ADEM

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
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December 3, 2003

CERTIFIED MAIL # 7003 0500 0001 2713 9806
RETURN RECEIPT REQUESTED

Ms. Anita Mitchell
Plant Lab/Environmental Team Leader
Occidental Chemical Corporation
1000 North Wilson Dam Road
Muscle Shoals, Alabama 35661

RE: Environmental Indicator Evaluations
Occidental Chemical Corporation
U.S. EPA I. D. No. ALD 004 019 642

Dear Ms. Mitchell:

The Alabama Department of Environmental Management (ADEM) has recently completed a qualitative evaluation of the environmental conditions at Occidental Chemical Corporation (OCC), in Muscle Shoals, Alabama. ADEM is pleased to provide you with a copy of the evaluation for your information.

While implementing the permitting requirements of the Alabama Hazardous Wastes Management and Minimization Act (AHWMMA) and the Resource Conservation and Recovery Act (RCRA), as amended by the 1984 Hazardous and Solid Waste Amendments (HSWA), at OCC, ADEM is always cognizant of its role in protecting human health and limiting further migration of groundwater contamination. As such, the enclosed evaluation covers two specific issues regarding environmental contamination applicable to the facility and local community:

1) Plausible human exposure to soil, groundwater, air and surface water contamination at or from the facility, and;

2) The continuing migration of contaminated groundwater, both on-site and off-site.

Please note that the purpose of the environmental indicator evaluation is solely to evaluate the status of the two environmental indicators discussed, and that it does not reduce or limit in any way the facility's obligation to perform any monitoring, maintenance, investigation, remediation, or other activity required pursuant to any applicable regulations, permits, or orders.

The enclosed environmental indicator evaluation should not be viewed as somehow separate and distinct from the corrective action activities taken at OCC. Rather, it is an evaluation of current environmental conditions and a focusing of efforts on potential concerns that ADEM, the facility and interested members of the public must work toward satisfying through implementation of the corrective action process at OCC. Therefore, every evaluation should conclude with a projection or outline of future actions to move the facility toward the point where human exposures and/or groundwater releases are controlled. It should be understood that the evaluations operate at the "facility level." In other words, **every area** at the facility must meet the control definition before human exposures or groundwater releases can be considered controlled.

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Because many different corrective action documents frequently exist at a facility, ADEM has tried to select the most pertinent documents from which to make its evaluation. The utilized source documents (titles and dates) are explicitly referenced in the evaluation to provide clarity and reproducibility. ADEM recognizes that the potential exists for current conditions at the facility to be somewhat different to that represented in the evaluation. Such discrepancies can be administratively managed during implementation of the ongoing corrective action process and subsequent re-evaluations.

In summary, the evaluation represents a "snap-shot" of the facility's environmental conditions at a particular point in time, and it is a dynamic document subject to revision. Because of the evaluation's focus on current environmental conditions, ADEM views the evaluation as an excellent resource for members of the public as well as the facility. ADEM hopes you find the evaluation useful and informative.

If questions or comments arise regarding this evaluation, please contact Mr. Metz Duites of my staff at (334) 271-7754.

Sincerely,

Phillip D. Davis, Chief
Industrial Hazardous Waste Branch
Land Division

PDD/MPD/set:Z:/OCC, MS/2003-11, EI Occidental MS.doc

Encl.: Environmental Indicator Memo

cc: Narindar Kumar, EPA (w/ enclosures)

File: Occidental / Colbert / ALD 004 019 642 / H / Correspondence

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December 3, 2003

TO: Phillip D. Davis, Chief
Industrial Hazardous Waste Branch
Land Division

THROUGH: Vernon H. Crockett, Chief
Engineering Services Section
Industrial Hazardous Waste Branch
Land Division

FROM: Metz Duites
Engineering Services Section
Industrial Hazardous Waste Branch
Land Division

RE: Re-evaluation of status under the RCRAInfo Corrective Action Environmental Indicator Event Codes (CA725 and CA750) for the Occidental Chemical Corporation (OxyChem) facility in Muscle Shoals, Colbert County, Alabama
USEPA Identification Number ALD 004 019 642

I. PURPOSE OF MEMO

This memo is written to formalize a re-evaluation of the status of OxyChem, in relation to the following corrective action event codes defined in the RCRAInfo database:

1) Current Human Exposures Under Control (CA725),
2) Migration of Contaminated Groundwater Under Control (CA750).

