DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA750)
Migration of Contaminated Groundwater Under Control

Facility Name: **ETHICON, Inc.**
Facility Address: **Route 22 West, Bridgewater, New Jersey, 08876**
Facility EPA ID#: **NJD002144145**

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 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 objectives 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 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).

Facility Information

The ETHICON, Inc., facility is located on gently rolling terrain in Bridgewater, New Jersey, on the north side of Route 22 and northwest of the Borough of Somerville. A public high school is located north of the site, and a golf course lies south of the site and Route 22. Peters Brook, a small stream trending

generally north-south, forms the eastern property boundary. The adjacent property to the east, previously owned by ETHICON, was sold to SJP Properties (SJP) in 1985. SJP built an office complex (five office buildings, a parking garage, and various parking lots) on that portion of the property in the late 1990s. Residential areas are located west and northeast of the site.

The northern portion of the ETHICON site currently contains a cluster of buildings, and the southern portion consists of parking lots, roads, and open space. Currently, the site is used for office work, research, storage, and a limited amount of manufacturing. Approximately 1,300 people are currently employed at the facility.

Historically, the ETHICON site was used for manufacturing of healthcare products, storage, and offices. The Needle Area, referred to as Area O, has been identified as a source of tetrachloroethylene (PCE) in groundwater. This area is located between the ATC Building and Buildings G and O, and used significant quantities of PCE between 1972 and the early 1980s to degrease wire prior to processing. During that period, two 550-gallon aboveground storage tanks (ASTs) were used to store virgin and waste PCE. Prior to and after that period, PCE was obtained and disposed of in 55-gallon drums. PCE use was discontinued at ETHICON in the mid-1980s.

Investigation of the ETHICON site began in 1983, when nine monitoring wells were installed and sampled for the first time. Soil and surface water investigations began in 1984. The New Jersey Department of Environmental Protection (NJDEP) has overseen the investigation of over 30 separate areas of concern (AOCs) at the current site and on the adjacent property now owned by SJP. NJDEP has approved no further action (NFA) for all soil AOCs. Groundwater remediation has been ongoing since 1987.

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 Areas of Concern (AOCs):

As part of previous site investigations, ETHICON identified 24 AOCs, 15 tanks, and four additional areas not included in the NJDEP record. Attachment 1 provides an AOC Status Summary compiled by ARCADIS to support the CA725 EI determination (Ref. 3). As indicated in the attachment, ETHICON has received NFA or equivalent determinations from NJDEP for all soil-based AOCs and tanks. AOC O, addressing the two former 500-gallon PCE ASTs (virgin and waste), received NFA for soil as part of AOC Y, but groundwater remediation is continuing as a component of corrective action for the original AOC O (Ref. 4).

Investigations have been completed at the four additional areas, with no evidence of historic releases detected at the Area Around B-29, the Area Around B-43, and the Observed Surface Debris area (Ref. 1). All buried material at the Former Private Disposal Area was removed in 1987, and NJDEP determined that NFA was appropriate based on the low concentrations of pesticides and volatile organic compounds (VOCs) in the post-excavation confirmation samples (Ref. 1).

Drawing 3 from the June 2008 Site Conceptual Model Summary (Ref. 4) shows the historic AOCs and the active remedial area – Area O. Additionally, ETHICON has acknowledged the presence of a chloroform source area on the current SJP Properties site; this contamination has been attributed to AOC E and is referred to as the empty drum storage area (Refs. 1 and 4). During investigations of this AOC in 1987, three concrete pits were located and excavated. Underlying soils were also excavated down to bedrock between 10 and 20 feet below ground surface (bgs). Confirmatory sampling indicated that residual chloroform concentrations were well below the New Jersey Impact to Groundwater Soil Cleanup Criterion of 1 milligram per kilogram (Ref. 2). Consequently, NJDEP approved NFA for AOC E in 1992 (Ref. 3).

