DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

RCRA Corrective Action
Environmental Indicator (EI) RCRAInfo Code (CA750)
Migration of Contaminated Groundwater Under Control

Facility Name: **Schering Corporation**
Facility Address: **1011 Morris Avenue, Union, New Jersey 07083**
Facility EPA ID#: **NJD001317601**

Definition of Environmental Indicators (for the RCRA Corrective Action)

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

Definition of "Migration of Contaminated Groundwater Under Control" EI

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

Relationship of EI to Final Remedies

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

Duration / Applicability of EI Determinations

EI determination status codes should remain in the Resource Conservation and Recovery Act Information (RCRAInfo) national database system ONLY as long as they remain true (i.e., RCRAInfo status codes must be changed when the regulatory authorities become aware of contrary information).

Facility Information

The Schering Corporation site is located on approximately 60 acres of land in Union, New Jersey. The site is bordered to the east and northeast by the Elizabeth River, to the northwest by Conrail railroad

tracks, to the southwest by Morris Avenue, and to the southeast by commercial offices and private residences. Elizabeth River Park, a county recreational area, is located on the other side of the Elizabeth River. Schering has operated a pharmaceutical research and development facility, with limited manufacturing activities, at this location since 1938. Infrastructure at the facility has included surface impoundments, a wastewater treatment plant (WWTP), underground storage tanks (USTs), aboveground storage tanks (ASTs), loading/unloading areas, drum and container storage areas, and sewer systems. Schering currently stores wastes in two containerized hazardous waste storage sheds and a waste solvent blending tank, pursuant to a New Jersey Department of Environmental Protection (NJDEP) RCRA Permit.

In 1984, Schering conducted a hydrogeologic study that identified groundwater contamination attributable to historical site practices. In 1985, Schering entered into an Administrative Consent Order (ACO) with NJDEP to investigate and remediate groundwater at the site. Subsequent investigations and remedial work were undertaken, leading to the issuance of a New Jersey Pollutant Discharge Elimination System–Discharge to Groundwater (NJPDES-DGW) permit in 1991. Under the terms of the NJPDES-DGW permit, Schering designed and constructed an extensive Ground Water Extraction System (GWES) to control off-site migration of contaminated groundwater from the overburden aquifer. The NJPDES-DGW permit was cancelled in 1994, and a second NJDEP ACO was issued. The GWES was installed in 1993 and brought on line in 1994, and remains in operation today under the terms of the 1994 ACO. Schering has also conducted a pilot study involving in-situ dual-phase extraction (DPE), biosparging, and enhanced bioremediation. Corrective actions and semiannual groundwater monitoring are ongoing.

EPA had been lead agency and drafted a HSWA Permit, but it was subsequently decided that NJDEP would be the lead for the site. NJDEP is addressing oversight through their 1994 ACO and EPA decided not to issue the HSWA Permit.

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.

Summary of Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs): The Schering site has been extensively investigated according to NJDEP direction over a period of approximately 20 years. During these studies, nearly 200 soil samples have been collected, and more than 120 groundwater monitoring points have been installed and monitored on and off site. A total of nine SWMUs and AOCs were identified in the 1998 draft Hazardous and Solid Waste Amendments (HSWA) permit for the Schering site. A facility map indicating the location of the SWMUs and AOCs is provided on Plate 1 of the Comprehensive Site Conditions Report (CSCR) from May 2000 (Ref. 5).

As outlined in the CSCR (Ref. 5), environmental concerns are being addressed on a site-wide rather than SWMU-specific basis at Schering. Such a strategy has led to implementation of various broad-based corrective actions including installation of the GWES in 1993 and remedial pilot studies for groundwater cleanup in 2003 and 2004. As a result of the site-wide focus, NJDEP has issued only one formal No Further Action determination to Schering for SWMU 4 (Suspect Waste Solvent Pit). Nevertheless, the current strategy has resulted in significant progress toward reducing and/or eliminating contamination at the individual SWMUs and AOCs. Soil and groundwater contamination has dropped below applicable NJDEP standards at SWMU 1 (Former Railroad Siding). Furthermore, no contamination above NJDEP soil criteria has been detected at AOC 7 (USTs) or AOC 9 (Backfill Area). The remaining five SWMUs and AOCs are discussed briefly below.

SWMU 2, Industrial Sewer Lines: This unit consists of a network of industrial sewer lines, concentrated in the northwestern portion of the property, that were in service from the 1940's through the present. New aboveground lines have been installed to handle hazardous wastewater. No soil contamination was detected at this unit, but volatile organic compounds (VOCs) and alcohols were detected in groundwater above New Jersey Groundwater Quality Criteria (NJ GWQC) in early investigations. This area is within the current capture zone of the GWES, and contaminant concentrations have generally been declining over time (Ref. 7). DPE and bioremediation pilot studies were conducted in this area in 2003 and 2004 to evaluate the possibility of accelerating cleanup. As of May 2004, benzene and toluene are the only contaminants present above NJ GWQC (Ref. 7).