Concurrence by the Industrial Hazardous Waste Branch Chief is required prior to entering these event codes into RCRAInfo. Your concurrence with the interpretations provided in the following paragraphs and the subsequent recommendations is satisfied by dating and signing at the appropriate locations within Attachments 1 and 2.

II. HISTORY OF ENVIRONMENTAL INDICATOR EVALUATIONS AT THE FACILITY AND REFERENCE DOCUMENTS

This particular evaluation is the second evaluation performed by the Alabama Department of Environmental Management (ADEM) for the Occidental Chemical Corporation (OxyChem) facility. A previous evaluation was completed by EPA in September 1998. The evaluation, and associated interpretations and conclusions on contamination, exposures and contaminant migration at the facility are based on information obtained from the following documents:

- Part B Post-Closure Permit Application, July 1995
- RCRA Facility Investigation Report, December 2000
- Corrective Measures Study Work Plan, February 2002
- SWMU Delineation QA/QC Review, February 2003
- GW Monitoring Report, Results and Evaluations of April 2003 Sampling Event, September 2003

III. FACILITY SUMMARY

OxyChem property occupies approximately 720 acres adjacent to the town of Muscle Shoals, Alabama and is located approximately one mile south of the Tennessee River. The 2,600-acre Tennessee Valley Authority is located just to the west across Wilson Dam Road. OxyChem property includes a company-owned golf course to the west, cotton fields to the south and southeast, and undeveloped woodlands to the north and northeast. The production facility encompasses approximately 50 acres and is centered on the property.

The chlor-alkali plant was built in 1953 by Monsanto Corporation for the U.S. Government according to plans approved by the U.S. Army Corps of Engineers. Subsequent to start-up and acceptance, the Government deactivated the facility and sold it to Diamond Shamrock Chemicals Company, who began private operation in 1955. OxyChem purchased the plant from Diamond Shamrock in 1986 and continues to operate the chlor-alkali plant. The plant produces chlorine, potassium hydroxide, potassium carbonate, hydrogen gas, and prior to 1992, caustic soda (sodium hydroxide). The chlor-alkali process involves the electrolytic decomposition of brine (water saturated with potassium chloride salt) in an electrolytic cell in which liquid mercury serves as the cathode and carbon as the anode. The products of the electrolytic process, which is the predominant process at the plant, are chlorine gas, hydrogen gas, and potassium hydroxide.

Volatile organic compounds (VOCs) and elevated levels of mercury, cadmium, and chloride were discovered in the groundwater beneath a portion of the facility around 1990. The primary waste produced at the site is the brine sludge materials, K071, generated during the brine saturation/purification process. Residual quantities of nonrecoverable mercury, classified as D009 waste, are generated from several sources. These mercury-laden carbon materials are transferred to the mercury retort unit where the mercury is volatilized, condensed and recycled back to the production process. Secondary recovery of chlorine vapors by a carbon tetrachloride stripper unit generated U211 and D019 hazardous wastes. In May 1994 this unit was replaced with a tertiary liquefaction system, which does not utilize a chlorinated solvent. Organic solvents, F001 and F005, were used prior to the late 1980s in the plant maintenance area and are currently used for cleaning and paint-stripping operations in the paint shop.

