994).

⁶ MCL = Maximum Contaminant Levels for public water systems (October 1996).

⁷ GPS = Groundwater Protection Standards.

⁸ A GPS has not been established for Ethylbenzene. It was detected twice in Well 30S during the September and December 2001 sampling events and it is below CALM GTARCs, RBCs, MWQSs, and MCLs. A GPS may be proposed at a later date if Ethylbenzene is detected in the groundwater at levels of potential concern.

⁹ Indicates background level.

NA = Information Not Available

* Indicates secondary MCL.