SWMU 3, Four Surface Impoundments: This unit consisted of four surface impoundments along the northwestern property boundary that were used to dispose of waste liquids (primarily chromic and sulfuric acids) from testosterone production in the 1940's and early 1950's. Early investigations indicated metals and VOCs in soil (Ref. 1), and VOCs in groundwater above

relevant standards. Soil was excavated in this area for construction of Building 14 in the early 1990's, and the area has been capped with asphalt paving. No further soil action is planned. This area is within the current capture zone of the GWES, and contaminant concentrations have generally been declining over time (Ref. 7). DPE pilot studies were conducted in this area in 2003 and 2004 to evaluate the possibility of accelerating cleanup. As of May 2004, several VOCs remain in SWMU 3 groundwater above NJ GWQC (Ref. 7).

SWMU 5, Unpaved Drum Storage Areas: This unit consists of two separate areas in the north-central portion of the site that were used for drum, refuse, and raw material storage from the 1940's to the 1970's. Early investigations indicated metals and VOCs in soil and VOCs and alcohols in groundwater. Soils from this SWMU were excavated during construction activities in the 1990's (Ref. 5), and the area has been capped with asphalt paving. Additional sampling and analysis conducted during 1997 also shows no soil contamination above New Jersey residential soil criteria (Ref. 5). No further soil action is planned. This area is within the current capture zone of the GWES, and contaminant concentrations have generally been declining over time (Ref. 7). DPE and bioremediation pilot studies were conducted in this area in 2003 and 2004 to evaluate the possibility of accelerating cleanup. As of May 2004, benzene and toluene are the only contaminants present above NJ GWQC (Ref. 7).

AOC 6, Aboveground Storage Tank (AST) Farms: This unit consists of four AST farms across the site that were previously used for storing raw materials, wastewater, and hazardous waste. All inactive ASTs have been decommissioned, and all active ASTs have been equipped with secondary containment and are inspected on a regular basis. Elevated levels of VOCs, semi-volatile organic compounds (SVOCs), and metals were detected in soil in some of the former AST locations. Groundwater contamination has also been observed in the vicinity of the tank farms. However, impacts reported in this location are being addressed in conjunction with corrective action for SWMUs 2 and 5 (as discussed above). Thus, no further soil action is planned, and groundwater cleanup and monitoring is ongoing.

AOC 8, Peninsula Area/MW-28: This AOC focuses on an area of light non-aqueous phase liquid (LNAPL) detected on groundwater in the vicinity of well MW-28 in the northeastern corner of the Schering site. LNAPL has been detected in this well during semiannual sampling events between 1992 and 1998 (Ref. 5). Soil sampling shows benzene, chloroform, and methylene chloride above relevant residential standards but below industrial standards (Ref. 5). Several VOCs were also reported in groundwater. This AOC is immediately upgradient and within the capture zone of the GWES, and significant VOC removal has been accomplished. DPE pilot studies were conducted in this area in 2003 and 2004, and in-situ bioremediation is being considered for 2005 in an attempt to accelerate cleanup. As of May 2004, several VOCs (including benzene, toluene, and chlorobenzene) remain above NJ GWQC in AOC 8 groundwater (Ref. 7).

References:

1. Remedial Investigation Report, Schering Corporation, Union, New Jersey. Prepared by Roy F. Weston, Inc. Dated June 1986.
2. Supplemental Remedial Investigation Report on Storage Tanks as Potential Sources of Contaminants, Schering Laboratories, Union, New Jersey. Prepared by Roy F. Weston, Inc.

Dated August 1989.

3. Supplemental Waste Disposal Pit Investigation Report, Schering Laboratories, Union, New Jersey. Prepared by Roy F. Weston, Inc. Dated August 1989.
4. Supplemental Remedial Investigation Report, Schering Corporation, Union, New Jersey. Prepared by Ebasco Environmental. Dated September 1990.
5. Comprehensive Site Conditions Report, Schering Corporation, 1095 Morris Avenue, Union, New Jersey. Prepared by Earth Tech. Dated May 24, 2000.
6. Semiannual Groundwater Extraction System Hydraulic Monitoring and Groundwater Quality Monitoring Report – May 2004. Prepared by Earth Tech, Inc. Dated July 2004.
7. Email correspondence from Bruce Sandmaier, Schering, to Shane Nelson, EPA Region 2. Re: Status of the SWMUs and AOCs at Schering Corporation Site. Dated August 24, 2004.