In 1995, OxyChem submitted a Part-B Post-Closure Permit Application for the two former waste piles – Waste Piles A and B. The waste piles were used from 1980 to 1985 to store wastes in drums and bulk (sludge) and used process equipment. On August 21, 1996 ADEM issued a RCRA permit for post-closure care of the two former waste piles and HSWA corrective action at all SWMUs and AOCs identified in the RFA. The permit also requires the implementation of a Corrective Action Program to address groundwater remediation of VOC contamination. OxyChem is currently in the process of implementing corrective measures, which consist of an air sparging pilot study and molasses-injection activities. Monthly progress reports are being submitted.

IV. CONCLUSION FOR CA725

The appropriate status code to be entered for RCRAInfo event code CA725 (Current Human Exposures Under Control) is YES. Except for the chlorinated hydrocarbons and mercury, the groundwater plumes are small and isolated. All plumes except the chlorinated hydrocarbons are distant from the plant boundaries and have been demonstrated to be stable by many years of groundwater monitoring.

Surface soil contamination by mercury above a risk based screening standard was found in only a

single boring at the former south impounding basin. This location is an unused grassy field south of the main process area. Passage across the surface of the former south impounding basin is solely by lawnmowers or incidental travel. Exposure to soil contamination is limited to the facility workers performing soil sampling or construction activities in certain areas within the facility. Therefore, while the pathway is potentially complete, the frequency and duration of exposure is very low.

V. CONCLUSION FOR CA750

The appropriate status code to be entered for RCRAInfo event code CA750 (Migration of Groundwater Under Control) is YES. The upper zone groundwater plumes are stable and confined on site. Monitoring wells are installed in all directions to detect an offsite migration. The lower zone groundwater plumes of chlorinated hydrocarbons have migrated toward the western site and passed the boundary well (OW-78). Monitoring well OW-84 was installed as the new boundary well and it has not detected any organics above MCLs. The source of organics to the subsurface has been capped and was taken out of service in 1994. Since the year 2000, the pump and treat system has removed the organic mass from the source area. Organics are also expected to sorb to soil continuously preventing the plume to any further advance westward. Natural biodegradation is also expected to take place.

OxyChem is currently implementing a full-scale interim measures by means of pump-and-treat system in the upper zone at the source area. A pilot test is being implemented in the lower zone by means of reductive dechlorination and another near the western boundary of in situ air sparging. Both the reductive dechlorination and in situ air sparging systems have been shown to be effective in capturing the plume migration.

Attachments:

1. CA725: Current Human Exposures Under Control
2. CA750: Migration of Contaminated Groundwater Under Control

ATTACHMENT 1
DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION
RCRA Corrective Action
RCRAInfo Event Code (CA725)
Current Human Exposures Under Control

Facility Name: Occidental Chemical Corporation
Facility Address: Muscle Shoals, Colbert County, Alabama
Facility EPA ID #: ALD 004 019 642

1. Has **all** available relevant/significant information on known and reasonably suspected releases to soil, groundwater, surface water/sediments, and air, 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 "Current Human Exposures Under Control" EI

A positive "Current Human Exposures Under Control" EI determination ("YE" status code) indicates that there are no "unacceptable" human exposures to "contamination" (*i.e.*, contaminants in concentrations in excess of appropriate risk-based levels) that can be reasonably expected under current land- and groundwater-use conditions (for all "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 "Current Human Exposures Under Control" EI are for reasonably expected human exposures under current land- and groundwater-use conditions ONLY, and do not consider potential future land- or groundwater-use conditions or ecological receptors. The RCRA Corrective Action program's overall mission to protect human health and the environment requires that Final remedies address these issues (*i.e.*, potential future human exposure scenarios, future land and groundwater uses, and ecological receptors).

Duration /Applicability of EI Determinations

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

2. Are groundwater, soil, surface water, sediments, or air **media** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective risk-based "levels" (applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action (from SWMUs, RUs or AOCs)?

