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:	Sunoco, Inc. (R&M) Marcus Hook, PA
Facility Address:	2nd and Green Streets, Marcus Hook, PA 19061
Facility EPA ID #:	PAD 980 550 594

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

   _X_ If yes - check here and continue with #2 below.

   ____ If no - re-evaluate existing data, or

   ____ if data are not available skip to #6 and enter"IN" (more information needed) status code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

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

2. Is **groundwater** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective "levels" (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

_X_ If yes - continue after identifying key contaminants, citing appropriate "levels," and referencing supporting documentation.

____ If no - skip to #8 and enter "YE" status code, after citing appropriate "levels," and referencing supporting documentation to demonstrate that groundwater is not "contaminated."

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

Rationale and Reference(s):

The major concern for groundwater in the refinery is the occurrence of light non-aqueous phase liquids (LNAPL) in the subsurface which exists beneath several locations around the facility. LNAPL composition varies and has not been chemically characterized at all locations, The primary impact of the LNAPL would be dissolved concentration of benzene, ethylbenzene, toluene and xylene (BETX) in groundwater. These constituents may or may not be present in the subsurface LNAPL materials and/or groundwater found at the various locations. Maximum concentrations of constituents detected in perimeter wells since 1995 are listed in the table below (from Refinery Dissolved Sampling Report datded May 22, 2001).

Contaminant	Drinking Water MCL*	PADEP Non-use aquifer standard	Max detected (1995-2001)
Benzene	0.005 mg/l	0.50 mg/l	2.3 mg/l
Toluene	1 mg/l	100 mg/l	0.24 mg/l
Ethyl-benzene	0.7 mg/l	70 mg/l	0.89 mg/l
Total Xylene	10 mg/l	180 mg/l	0.40 mg/l
MTBE		0.2 mg/l	0.074 mg/l
Benzo(a)anthracene		0.014 mg/l	ND
Benzo(b)fluoranthene		0.0012 mg/l	ND
Benzo(a)pyrene	0.0002 mg/l	0.0038 mg/l	ND
Chrysene		0.0018 mg/l	ND
Dibenz(a,h)anthracene		0.0005 mg/l	ND
Indene			ND
Arsenic	0.05 mg/l	50 mg/l	0.268 mg/l
Barium	2 mg/l	2000 mg/l	1.46 mg/l
Cobalt		2200 mg/l	0.222 mg/l
Chromium	0.1 mg/l	100 mg/l	0.297 mg/l
Lead	0.005 mg/l	5 mg/l	9.1 mg/l

The most recent testing in April 2001 reported benzene above the PADEP non-use aquifer statewide health standards in 2 of the 20 wells samples. This data can be found in the Refinery Dissolved Sampling Report dated May 2001 prepared by Handex. MW-11 and MW-55 contained a film of LNAPL.

LNAPL has also been detected in wells recently installed in the Phillips Island portion of the refinery which borders the Delaware River. LNAPL seeps to the river in this area are contained by sorbent booms

and the installation of LNAPL recovery system in this area is planned for 2003/2004.

Footnotes:

1 [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):

VERTICAL MIGRATION

The aquifer underlying the facility is an unconsolidated water table aquifer overlying crystalline metamorphic bedrock. Therefore, it is anticipated that vertical groundwater migration is not significant. Groundwater discharges to the Delaware River which borders the facility.

HORIZONTAL MIGRATION

The majority of groundwater flow beneath the facility is generally to the south toward the Delaware River. LNAPL recovery systems have been installed in certain areas where there has been evidence of migration toward the river. Phillip Island is a former waste disposal area adjacent to the Delaware River that is being remediated under Pennsylvania's Act 2 program. The area is being redeveloped for use as a co-generation facility. The remediation consists of sheetpiling along the river and installing groundwater recovery systems to prevent discharge of contaminated groundwater or LNAPL to the river. Additional investigations of LNAPL occurrence in areas of Phillips island is on-going. Installation/operation of remediation systems in this area is planned for 2003/2004. A series of oil containment booms are maintained in certain areas where oil sheens on surface water have been observed.

Annual perimeter sampling and analysis along the eastern property boundary near Post Road demonstrates that dissolved hydrocarbon levels are on a decreasing trend and below the Pennsylvania Statewide Health Standard. Further south on the eastern border, any component of off-site migration is apparently prohibited by an 84" wide sewer.

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.

Data is not currently available to characterize off site groundwater to the west of the refinery. However, the potential for LNAPL migration is currently subject to monitoring and further investigation.

Groundwater beneath the northern portion of the refinery flows towards utility conduits along Post Road. Groundwater recovery systems are operational along Post Road and provide sufficient hydraulic control to prevent migration offsite.

In general, annual perimeter sampling has shown steady or decreasing dissolved contaminant trends (see the May 2001 Refinery Dissolved Sampling report, dated May 22, 2001, prepared by Handex).

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):

There is approximately 350 feet of riverfront where sheening occurs in the Delaware river at Phillips Island. LNAPL recovery systems are being installed to prevent migration of LNAPL to the river. In addition, a sheet pile wall with impermeable jointing and an enhanced groundwater recovery system is being installed along a portion of the river.

Certain other areas of the riverfront along the Delaware River adjacent to Phillips Island exhibit sheening on surface water. In addition, an area of surface water located after the terminus of Middle Creek conveyance system exhibits surface sheening. These areas are currently under investigation and the installation of remediation systems are planned over the next two years. As noted previuosly, sorbent booms are maintained in order to control LNAPL seepage to surface waters.

The entire riverfront, including the 84" sewer, is monitored on a routine basis for changed conditions.

Perimeter groundwater sampling and analysis is performed annually at the refinery. With the exception of the areas noted above, all other groundwater appears to be under control. The data can be found in the Refinery Dissolved Sampling Report dated May 22, 2001 prepared by Handex.

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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X 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.

____ 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 Delaware River will be controlle by the LNAPL recovery systems and installation of a sheet pile wall at Phillips Island as described above in No.4

In addition, a series of oil contaminated booms are maintained in certain areas. Monitoring and further investigations as to the occurrence and recovery of LNAPL in other areas of Phillips Island is ongoing. The installation of additional remediation systems is planned for this area. The occurrence of sheening on the Delaware River, while contained by booms, is insignificant considering the river size and regional setting.

Contaminated groundwater does not enter the Delaware River in any other areas of the refinery.

[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])?

____ 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):

[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 monitoring data will be collected in the future as agreed upon with the PADEP in the Sun Company, Inc. Comprehensive Remedial Plan, May 18, 1995. The groundwater monitoring includes semi-annual depth to liquids measurements and annual groundwater sampling of perimeter monitoring wells. This data is submitted to PADEP and USEPA in quarterly and annual reports, respectively.

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 Sunoco, Inc. (R&M) Marcus Hook Refinery facility , EPA ID # PAD 980 550 594 , located at 2nd and Green Streets, Marcus Hook, PA 19061. 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 12-31-02
	(print)	Hon Lee	
	(title)	Remedial Project Manager	

Supervisor	(signature)	/s/	Date 1-06-2003
	(print)	Paul Gotthold	
	(title)	Chief, PA Operation Branch (3WC22)	
	(EPA Region or State)	EPA region 3	

Locations where References may be found:

US EPA Region III, 3WC22, 1650 Arch Street, Philadelphia, PA 19103
EPA Administrative Records

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