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:

Groundwater contamination was initially detected at the facility during the Phase II Hydrogeologic Study in 1984 (Ref. 1). This contamination was concentrated primarily beneath the plant production area, the former surface impoundments, and the fill area at the WWTP. Semiannual groundwater monitoring continues to show elevated levels of contamination, predominantly VOCs. Floating product (LNAPL) has also recently been reported at wells MW-24 and MW-28. Figure 2-1 from the May 2004 Semiannual Groundwater Monitoring Report (Ref. 11) shows the location of monitoring and extraction wells at Schering. Table 1 lists the highest concentrations of contamination detected on site during the most recent monitoring event in May 2004 (Ref. 11). Only those hazardous constituents exceeding NJ GWQC are included in the table. Comparing Table 1 with the monitoring well maps shows that, with the exception of tetrachloroethylene (PCE) and trichloroethylene (TCE) at shallow bedrock well BW-07, the highest on-site exceedances are located within the capture zone of the GWES.

Groundwater monitoring also shows some contamination at off-site wells on the eastern side of the Elizabeth River (Ref. 2). Table 2 presents the highest exceedances detected off site during the May 2004 monitoring event (Ref. 11). A review of the monitoring well map indicates that off-site exceedances are more widely distributed along the northern and eastern bank of the Elizabeth River.

Table 1. Maximum Concentrations Exceeding NJ GWQC in On-Site Groundwater in May 2004 (µg/L)

Compound	NJ GWQC	Overburden Aquifer		Shallow Bedrock Aquifer		Deep Bedrock Aquifer	
		Max Conc. *	Sample Location	Max Conc.	Sample Location	Max Conc.	Sample Location
Benzene	1	15,100	MW-28	41.9	BW-04S	–	–
Carbon tetrachloride	2	–	–	2.7	BW-14S	–	–
Chlorobenzene	50	290	MW-28	–	–	–	–

[1] "Contamination" and "contaminated" describe 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).

Compound	NJ GWQC	Overburden Aquifer		Shallow Bedrock Aquifer		Deep Bedrock Aquifer	
		Max Conc. *	Sample Location	Max Conc.	Sample Location	Max Conc.	Sample Location
Chloroform	6	35	MW-40	11.9	BW-04S	–	–
1,2-dichloroethane (DCA)	2	–	–	5.9	BW-04S	–	–
1,1-dichloroethene (DCE)	2	–	–	5	BW-14S	–	–
Tert-Butyl alcohol	100	–	–	574	BW-04S	–	–
Methylene chloride	3	–	–	19.3	BW-04S	–	–
PCE	1	–	–	29.5	BW-07	–	–
Toluene	1,000	42,400	MW-28	–	–	–	–
TCE	1	3.2	MW-40	11.1	BW-07	4.7	BW-14D
Bis(2-chloroethyl)ether	10	–	–	31.3	BW-04S	–	–
Isopropyl alcohol	100	110	MW-20	–	–	–	–
Lead	10	10.3	MW-28	–	–	–	–
Arsenic	8	20.4	MW-20	–	–	–	–

The NJ GWQC is the higher of the GWQC or the Practical Quantitation Level (PQL).

– Concentrations were below standards or nondetected.

* Certain analyses were performed with elevated detection limits (above NJ GWQC).

Table 2. Maximum Concentrations Exceeding NJ GWQC in Off-Site Groundwater in May 2004 (µg/L)

Compound	NJ GWQC	Overburden Aquifer		Shallow Bedrock Aquifer		Deep Bedrock Aquifer	
		Max Conc. *	Sample Location	Max Conc.	Sample Location	Max Conc.	Sample Location
Benzene	1	47.1	PE-02D	–	–	–	–
Carbon tetrachloride	2	2.2	PE-08D	17.4	BW-12S	3.9	BW-12D
Tert-Butyl alcohol	100	667	PE-02D	–	–	–	–
PCE	1	21	PE-11D	1.8	BW-10S	–	–
TCE	1	20.6	PE-13D	13	BW-10S	–	–
Bis(2-chloroethyl)ether	10	18.8	PE-02D	–	–	–	–
Lead	10	27	PE-05S	–	–	–	–
Chromium	100	3,880	PE-06D	–	–	–	–
Nickel	100	1,500	PE-06D	–	–	–	–

The NJ GWQC is the higher of the GWQC or the Practical Quantitation Level (PQL).

– Concentrations were below standards or nondetected.

* Certain analyses were performed with elevated detection limits (above NJ GWQC).

