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: _____Occidental Chemical Corporation _____
Facility Address: _____1657 River Road, Delaware City, Delaware 19720_____
Facility EPA ID #: _____DED003913266 _____

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 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):

Groundwater in the water table aquifer (recent sediments and Columbia Formation) and in the upper sands of the Potomac Formation (Potomac A and B sands) at the site is known to be contaminated above appropriately protective levels including Maximum Contaminant Levels ("MCLs"), USEPA Region III Risk-based concentrations ("RBCs") for tapwater, surface water quality criteria for aquatic and human receptors.

Table 1 identifies the contaminants of concern ("COCs") found to be present in groundwater at the site above appropriately protective levels. This table was prepared based on groundwater data collected at the site from 1993 to 2005.

References: Summary of Site Conditions Report, February 2005

Footnotes:

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

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

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

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

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

Rationale and Reference(s):
Data collected from monitoring locations designated at the time of this determination indicates that the migration of contaminated groundwater has stabilized such that contaminated groundwater is expected to remain within the existing area of contaminated groundwater. In 2003, barrier walls (slurry walls) were constructed around two of the most significant contaminated source areas found at the site based on the RFI; the Process Area and Waste Lake 1. Due to constructability issues, all impacted groundwater could not be contained by the barrier walls. The following areas of groundwater contamination remain outside the barrier walls:

1) The water table aquifer adjacent to and downgradient of the Process Area (mercury, carbon tetrachloride, chlorobenzenes);
2) The water table aquifer adjacent to and downgradient of Waste Lake 1 (chlorobenzenes, mercury);
3) The Potomac A Sands adjacent to and downgradient of Waste Lake 1 (DNAPL and dissolved phase chlorobenzenes);
4) The water table aquifer downgradient of one portion of Standard Chlorine/Metachem Pipeline (benzene, 1,2,4-trichlorobenzene, etc.), and;
5) The Potomac B Sands downgradient of Waste Lake 1 (benzene, vinyl chloride).

<u>Definition of Existing Area of Contaminated Groundwater</u>
Several figures were prepared to illustrate the current distribution of contaminants of concern ("COCs") found in groundwater at the site above appropriately protective levels. Although at least 70 COCs were identified as exceeding appropriately protective levels in groundwater at the site, mercury and chlorobenzene were used on these figures (as primary COCs/indicators) to represent the extent of contamination based on monitoring conducted over the last 2 years. Figures 1and 2 illustrate the distribution of dissolved mercury and chlorobenzene concentrations in the groundwater and in surface waters. Figure 3 illustrates the distribution of chlorobenzene concentrations in the Potomac A Sands at Waste Lake 1. These figures provide a summary of the distribution of groundwater contaminant concentrations present at the site based on current monitoring locations (hydraulic and chemistry). Additional future monitoring locations and activities will be used to verify or refine these distributions.

Figure 6 is a summary map showing the outer perimeter or "boundary" of the existing area of contaminated groundwater that is considered representative of all COCs found to be present above appropriately protective levels. In the water table aquifer and Potomac A Sands, groundwater flows in a general northerly direction and discharges to the Tributary and Red Lion Creek based on presently available site and off-site hydrogeologic information. Additional data is currently being collected to verify the site conceptual model with regard to groundwater flow and discharge areas.

There are two Potomac B Sands wells at the site (A-52 and A-58), and only A-58 has been sampled to date. The

discontinuous nature of the Potomac B Sands and the thick body of clay separating the Potomac B Sands from deeper Potomac sands beneath the site suggests that there is little horizontal or vertical groundwater flow in these sands. Based on the information collected to date, the Potomac B Sands are not considered to be a significant contamination migration pathway for the site.

Groundwater Interim Measures

In 2003, barrier walls were constructed through the water table aquifer around the Process Area and through the water table and Potomac A Sands around Waste Lake 1. The barrier walls were constructed of cement-bentonite and soil-bentonite to create a vertical low permeability barrier (approx. 1×10^{-6} centimeters per second). The barrier walls were keyed into a clay layer beneath both the Process Area and at Waste Lake 1. These barrier walls and the clay that they are keyed into essentially isolate groundwater flow into and out of both areas. A collection trench within the Process Area and extraction wells within Waste Lake 1 provide mechanisms to withdraw groundwater from inside the containment areas. A treatment system was constructed for treatment of organic contaminants, and effluent from the treatment system flows to the Occidental Plant's wastewater treatment plant for treatment of mercury prior to discharge to the Delaware River.