References:

1. Review of Soil Areas of Concern. Prepared by ARCADIS G&M, Inc. Dated July 2006.
2. Memorandum from Eric Killenbeck, ARCADIS U.S., Inc., to Sameh Abdellatif, USEPA, re: Chloroform on SJP Properties. Dated September 28, 2006.
3. Determination of Environmental Indicator Determination, RCRA Corrective Action, Environmental Indicator (EI) RCRIS Code (CA725), Current Human Exposures Under Control, ETHICON facility, Bridgewater, New Jersey. Prepared by Booz Allen Hamilton. Dated September 29, 2006.
4. Memorandum from Eric Killenbeck, ARCADIS U.S., Inc., to Sameh Abdellatif and Barry Tornick, USEPA, re: Site Conceptual Model Summary. Dated June 30, 2008.

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 Conditions

The site geology is characterized by a 10 to 20 feet of overburden consisting of sands, silts, and clays. The overburden is underlain by bedrock consisting of shale, siltstone, and sandstone. The bedrock is weathered through the uppermost approximately ten feet and is underlain by competent rock. Bedding planes strike northwest-southeast and dip to the northeast at 7 to 12 degrees. Sub-vertical fractures are present (Ref. 3).

Geophysical and lithologic logging indicate that competent bedrock can be divided into shallow and deep units. Shallow bedrock "was defined by generally having few horizontal hairline fractures, and regular occurrence of weathered zones," and deeper bedrock "has a greater number of hairline and discontinuous fractures and fewer weathered zones than the shallow." Four major groupings of fractures have been identified within competent bedrock: 23 to 43 feet (ft) below ground surface (bgs) (weathered and shallow bedrock), 50 to 60 ft bgs, 70 to 82 ft bgs, and 86 to 100 ft bgs (deeper bedrock) (Ref. 3).

Groundwater primarily occurs and flows southeast along bedding plane fractures in the direction of strike. Depth to water typically ranges from approximately 5 to 30 feet bgs with shallower depths in the vicinity of Peters Brook (Ref. 3). Groundwater elevations and flow directions observed in February and August 2007 are illustrated in Drawings 4 and 5, respectively, from the 2007 Annual Groundwater Cleanup Monitoring/Progress Report (Ref. 1). The sub-vertical fractures mentioned above reportedly "play little role in controlling site-wide flow paths" (Ref. 3).

Groundwater Quality

A total of 77 on-site and off-site wells have been installed to investigate and monitor groundwater quality at and around the ETHICON site (Ref. 2). ETHICON implemented a well abandonment program in the late 1990s and early 2000s to reduce the number of active monitoring wells, based on consistent absence of site-specific constituents of concern (COCs) and other considerations. At present, ETHICON conducts several separate groundwater monitoring programs at the remaining wells, as indicated in Table 1 of the 2007 Annual Groundwater Cleanup Monitoring/Progress Report (Ref. 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).

- Operational groundwater sampling is conducted quarterly to monitor effectiveness of ongoing treatment operations. Nine monitoring wells are sampled for VOCs and total organic carbon (TOC). Two injection wells are sampled for TOC analysis. Six of these monitoring wells are located in the source area and are also analyzed for dissolved gases.

- Semi-annual compliance and performance monitoring is performed at 19 monitoring wells and two injection wells. All of the wells are sampled and analyzed for VOCs. Ten monitoring wells are sampled and analyzed for dissolved gases. Two monitoring wells are sampled and analyzed for total and dissolved iron and chloride. Ten monitoring wells and two injection wells are sampled and analyzed for TOC.

- Groundwater sampling pursuant to the facility's New Jersey Pollutant Discharge Elimination System (NJPDES) is conducted semi-annually at four wells. These samples are analyzed for sulfate, pH, total and dissolved iron, biochemical oxygen demand (BOD), and chemical oxygen demand (COD).

Groundwater COCs at the ETHICON site include chloroform, PCE, and associated degradation products – cis-1,2-dichloroethylene (cis-1,2-DCE), trichloroethylene (TCE), and vinyl chloride (VC). The latest, most complete set of monitoring results for this site was obtained during a February 2008 sampling event (Ref. 3). Table 1 presents a summary of groundwater concentrations detected above the New Jersey Groundwater Quality Criteria (NJ GWQC) during this sampling event. Drawing 2 from the 2007 Annual Groundwater Cleanup Monitoring/Progress Report (Ref. 1) depicts the monitoring and injection well locations.