As outlined in the most recent Semiannual Groundwater Monitoring Report (Ref. 11), several plumes of contamination can be identified in the groundwater. The highest concentrations of benzene in shallow groundwater are focused in the northeastern corner of the site adjacent to the Elizabeth River, roughly centered around well MW-28. Another large plume of benzene contamination in shallow groundwater is centered beneath the plant production area with a finger extending northward across the river to well PE-02D. Toluene and chlorobenzene plumes are present in similar locations in shallow groundwater, but with much smaller areas. Two small chloroform plumes also exist in shallow groundwater, west of the benzene and chlorobenzene plumes. Two areas of carbon tetrachloride exceedances have also been

identified in bedrock groundwater. A very small area of carbon tetrachloride contamination surrounds nested well BW-14. A larger area of carbon tetrachloride is present in bedrock groundwater beneath the northern peninsula of the site and extending northwest across the Elizabeth River, with the highest concentrations centered around well BW-12S. A small area of chloroform exceedances is also present in bedrock groundwater beneath the production area around well BW-04S.

While some of the reported contamination in groundwater (e.g., benzene, toluene, alcohols) appears to be site-related, Schering contends that other contaminants originate from off-site sources. TCE and PCE reported in groundwater along Schering's northeastern property boundary appear to be migrating toward the site from off-site sources due to pumping at the GWES and on-site production wells. According to available records, these chlorinated solvents and related breakdown products were never stored on site in bulk and were detected at low levels (2 parts per million [ppm] of PCE and 25 ppm of 1,1-DCE) in only one on-site soil boring (boring I-9) back in 1985. TCE and PCE have also been only sporadically reported in shallow on-site groundwater (one occurrence in selected wells in 1985), with the exception of more recent detections in shallow overburden well MW-40 and bedrock groundwater wells BW-06 and BW-07. These wells are three of the most downgradient wells on the Schering property and would be more likely to show the effects of contaminant intrusion onto the site than other, more interior monitoring wells.

The spatial distribution of contaminant concentrations also supports the conclusion that TCE and PCE in Schering groundwater is not site-related. For example, the highest TCE detections in off-site shallow groundwater are consistently higher than the on-site maximum concentrations. In May 2004, the off-site maximum TCE concentration was 20.6 ppm, whereas the on-site maximum was only 3.2 ppm (Ref. 11). Furthermore, PCE was not reported above the NJ GWQC in any of the on-site shallow overburden wells, but does appear in off-site shallow wells up to 21 ppm. Finally, the detection of various chlorinated solvents in shallow bedrock groundwater but not in overlying overburden groundwater suggests lateral movement of contamination from off site rather than vertical migration from on-site sources in the soil. This conclusion has been presented in numerous semiannual groundwater monitoring reports. However, soil vapor samples collected during the in-situ remediation pilot study contained PCE and TCE, raising the possibility that these constituents may, in fact, be present in site soil (Ref. 8). Although NJDEP has not required additional soil investigation to locate any such sources (Ref. 9), they continue to request concrete evidence from Schering that the chlorinated solvent contamination is completely attributable to off-site sources (Ref. 7). Nevertheless, in a recent letter to the facility (Ref. 10), NJDEP identifies PCE and TCE as contaminants originating from off-site sources. Because these contaminants are presumed to be unrelated to the Schering site at this time, TCE and PCE contamination in groundwater will not be further addressed in this EI determination.

References:

1. Phase II Hydrogeologic Study, Schering Corporation, Union, New Jersey. Prepared by Roy F. Weston, Inc. Dated November 1984.
2. Remedial Investigation Report, Schering Corporation, Union, New Jersey. Prepared by Roy F. Weston, Inc. Dated June 1986.
3. Supplemental Waste Disposal Pit Investigation Report, Schering Laboratories, Union, New Jersey. Prepared by Roy F. Weston, Inc. Dated August 1989.
4. Supplemental Remedial Investigation Report on Storage Tanks as Potential Sources of Contaminants, Schering Laboratories, Union, New Jersey. Prepared by Roy F. Weston, Inc. Dated August 1989.
5. Supplemental Sampling Report, Schering Corporation, Union, New Jersey. Prepared by IT

Corporation. Dated January 2000.