A groundwater flow model was constructed to simulate groundwater flow based on the construction of the barrier walls, and to assess the hydraulic properties of the barriers. Barrier performance evaluations demonstrate that hydraulic conductivity of the barrier walls is less than or equal to 1×10^{-6} centimeters per second (cm/sec), and has achieved the design criteria. Prior to installation of the Process Area barrier wall, approximately 2.5 pounds per year (0.035 kilograms per year) of mercury migrated from the Process Area in the groundwater. After the construction of the barrier walls, 0.02 pounds per year (0.00028 kilograms per year) of mercury is predicted to migrate from the Process Area.

Additional Interim Measures have been completed to address a localized area of free phase dense non-aqueous phase liquid (DNAPL) that is present in the Potomac A Sands at Waste Lake 1and outside the barrier wall. Since May 21, 2004 when DNAPL pumping was initiated, 559 gallons (5,162 pounds) of DNAPL have been removed from the localized area of DNAPL contamination present in the Potomac A sands immediately adjacent to the northwest face of WL-1. Monitoring of DNAPL presence and thickness and manual pumping of DNAPL from specific wells in the DNAPL area continues to occur on a biweekly basis. Additional measures are being implemented at the DNAPL area to remove source material, monitor dissolved phase contamination associated with the DNAPL, and evaluate remedial options.

Additional measures were completed to address a localized area of chlorobenzene contamination found to be present along a section of the Standard Chlorine/Metachem effluent pipeline that runs across the Occidental Chemical site. Impacted soils along and under a section of the pipeline were removed and restoration and reinforcement of a section of the pipeline was completed prior to backfill and grading. Shallow monitoring wells were installed downgradient of the impacted pipeline area to monitor residual concentrations that may be present in groundwater. These wells are sampled as part of the ongoing monitoring activities under way at the site.

The continued implementation and ongoing monitoring and source removal activities associated with these measures will help ensure that the migration of contaminated groundwater remains stabilized.

References - Summary of Site Conditions Report, February 2005
One-Year Report, March 2005
Bimonthly Progress Report dated July 27, 2005, Section 1.2
DNAPL Monitoring/Recovery Program Summary dated September 13, 2005

[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):

Contaminated groundwater in the water table aquifer and Potomac A Sands discharges to the Tributary and to Red Lion Creek.

Reference: Summary of Site Conditions Report, February 2005

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):

The discharge of contaminated groundwater into the two surface water bodies identified in Question #4 is potentially significant. Based on sampling results from the surface water and the current understanding of groundwater flow, it appears that the Tributary and Red Lion Creek are the principle contaminated groundwater discharge locations. Table 1 includes a summary of the maximum concentration of contaminants detected in site groundwater from 1993 to present and a ratio of the maximum observed contaminant concentration to the appropriately protective level (defined in Question #2). Table 1 also identifies the contaminants discharging into surface water at concentrations greater than 100 times their appropriately protective level(s).

The mass flux of each contaminant discharging into surface water at concentrations greater than 100 times their appropriately protective level(s) was calculated for the water table aquifer and Potomac A Sands. These calculations were based on groundwater data collected in June 2005, approximately two years after construction of the barrier walls was completed. The results are presented in Table 2.

Fluxes were not calculated for the Potomac B Sands since there are only two Potomac B wells, and only one of these wells has been sampled (A-58). A-58 has been sampled twice (in November 2004 and March 2005), and benzene and vinyl chloride were positively detected during both events. The maximum vinyl chloride concentration was 5 ppb, 2.5 times the MCL. The maximum benzene concentration was 30 ppb, 6 times the MCL. However, the discontinuous nature of the Potomac B Sands and the thick body of clay separating the Potomac B Sands from deeper Potomac sands beneath the site suggest that there is little horizontal or vertical groundwater flow in these sands. Based on the information collected to date, the Potomac B Sands are not considered to be a significant contaminant migration pathway for the site.

The barrier walls constructed in 2003 have essentially isolated groundwater flow into and out of two of the most

significant contaminant source areas identified at the facility. These measures in combination with other interim measures completed to address localized areas of groundwater contamination present outside the barrier walls are expected to result in a decreasing contaminant mass flux over time. None of the data reviewed for this determination suggest that the contaminant mass flux is increasing.