Media	Yes	No	?	Rationale/Key Contaminants
Groundwater	X			CIHC and Hg exceed MCLs and risk-based standards under Site as contiguous plumes. Lead and cadmium have isolated occurrences over MCLs.
Air (indoors)[2]		X		
Surface Soil (*e.g.*, <2 ft)	X			One boring at SWMU 2 found Hg above risk based concentration in surface soil.
Surface Water		X		
Sediment		X		
Subsurface Soil (*e.g.*, >2 ft)	X			Hg concentration in subsurface soil at SWMU 2 exceeds risk based screening standard.
Air (outdoors)		X		

____ If no (for all media) - skip to #6, and enter "YE," status code after providing or citing appropriate "levels," and referencing sufficient supporting documentation demonstrating that these "levels" are not exceeded.

__X__ If yes (for any media) - continue after identifying key contaminants in each "contaminated" medium, citing appropriate "levels" (or provide an explanation for the determination that the medium could pose an unacceptable risk), and referencing supporting documentation.

____ If unknown (for any media) - skip to #6 and enter "IN" status code.

Rationale and Reference(s):

Groundwater

Groundwater plumes under the plant exceed the MCL of 5 µg/L for carbon tetrachloride and tetrachloroethene. During the last semiannual sampling event (April 2003) the maximum concentration of carbon tetrachloride was 19,000 µg/L and the maximum concentration of tetrachloroethene was 170 µg/L. In more isolated detections, trichloroethene, at a maximum concentration of 150 µg/L, exceeds the MCL of 5 µg/l; chloroform, at 790 µg/L, exceeds the TTHM MCL of 80 µg/L; and a methylene chloride maximum concentration of 36 µg/L exceeds the MCL of 5 µg/L.

The MCL of 2 µg/L for mercury is also exceeded in groundwater, with the maximum concentration on site of 241 µg/L during the April 2003 sampling event. Isolated lead detections exceed the MCL of 15 µg/L with a maximum concentration of 24.7 µg/L. Cadmium also exceeds the MCL of 5 µg/L with a maximum concentration of 133 µg/L.

Except for the chlorinated hydrocarbons and mercury, the plumes are small and isolated. All plumes except the chlorinated hydrocarbons are distant from the plant boundaries and have been demonstrated to be stable by many years of groundwater monitoring.

---

[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 appropriately protective risk-based "levels" (for the media, that identify risks within the acceptable risk range).

[2]Recent evidence (from the Colorado Dept. of Public Health and Environment, and others) suggests that unacceptable indoor air concentrations are more common in structures above groundwater with volatile contaminants than previously believed. This is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration necessary to be reasonably certain that indoor air (in structures located above (and adjacent to) groundwater with volatile contaminants) does not present unacceptable risks.

Soil

SWMU 2 (Former South Impounding Basin) has subsurface soil concentrations in excess of the 340 mg/kg standard established by Region 6 (neither Region 4 nor Region 3 have a standard) as a screening standard for outdoor air to an industrial worker. SWMU 2, in its present condition, is an unused grassy field south of the main process area. No one works in the area and no trailers or vehicles are parked there. Passage across the surface of SWMU 2 is solely by lawnmowers or incidental travel. The maximum concentration found at SWMU 2 during either the RFI or the CMS borings was 2950 mg/kg.

SWMU 2 has a single instance (out of 22 borings made during the RFI and CMS) of mercury concentration in the surface soil exceeding the screening standard of 340 mg/kg. This maximum concentration was 649 mg/kg.

3. Are there **complete pathways** between "contamination" and human receptors such that exposures can be reasonably expected under the current (land- and groundwater-use) conditions?

Summary Exposure Pathway Evaluation Table
Potential **Human Receptors** (Under Current Conditions)

"Contaminated" Media	**Residents**	**Workers**	**Day-Care**	**Construction**	**Trespassers**	**Recreation**	**Food**[3]
Groundwater	No	No	No	No	No	No	No
Air (indoors)	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Soil (surface, *e.g.*, <2 ft)	No	Yes	No	Yes	No	No	No
Surface Water	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Sediment	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Soil (subsurface, *e.g.*, >2 ft)	No	No	No	No	No	No	No
Air (outdoors)	N/C	N/C	N/C	N/C	N/C	N/C	N/C

Instructions for Summary Exposure Pathway Evaluation Table:

1. For Media which are not "contaminated" as identified in #2, please strike-out specific Media, including Human Receptors' spaces, or enter "N/C" for not contaminated.