Table 1: Maximum Detections of COCs Above Relevant NJ GWQC, in micrograms per liter (μg/L) (February 2008)

Constituent	NJ GWQC	Maximum On-Site Concentration	On-Site Well	Maximum Off-Site Concentration	Off-Site Well
PCE	1	1,840	MW-05	33.5	MW-15
TCE	1	3,280	IW-14	17.4	MW-09
cis-1,2-DCE	70	130,000	MW-20D	154	MW-09
VC	1	7,040	MW-20S	1.8	MW-09
Chloroform	70	0.9 J	IW-05	1,220	MW-31

Source: Reference 4

The highest on-site COC concentrations were reported in wells IW-05, IW-14, MW-05, MW-20S, and MW-20D. The highest off-site COC concentrations were reported in wells MW-09, MW-15, and MW-31. As indicated in Table 1, with the exception of chloroform, on-site COC concentrations are significantly higher than downgradient, off-site concentrations. Current data further indicate that the PCE groundwater plume extends southeast from the on-site source area at Area O, through the in-situ groundwater treatment area (discussed further in the response to Question 3), and off site toward well MW-29. Elevated chloroform concentrations are limited to the vicinity of the drum storage area at AOC E and well MW-31.

References:

1. 2007 Annual Groundwater Cleanup Monitoring/Progress Report. Prepared by ARCADIS. Dated March 2008.
2. Email correspondence from Vincent Mignone, ETHICON, Inc., to Sameh Abdellatif and Barry Tornick, USEPA, re: *Date Range of MW Data.pdf*. Dated May 9, 2008.
3. Memorandum from Eric Killenbeck, ARCADIS U.S., Inc., to Sameh Abdellatif and Barry Tornick, USEPA, re: Site Conceptual Model Summary. Dated June 30, 2008.
4. Memorandum from Eric Killenbeck, ARCADIS U.S., Inc., to Sameh Abdellatif and Barry Tornick, USEPA, re: Response to Email Comments from USEPA. Dated July 2, 2008.

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:

Implemented Remedial Actions for Groundwater

Groundwater investigations were initiated at the ETHICON site in 1983, and groundwater remediation has been underway since 1987. A on-site groundwater pump and treat system was implemented in the source area at Area O in 1987 with the installation of recovery wells MW-5 and MW-20, which discharged water to the local Publicly Owned Treatment Works (POTW). In 1988, soil excavations were completed down to bedrock at Area O to remove impacted soils. The pump and treat system operated for 11 years and was enhanced with the addition of recovery wells MW-9 and VE-3D (Ref. 1).

The pump and treat system was later supplemented and ultimately replaced by more efficient remedial measures. In 1999, wells VE-2D, MW-6, and MW-40 were added to the pumping network. In 2002, an in-situ reactive zone plume cutoff system (referred to as Treatment Lines #1 and #2) was added downgradient of the source area and along the property boundary to control plume migration, which led to a discontinuation of pumping from off-site capture wells. Treatment Line #1 is ongoing, and currently receives six molasses injections per year at eight injection points. Use of Treatment Line #2 was discontinued in March 2006 due to the effectiveness of upgradient Treatment Line #1, and COC concentrations at Treatment Line #2 have not rebounded since that time. Additional mass removal has been performed in the source area using complementary technologies such as pneumatic fracturing, coupled with injection of nano-scale zero valence iron (ZVI). The NJDEP-approved groundwater remedy for off-site groundwater is monitored natural attenuation (MNA) (Ref. 1).

Current Status of Stabilization

Based on all available information, contaminated groundwater at the ETHICON facility appears to have stabilized as evidenced by the following conditions:

[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.

1. Remedial measures have been effective at reducing PCE concentrations in the source area and at the property boundary (Treatment Lines #1 and #2) through mass removal and degradation to byproducts cis 1,2-DCE, and VC. Evidence for the effectiveness of these measures is demonstrated by decreasing PCE concentrations in monitoring wells located at the source area. Table 2 presents PCE concentrations for wells MW-20S, MW-20D, and MW-53, which are located in the vicinity of Area O. As shown, PCE concentrations have decreased by several orders of magnitude over the last three (well MW-53) to seven (wells MW-20S and MW-20D) years.