References - Summary of Site Conditions Report, February 2005
One Year Performance Monitoring Report, March 2005
Mass flux submittals dated June 30, 2005 and September 12, 2005

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

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

__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 Tributary Report was prepared to document the results of the surface water, sediment and fish sampling completed in surface water bodies at the site in 2004, and the conclusions of the screening level ecological risk assessment. Although several uncertainties are associated with the risk evaluation completed for the Tributary and Red Lion Creek, it appears that site-related contaminants (mercury, manganese and chlorinated benzenes) are present at levels that pose a potential risk to the ecosystem.

Although potential adverse impacts to surface water, sediments and eco-systems downgradient of the site have been documented based on surface water, sediment, and fish sampling completed at the site in 2004, significant progress has been made to reduce ongoing contaminant discharge via groundwater. Since the barrier walls were constructed at the site in 2003, a portion of the contaminant mass that was contributing to surface water discharges has been effectively isolated. Additional interim measures have been implemented to address localized areas of groundwater contamination that are present outside of the barrier walls. Although the mass flux calculations completed for Question #5 indicate that some discharge (loading) of contaminated groundwater from the site is ongoing, we expect to see a decreasing trend in contaminated groundwater discharge over time due to the source removal efforts, barrier performance, and additional measures to be implemented as part of the final cleanup of the site. Routine monitoring activities will continue at the site to verify this trend, and to ensure that the potential impacts observed in the Tributary and Red Lion Creek based on historical contaminant discharge are not likely to get worse during the interim period until a final remedy decision is made. Therefore, the discharge of contaminated groundwater into surface water is not expected to cause additional adverse impacts to surface water, sediments or ecosystems at least

for the interim period until a full assessment and final remedy decision can be made.

EPA Region III and Occidental Chemical Corporation agree that there are site-related contaminants (including mercury, manganese and chlorinated benzenes) present in surface water bodies downgradient from the facility. Although it appears that the migration of contaminated groundwater has stabilized since the construction of the barrier walls and implementation of other groundwater Interim Measures at the site, additional work must be completed to determine the transport mechanism for site contaminants to reach the surface water bodies (i.e., historical overland flow versus groundwater discharge). Occidental Chemical Corporation has committed to evaluate the transport mechanism for site contaminants and to address impacted sediments as part of the final remediation of the site. Based on the Interim Measures implemented to date and our review of post-construction monitoring data, the Occidental Chemical Corporation site meets the requirements for a positive Groundwater Environmental Indicator ("EI") determination as defined by the EI guidance and CA 750 form: the migration of contaminated groundwater has stabilized and monitoring will be conducted to confirm that contaminated groundwater remains within the existing "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the facility).

References - Tributary Report, September 2005
One Year Performance Monitoring Report, March 2005
Mass flux submittals dated June 30, 2005 and September 12, 2005

[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.

Rationale and Reference(s):

Groundwater and surface water monitoring will be completed at the site to continue to evaluate the performance of the barrier walls constructed in 2003 and the other groundwater interim measures described in Question #3, and to verify that the migration of contaminated groundwater remains stabilized. Figures 5 and 2.1 identify the monitoring locations where hydraulic and chemical data are collected on a routine basis to verify that groundwater contamination will not migrate beyond the existing area of contaminated groundwater. Additional wells are currently being installed to verify the site conceptual model with regard to groundwater flow and discharge areas, and to provide additional monitoring points.

Additional monitoring work and continued evaluation of the nature and extent of contaminated groundwater discharge and potential impacts to receiving surface water bodies (and associated risk to ecological receptors) will be completed over the next few years as focused data collection work is completed to support the evaluation and selection of final cleanup measures for the site. Performance monitoring activities will continue at the site on a regular basis for the barrier walls and other measures implemented to address localized areas of groundwater contamination present outside of the containment areas.

References - PMP Summary Memo dated September 9, 2005
Additional Well Installation Memo and figures dated July 22, 2005

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 _Occidental Chemical Corporation facility , EPA ID # **DED003913266__** , located at_Delaware City, Delaware 19720____. 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) /s/ Date 9/28/05
(print) Donna M. McCartney
(title) USEPA Project Manager

Supervisor (signature) /s/ Date 9/28/05
(print) Robert E. Greaves
(title) Chief, General Operations Branch
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Locations where References may be found:

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