6. Comprehensive Site Conditions Report, Schering Corporation, 1095 Morris Avenue, Union, New Jersey. Prepared by Earth Tech. Dated May 24, 2000.
7. Letter from John Doyon, NJDEP, to Lawrence Adrian Jr., Schering. Re: Schering Correspondence Dated January 28, 2002 in Response to the Department's Letter Dated November 15, 2001. Dated July 10, 2002.
8. Letter from Larry Adrian Jr., Schering, to John Doyon, NJDEP. Re: In Situ Remediation Pilot Study Report. Dated August 7, 2002.
9. Letter from John Doyon, NJDEP, to Bruce Sandmaier, Schering. Re: Response to Various NJDEP Correspondence and GWES Hydraulic Monitoring and Semiannual Groundwater Monitoring Report Dated July 31, 2002. Dated June 2, 2003.
10. Letter from John Doyon, NJDEP, to Bruce Sandmaier, Schering. Re: Semiannual GWES Hydraulic Monitoring and Groundwater Monitoring Report – May 2003. Dated January 12, 2004.
11. Semiannual Groundwater Extraction System Hydraulic Monitoring and Groundwater Quality Monitoring Report – May 2004. Prepared by Earth Tech, Inc. Dated July 2004.

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:

Background

Groundwater beneath the Schering facility occurs at approximately 10 feet below ground surface across most of the site. The uppermost (overburden) aquifer beneath the facility is located in unconsolidated glacial, fill and alluvial deposits of the Elizabeth River (Ref. 1). Groundwater in this unit flows to the north and northeast in the general direction of the GWES and the Elizabeth River. The GWES wells are located less than 100 feet from and generally follow the curve of the Elizabeth River. Available water level data show shallow groundwater moving toward the GWES from both sides (including beyond the river off site to the northeast). Under current pumping conditions, the river does not appear to act as a hydraulic boundary to flow entering the Schering site from adjacent properties to the northeast.

At a depth of approximately 20 to 35 feet, the overburden aquifer is underlain by a fractured bedrock aquifer. The bedrock beneath the facility is comprised of the Passaic Formation (formerly referred to as the Brunswick formation), a shale with sandstone and siltstone interbeds. Groundwater in the bedrock aquifer generally flows northeast toward the GWES and Elizabeth River in both the shallow and deep zones. However, in upgradient areas of the site at the southern end of the study area, flow is more vertically downward toward on-site production wells PW-2 and PW-3 (Refs. 2 and 5). Bedrock groundwater flow northeast of the site is also toward the river, and appears to be influenced by pumping from the GWES and on-site production wells.

Hydraulic Control in Overburden and Shallow Bedrock Groundwater

As stated previously, the facility operates a GWES to control and extract contaminated groundwater beneath the production area of the facility. The GWES was installed in 1993 and brought on line in 1994.

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[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.

The GWES recovers groundwater at an average design flow of 25 to 30 gallons per minute (Ref. 6). Operation of the GWES creates a linear depression in water levels slightly upgradient of the river as shown on Figure 2-1 from the Semiannual Groundwater Monitoring Report for May 2004 (Ref. 6). According to the CSCR (Ref. 4), ongoing operation of the GWES creates a zone of influence within both the overburden and shallow bedrock aquifers.

To assess effectiveness of the GWES in preventing further contaminant migration, Schering collects semiannual water level measurements in on- and off-site wells. The most recent water level measurements were collected in April 2004. According to the Semiannual Groundwater Monitoring Report for May 2004 (Ref. 6), these measurements show that both overburden and shallow bedrock groundwater is drawn toward the GWES from: (1) the main on-site production area, (2) on-site areas between the Elizabeth River and the GWES, (3) off-site areas across the river, and (4) the river itself. On site, overburden and shallow bedrock groundwater flows to the northeast, and contamination from the main production area is captured by the GWES before leaving the site. Beyond the river, off-site groundwater in the overburden and shallow bedrock flows southwesterly back toward the Elizabeth River and the GWES. Both site-related and non-site-related contamination are present in this area.

Surface water levels in the Elizabeth River are higher than those recorded at adjacent monitoring and extraction wells in the vicinity of the GWES (Ref. 6). These data indicate that contaminated overburden and shallow bedrock groundwater within the GWES capture zone does not discharge into the river from the Schering property. However, surface water levels are below water levels measured in wells on the northeastern (off site) side of the Elizabeth River. Impacted groundwater flowing back toward the site and GWES from the northeast does appear to discharge to surface water.

At the extreme eastern and western ends of the Schering site, groundwater flow does not appear to be influenced by GWES pumping. As a result, shallow groundwater in the western corner of the site around monitoring wells MW-14, MW-15, and MW-39 flows north and northwest. Groundwater at the opposite end of the site near wells MW-07, MW-30, and BW-07 flows eastward toward and discharges into the Elizabeth River. However, because site-related contamination has not been reported above NJ GWQC in these areas, this lack of hydraulic control is not a concern.