2. Enter "yes" or "no" for potential "completeness" under each "Contaminated" Media -- Human Receptor combination (Pathway).

Note: In order to focus the evaluation to the most probable combinations some potential "Contaminated" Media - Human Receptor combinations (Pathways) do not have assigned spaces in the above table. While these combinations may not be probable in most situations they may be possible in some settings and should be added as necessary.

[3]Indirect Pathway/Receptor (*e.g.*, vegetables, fruits, crops, meat and dairy products, fish, shellfish, etc.)

___ If no (pathways are not complete for any contaminated media-receptor combination) - skip to #6, and enter "YE" status code, after explaining and/or referencing condition(s) in-place, whether natural or man-made, preventing a complete exposure pathway from each contaminated medium (*e.g.*, use optional Pathway Evaluation Work Sheet to analyze major pathways).

__X__ If yes (pathways are complete for any "Contaminated" Media - Human Receptor combination) - continue after providing supporting explanation.

____ If unknown (for any "Contaminated" Media - Human Receptor combination) - skip to #6 and enter "IN" status code

Rationale and Reference(s):

Incomplete Pathways
Groundwater
Although groundwater is contaminated in the Upper Zone and Lower Zone under the site, there is not a complete pathway for exposure to this contamination. There are no wells screened in either of these two zones on the plant site for any purpose except groundwater monitoring and groundwater remediation.

Soil
Although subsurface soil is contaminated with mercury at SWMU 2 there is not a completed exposure to the soil. SWMU 2, in its present condition, is an unused grassy field south of the main process area. No one works in the area and no trailers or vehicles are parked there. Passage across the surface of SWMU 2 is solely by lawnmowers or incidental travel. Furthermore, the contaminants are at depth rather than on the surface. Plant procedures require that excavation anywhere on the plant site (including SWMU 2) may not take place on site without notification to, and approval by, ADEM. The plant is fenced-in and gated, which mitigate the potential for trespassers. The environmental department is aware of the contaminants at SWMU 2 and will not issue excavation approval without a plan of monitoring and preventing exposure during excavation.

Potentially Complete Pathway
Surface Soil
Surface soil contamination with mercury above a risk-based screening standard was found in only a single boring at SWMU 2. This location is an unused grassy field south of the main process area. No one works in the area and no trailers or vehicles are parked there. Passage across the surface of SWMU 2 is solely by lawnmowers or incidental travel. Therefore, while the pathway is potentially complete, the frequency and duration of exposure is very low. Due to the infrequency of human presence, the duration of exposure would be a small fraction of the default scenarios used in determining exposures for screening concentrations, and the degree of exceedance of the screening level in one boring does not represent a significant threat.

4. Can the **exposures** from any of the complete pathways identified in #3 be reasonably expected to be **"significant"**[1] (*i.e.*, potentially "unacceptable" because exposures can be reasonably expected to be: 1) greater in magnitude (intensity, frequency and/or duration) than assumed in the derivation of the acceptable "levels" (used to identify the "contamination"); or 2) the combination of exposure magnitude (perhaps even though low) and contaminant concentrations (which may be substantially above the acceptable "levels") could result in greater than acceptable risks)?