Hydraulic Control in Deep Bedrock Groundwater

Groundwater in the deep bedrock beneath the Schering site also flows northeastward toward the Elizabeth River. However, in the far interior sections of the property, groundwater flow is influenced by the two on-site production wells. Groundwater in this area also appears to move vertically downward from the overburden toward productions well in the bedrock aquifer. While this flow pattern has the potential to pull contaminants downward, none of the deep bedrock wells at Schering reported exceedances of site-related contamination during the most recent round of groundwater sampling (Ref. 6). As a result, hydraulic control over deep bedrock groundwater is not necessary in on-site areas.

Carbon tetrachloride is the only site-related contaminant reported above NJ GWQC in either shallow or deep bedrock groundwater off site. These impacts were reported north-northeast of the site at nested well BW-12, and are presumably related to contaminant migration that occurred prior to installation and startup of the GWES. Water level measurements presented in the most recent Semiannual Groundwater Monitoring Report show both shallow and deep bedrock groundwater in this area flowing from the northeast toward the site, the Elizabeth River, and the GWES (Ref. 6).

Concentration Reductions

A review of historical and current groundwater data shows significant decreases in contaminant concentrations (Ref. 6). Benzene concentrations in on-site well MW-28 dropped from 24,700 µg/L in May 2003 to 15,100 µg/L in May 2004. In off-site well PE-02D, benzene concentrations decreased from the historic high of 1,800 µg/L in May 1995 to 47.1 µg/L in May 2004. The chlorobenzene concentration of 290 µg/L that was detected in well MW-28 in May 2004 is substantially lower than the estimated concentration of 481 µg/L detected in the well in May 2003. Similarly, the toluene concentration reported in well MW-28 dropped from 64,200 µg/L to 42,400 µg/L between May 2003 and May 2004.

The areal extent of contaminant plumes also appears to have stabilized. While certain wells still contain concentrations of site-related contamination above NJ GWQC, these exceedances are reported in previously impacted areas. The combined influence of the GWES, the Elizabeth River, and pumping from the on-site production wells appears to control contaminant migration in groundwater at Schering (Ref. 6).

Interior Remediation Pilot Studies

Schering has conducted pilot studies involving in-situ DPE, biosparging, and enhanced bioremediation (Ref. 5). These efforts are intended to accelerate remediation of contaminant source areas within the Schering property. DPE technology was applied in locations with elevated VOCs. Biosparging was applied in locations with elevated alcohols and ketones and lower VOC concentrations. Groundwater monitoring results show that these pilot studies were successful in lowering contaminant concentrations around wells MW-15, MW-20, MW-24, and MW-28. A combined total of approximately 34 pounds of VOC mass were removed from the subsurface each day of DPE operations. Additional, expanded studies are planned, and corrective actions and semiannual groundwater monitoring are ongoing.

References:

1. Phase II Hydrogeologic Study, Schering Corporation, Union, New Jersey. Prepared by Roy F. Weston, Inc. Dated November 1984.
2. Remedial Investigation Report, Schering Corporation, Union, New Jersey. Prepared by Roy F. Weston, Inc. Dated June 1986.
3. Supplemental Sampling Report, Schering Corporation, Union, New Jersey. Prepared by IT Corporation. Dated January 2000.
4. Comprehensive Site Conditions Report, Schering Corporation, 1095 Morris Avenue, Union, New Jersey. Prepared by Earth Tech. Dated May 24, 2000.
5. In-situ Remediation Extended Pilot Study Interim Report. Prepared by Earth Tech, Inc. Dated January 2004.
6. Semiannual Groundwater Extraction System Hydraulic Monitoring and Groundwater Quality Monitoring Report – May 2004. Prepared by Earth Tech, Inc. Dated July 2004.

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:

The Elizabeth River is located immediately north and east of the Schering site and has historically received groundwater discharge from the Schering area. To minimize contaminant migration toward the river and other off-site areas, Schering installed a GWES immediately upgradient and roughly following the curve of the Elizabeth River downgradient of the main production areas. Continuous operation of the GWES since 1994 has created a depression in groundwater levels just upgradient of the river, and surface water levels are now higher than those measured in adjacent wells. Consequently, within the area of GWES influence (where all on-site groundwater contamination is located), overburden and shallow bedrock groundwater from the Schering site does not reach the Elizabeth River. No site-related contamination was reported in deeper bedrock groundwater beneath the Schering property.

Away from the GWES and outside the capture zone, shallow groundwater in the vicinity of wells MW-07, MW-30, and BW-07 does appear to flow eastward toward and into the Elizabeth River. However, no site-related groundwater exceedances have been reported in this area (Ref. 2). Thus, groundwater beneath this portion of the Schering site is not considered "contaminated" and should not negatively impact surface water quality.

Site-related groundwater contamination flowing toward the Elizabeth River from the northeast (off site) does appear to discharge to surface water. Recent water level measurements show off-site groundwater moving toward and upward into the river from both the off-site overburden and bedrock aquifers. The river's influence has been observed even into the deep bedrock aquifer northwest of the Schering site (Ref 2).

References:

1. Semiannual Groundwater Extraction System Hydraulic Monitoring and Groundwater Quality Monitoring Report – November 2003. Prepared by Earth Tech, Inc. Dated January 2004.
2. Semiannual Groundwater Extraction System Hydraulic Monitoring and Groundwater Quality Monitoring Report – May 2004. Prepared by Earth Tech, Inc. Dated July 2004.

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 ecosystems 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[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 ecosystem.

_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:

As stated in the responses to Questions 3 and 4, site-related groundwater contamination that had migrated off site prior to initiating GWES operations in 1994 now flows southwest back toward the Elizabeth River and on-site extraction wells. To determine if these discharges are significant, groundwater contaminant concentrations closest to the river have been compared to applicable NJ GWQC (multiplied by a factor of ten to account for dilution and mixing). As shown in Table 3 below, three constituents of concern were reported at levels greater than ten times the relevant NJ GWQC in May 2004 (Ref. 1).

Table 3. Maximum Site-Related Groundwater Exceedances Off Site and Adjacent to the Elizabeth River (ug/L)

Contaminant	NJ GWQC	10 x NJ GWQC	Maximum Concentration	Well	Potentially Significant?
Benzene	1	10	47.1	PE-02D	Y
Chromium	100	1,000	3,880	PE-06D	Y
Nickel	100	1,000	1,500	PE-06D	Y

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

References:

1. Semiannual Groundwater Extraction System Hydraulic Monitoring and Groundwater Quality Monitoring Report – May 2004. Prepared by Earth Tech, Inc. Dated July 2004.

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 ecosystems 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 ecosystems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR 2) providing or referencing an interim-assessment[5], appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialist, including an ecologist) adequately protective of receiving surface water, sediments, and ecosystems, 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 ecosystem.

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

Rationale:

Discharge of site-related contamination to the Elizabeth River is believed to be insignificant for several reasons, as discussed below.

Current Corrective Action Strategy

Prior to installation and operation of the GWES, contamination from the Schering site spread into off-site areas to the northeast. As a condition of the existing ACO, Schering is required to attain and demonstrate hydraulic control over groundwater contamination (Ref. 3). To achieve this objective, Schering installed and initiated operation of the GWES in 1993 and 1994. Ongoing pumping of the GWES has been shown

[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.

to draw overburden and shallow bedrock groundwater from the southwest (on site) and the northeast (on site and off site). Short of constructing off-site extraction wells, groundwater contamination already located off site cannot be prevented from entering the river as it is pulled back toward the GWES.

Surface Water Sampling Data

Surface water samples were collected adjacent to the Schering site in 1999 and 2000 (Ref. 1). Analytical results for these samples revealed only a limited number of contaminants above surface water standards present throughout the study area (upstream and downstream). The two main contaminants in surface water, TCE and PCE, are not attributable to the Schering site (as outlined above in the response to Question 2). Furthermore, the report concluded that groundwater to surface water discharges from Schering that may have occurred prior to installation of the GWES were not responsible for the observed impacts.

As stated previously, the concentration of benzene in well PE-02D has dropped significantly from a historic high of 1,800 µg/L in May 1995 to 47.1 µg/L in May 2004 (Ref. 3). Concentrations of chromium and nickel in the vicinity of co-located wells PE-05S and PE-06D have also dropped substantially. In May 2000, the chromium concentration in this area was reported as 87,500 µg/L (Ref. 1), whereas the total chromium value in May 2004 was only 3,880 µg/L (Ref. 3). Similarly, the total nickel concentration in this area dropped from 4,910 µg/L to 1,500 µg/L between May 2000 and May 2004 (Refs. 1 and 3). Because surface water quality was not adversely affected by contaminant concentrations being pulled toward and discharging into the Elizabeth River in 1999 and 2000, it is reasonable to assume that the current concentrations (which are lower than those measured in 2000) will have no significant impact on surface water quality in the river.

References:

1. Surface Water and Sediment Sampling and Analysis Report. Prepared by Earth Tech. Dated May 1, 2000.
2. Semiannual Groundwater Monitoring Report for May 2000. Prepared by Earth Tech. Dated July 28, 2000.
3. Semiannual Groundwater Extraction System Hydraulic Monitoring and Groundwater Quality Monitoring Report – May 2004. Prepared by Earth Tech, Inc. Dated July 2004.