__X__ If no (exposures cannot be reasonably expected to be significant (*i.e.*, potentially "unacceptable") for any complete exposure pathway) - skip to #6 and enter "YE" status code after explaining and/or referencing documentation justifying why the exposures (from each of the complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

____ If yes (exposures could be reasonably expected to be "significant" (*i.e.*, potentially "unacceptable") for any complete exposure pathway) - continue after providing a description (of each potentially "unacceptable" exposure pathway) and explaining and/or referencing documentation justifying why the exposures (from each of the remaining complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

____ If unknown (for any complete pathway) - skip to #6 and enter "IN" status code

Rationale and Reference(s):

Surface soil contamination by mercury above a risk based screening standard was found in only a single boring at SWMU 2. This location is an unused grassy field south of the main process area. No one works in the area and no trailers or vehicles are parked there. Passage across the surface of SWMU 2 is solely by lawnmowers or incidental travel. Therefore, while the pathway is potentially complete, the frequency and duration of exposure is very low. Due to the infrequency of human presence, the duration of exposure would be a small fraction of the default scenarios used in determining exposures for screening concentrations, and the degree of exceedance of the screening level in the one boring does not represent a significant threat.

5. Can the "significant" **exposures** (identified in #4) be shown to be within **acceptable** limits?

____ If yes (all "significant" exposures have been shown to be within acceptable limits) - continue and enter "YE" after summarizing and referencing documentation justifying why all "significant" exposures to "contamination" are within acceptable limits (*e.g.*, a site-specific Human Health Risk Assessment).

____ If no (there are current exposures that can be reasonably expected to be "unacceptable")- continue and enter "NO" status code after providing a description of each potentially "unacceptable" exposure.

____ If unknown (for any potentially "unacceptable" exposure) - continue and enter "IN" status code.

Rationale and Reference(s): (N/A)

[1]If there is any question on whether the identified exposures are "significant" (*i.e.*, potentially "unacceptable") consult a human health Risk Assessment specialist with appropriate education, training and experience.

6. Check the appropriate RCRAInfo status codes for the Current Human Exposures Under Control EI event code (CA725), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (and attach appropriate supporting documentation as well as a map of the facility):

_X_ YE - Yes, "Current Human Exposures Under Control" has been verified. Based on a review of the information contained in this EI Determination, "Current Human Exposures" are expected to be "Under Control" at the Occidental Chemical., facility, EPA ID # ALD 004 019 642, located in Muscle Shoals, Alabama under current and reasonably expected conditions. This determination will be re-evaluated when the Agency/State becomes aware of significant changes at the facility.

____ NO - "Current Human Exposures" are NOT "Under Control."

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

Completed by: Metz D. Duites — 3 DEC 2003 (date)
Metz Duites
Engineering Services Section
Industrial Hazardous Waste Branch
Land Division

Supervisor: Vernon H. Crockett — 3 Dec 2003 (date)
Vernon H. Crockett, Chief
Engineering Services Section
Industrial Hazardous Waste Branch
Land Division

Hazardous Waste Branch Chief: Phillip D. Davis — 3 Dec 2003 (date)
Phillip D. Davis, Chief
Industrial Hazardous Waste Branch
Land Division

References:

- RCRA Facility Investigation Report, December 2000
- Corrective Measures Study Work Plan, February 2002
- SWMU Delineation QA/QC Review, February 2003
- Groundwater Monitoring Report, Results and Evaluations of April 2003 Sampling Event, September 2003

Location where References may be found:

Alabama Department of Environmental Management Main Office
1400 Coliseum Boulevard
Montgomery, Alabama 36110-2059
(334) 271-7700

Contact telephone number and e-mail address:

Metz Duites
(334) 271-7754
mpd@adem.state.al.us

ATTACHMENT 2
DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION
RCRA Corrective Action
RCRAInfo Event Code (CA750)
Migration of Contaminated Groundwater Under Control

Facility Name: Occidental Chemical Corporation
Facility Address: Muscle Shoals, Colbert County, Alabama
Facility EPA ID #: ALD 004 019 642

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 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 RCRAInfo national database ONLY as long as they remain true (*i.e.*, RCRAInfo 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):

Groundwater plumes under the plant exceed the MCL of 5 µg/L for carbon tetrachloride and tetrachloroethene. During the last semiannual sampling event (April 2003) the maximum concentration of carbon tetrachloride was 19,000 µg/L and the maximum concentration of tetrachloroethene was 170 µg/L. In more isolated detections, trichloroethene, at a maximum concentration of 150 µg/L, exceeds the MCL of 5 µg/l; chloroform, at 790 µg/L exceeds the TTHM MCL of 80 µg/L; and a methylene chloride maximum concentration of 36 µg/L exceeds the MCL of 5 µg/L.