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:

In accordance with the ACO, Schering has implemented an ongoing groundwater monitoring program. The program is designed to provide data on groundwater quality, monitor trends in contaminant concentrations and plume extent, and assess effectiveness of hydraulic controls (e.g., GWES operations, surface water interaction, and production well pumping). Groundwater samples and water level measurements are collected both on and off site from both the shallow overburden and bedrock aquifers. Although some wells are sampled annually (in locations where historical sampling shows little or no site-related contamination), most wells in the monitoring program are sampled on a semiannual basis. Analytes include VOCs, SVOCs, low molecular weight alcohols (e.g., methanol, isopropyl alcohol), priority pollutant metals, various nonhazardous metals, and other geochemical parameters. Specific details on the current groundwater monitoring program are presented in Tables 1-1 and 4-1 of the Semiannual Groundwater Monitoring Report for May 2004 (Ref. 2).

Monitoring activities are also in place to assess the effectiveness of ongoing DPE and/or biosparging pilot study efforts around wells MW-15, MW-20, MW-24, and MW-28. Additional detail on these sampling efforts is provided in the In-situ Remediation Extended Pilot Study Interim Report (Ref. 1).

References:

1. In-situ Remediation Extended Pilot Study Interim Report. Prepared by Earth Tech, Inc. Dated January 2004.
2. Semiannual Groundwater Extraction System Hydraulic Monitoring and Groundwater Quality Monitoring Report – May 2004. Prepared by Earth Tech, Inc. Dated July 2004.

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 Schering Corporation Facility, EPA ID# NJD001317601, located at 1011 Morris Avenue, in Union, New Jersey. 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: _____ Date:_____

Michele Benchouk
Environmental Consultant
Booz Allen Hamilton

Reviewed by: _____ Date:_____

Lucas Kingston
Hydrogeologist
Booz Allen Hamilton

_____ Date:_____

Shane Nelson, RPM
RCRA Programs Branch
EPA Region 2

_____ Date:_____

Barry Tornick, Section Chief
RCRA Programs Branch
EPA Region 2

Approved by: original signed by: Date: 9/23/2004

Adolph Everett, Chief
RCRA Programs Branch
EPA Region 2

Locations where references may be found:

References reviewed to prepare this EI determination are identified after each response. Reference materials are available at the USEPA Region 2, RCRA Records Center, located at 290 Broadway, 15th Floor, New York, New York, and the New Jersey Department of Environmental Protection Office located at 401 East State Street, Records Center, 6th Floor, Trenton, New Jersey.

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Attachments

The following attachment has been provided to support this EI determination.

- Attachment 1 — Media Impacts Summary Table

Attachment 1 — Summary of Media Impacts Table
Schering Corporation

	GW	AIR (Indoors)	SURF SOIL	SURF WATER	SED	SUB SURF SOIL	AIR (Outdoors)	CORRECTIVE ACTION MEASURE	KEY CONTAMINANTS
SWMU 1. Former Railroad Siding Area	Yes	No	No	No	No	No	No	▸ GWES ▸ Soil Removal ▸ Capping* ▸ In-situ bioremediation pilot study	VOCs, alcohols, metals
SWMU 2. Industrial Sewer Line	Yes	No	No	No	No	No	No	▸ GWES ▸ Capping* ▸ DPE pilot study ▸ In-situ bioremediation pilot study	VOCs, SVOCs, alcohols
SWMU 3. Four Surface Impoundments	Yes	No	Yes	No	No	Yes	No	▸ GWES ▸ Capping* ▸ DPE pilot study	VOCs, metals
SWMU 4. Waste Solvent Pit	NA	NA	NA	NA	NA	NA	NA	NFA	NFA
SWMU 5. Unpaved Drum Storage Area	Yes	No	No	No	No	No	No	▸ GWES ▸ Soil Removal ▸ Capping* ▸ DPE pilot study ▸ In-situ bioremediation pilot study	VOCs
AOC 6. Aboveground Storage Tank Farms	Yes	No	No	No	No	No	No	▸ GWES ▸ Capping* ▸ DPE pilot study ▸ In-situ bioremediation pilot study	VOCs, SVOCs, metals
AOC 7. Underground Storage Tanks	Yes	No	No	No	No	No	No	▸ GWES ▸ Capping*	VOCs, SVOCs
AOC 8. Peninsula Area/ MW-28	Yes	No	Yes	No	No	Yes	No	▸ GWES ▸ Capping*	VOCs, LNAPL
AOC 9. Backfilled Area	Yes	No	No	No	No	No	No	▸ GWES ▸ Capping*	VOCs

* Capping consists of asphalt pavement and/or building