The MCL of 2 µg/L for mercury is also exceeded in groundwater, with the maximum concentration on site of 241 µg/L during the April 2003 sampling event. Isolated lead detections exceed the MCL of 15 µg/L with a maximum concentration of 24.7 µg/L. Cadmium also exceeds the MCL of 5 µg/L with a maximum concentration of 133 µg/L.

Except for the chlorinated hydrocarbons and mercury, the plumes are small and isolated. All plumes except the chlorinated hydrocarbons are distant from the plant boundaries and have been demonstrated by many years of groundwater monitoring to be stable.

[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"[6]).

_____ If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"[1]) - 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):

Upper Zone groundwater plumes are quite stable on site. They are confined well within the interior of the site with numerous monitor wells available in all directions to detect an offsite migration hundreds of feet before it occurred.

Lower Zone groundwater plumes of chlorinated hydrocarbons have migrated toward the western site boundary for several years. When the then farthest west on-site well (OW-78) became impacted a new well (OW-84) was installed off site as a replacement, just across Wilson Dam Road. This new well (OW-84) has not detected any organics above MCLs.

The source of organics to the subsurface was taken out of service in 1994. While migration of the plume took place for several years after that, several factors point to the migration being likely to have ceased or to cease soon. The mass of organics in the ground has been capped. In addition, organic mass has been removed from the source area by means of pump and treat since the year 2000. In addition to the removal, organics are expected to sorb to soil continuously making it increasingly difficult for the front edge of the plume to advance westward. Natural attenuation in the form of biodegradation is also expected to take place.

To assist these natural processes, the facility has implemented two pilot scale and one full scale interim measures. The full scale measure is an active pump-and-treat system in the Upper Zone at the source area. Mass has been extracted and concentrations of extracted groundwater have dropped consistently. In the Lower Zone a pilot test is taking place of reductive dechlorination and another near the western boundary of in situ air sparging. The reductive dechlorination has resulted in the creation of daughter compounds which indicates a reduction in mass of constituents. The in situ air sparging also indicates a trend of declining organics concentrations down-gradient of the air sparging system. Both of these are indicators that the technology can be used on a full scale basis to arrest the plume migration.

Lastly, even at locations distant from the interim measures evidence from the periodic sampling and analysis indicates that migration of the plume is slowing or has stopped. Monitoring wells at the advancing edge of the plumes show declines in concentration over time.

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[1]"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):

Contaminated groundwater does not travel far enough to intercept a surface water body. This conclusion is supported both by the definition of the groundwater plumes which do not extend to surface water bodies, and by the annual sampling of springs in the area. The sampling of the springs has never detected any site-related constituents.

5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (*i.e.*, the maximum concentration[8] 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)?

____ 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[8] 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) providing 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[8] 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[2] greater than 100 times their appropriate groundwater "levels," providing 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 identifying if there is evidence that the amount of discharging contaminants is increasing.

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

Rationale and Reference(s): (N/A)

[2]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[3])?

____ 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,[4] appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of trained specialists, including ecologists) 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): (N/A)

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):

For the foreseeable future groundwater will be monitored by a system of monitoring wells presently incorporated into the post closure permit. These wells monitor the interior and front of plumes in all impacted zones. Should impact occur at the front edge of the plume, as observed by constituents in the most distant monitoring well OW-84, additional well(s) will be installed to monitor the front of the plume.

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[3]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.

[4]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.

8. Check the appropriate RCRAInfo 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 Occidental Chemical Corporation. facility, EPA ID ALD 004 019 642, located at Muscle Shoals, Alabama. 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: Metz P. Duites — 3 DEC 2003 (date)
Metz Duites
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Supervisor: Vernon H. Crockett — 3 Dec 2003 (date)
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