Table 2: PCE Concentrations Over Time in Source Area Wells, in μg/L

Well	PCE Concentration	
	December 2000 Data	February 2008 Data
MW-20S	108,000	137
MW-20D	13,000	ND (<500)
MW-53	17,400*	12.8

* Earliest data available for MW-53 is from May 5, 2005
Source: Reference 2

2. COC concentrations at the leading edge of the plume are stable or declining. The PCE plume extends from the source area, through the treatment lines and medial plume wells (MW-7, MW-9, MW-31, and MW-51), and toward MW-29. Well MW-29 reports relatively low concentrations of PCE and forms the leading edge of the plume. Lateral plume boundaries on either side of MW-29 are defined by historic non-detections of COCs in adjacent wells MW-25 and MW-49.

   Table 3 presents COC concentrations at well MW-29 obtained from sampling events completed in February 2003 and February 2008. The table indicates that PCE concentrations have declined from a concentration of 9.9 μg/L in 2003 to 3.5 μg/L in 2008. Review of the entire historic record of water quality data from well MW-29 can be considered stable over time. However, it should be noted that PCE concentrations in well MW-29 are highly variable and have fluctuated by an order of magnitude within relatively short time frames. ETHICON has explained that this variability, which ranges between 1 and 11.2 μg/L, is due to a change in sampling methodology from the three well volume approach to the use of passive diffusion bag (PDB) samplers, and a period of procedure adjustment (Ref. 2). ETHICON explains that the change was made in August 2005 and that adjustments were made to the methodology through 2006 to identify the sampling intervals with the highest COC concentration and set the PDB samplers at those locations.

   Table 3 also presents chloroform concentrations at well MW-31 obtained from sampling events completed in February 2003 and February 2008 (although positive detections of other COCs were reported during both sampling events, for purposes of this discussion, this portion of Table 3 focuses only on chloroform). The table indicates that chloroform concentrations have increased from a concentration of 429 μg/L in 2003 to 1,220 μg/L in 2008. Despite this apparent increase in chloroform levels, review of the entire historic record of water quality data from well MW-31 indicates that chloroform concentrations can be considered stable over time. However, the chloroform concentrations in well MW-31 are also highly variable and have fluctuated by over an order of magnitude within relatively short time frames. As stated above, ETHICON has explained that some of the recent variability is due to a change in sampling methodology from the three well volume ap`proach to the use of PDB samplers. The change was made in May 2005, and was followed by a period of procedure adjustment (Ref. 2). Analytical results from samples collected at five discrete intervals within well MW-31 have indicated that the PDB samplers are being placed at the interval containing the highest COC concentrations.

Table 3: Contaminant Concentrations Over Time in Wells at the Leading Edge of the Plume, in µg/L

Well	Analyte	NJ GWQC	February 2003 Data	February 2008 Data
MW-29	PCE	1	9.9	3.5
	TCE	1	0.35 J	ND
	cis-1,2-DCE	70	<5	ND
	VC	1	<1	ND
	Chloroform	70	2.2 J	ND
MW-31	Chloroform	70	429	1,220

Source: Reference 2
Wells MW-25 and MW-49 flank MW-29 and help define the leading edge of the plume. These wells were previously monitored, but were removed from the monitoring programs following consistent non-detections of COCs.

Upon review of ETHICON's Site Conceptual Model Summary (Ref. 1), NJDEP concluded that "ground water quality at the end of the plume has been stable and slowly declining. The downgradient monitoring well (MW-29) represents the limits of the plume and there is no need for additional delineation at this time downgradient of this point" (Ref. 3).

References:

1. Memorandum from Eric Killenbeck, ARCADIS U.S., Inc., to Sameh Abdellatif and Barry Tornick, USEPA, re: Site Conceptual Model Summary. Dated June 30, 2008.
2. Memorandum from Eric Killenbeck, ARCADIS U.S., Inc., to Sameh Abdellatif and Barry Tornick, USEPA, re: Response to Email Comments for the USEPA. Dated July 2, 2008.
3. Email from Sylvia Pearce, NJDEP, to Sameh Abdellatif and Barry Tornick, USEPA, re: Ethicon E86001. Dated August 6, 2008.

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:

Peters Brook is a small stream trending generally north-south, which forms the eastern property boundary and is approximately 10 to 30 feet wide (Ref. 1). Based on water level measurements, Peters Brook is a gaining stream (Ref..2&3). The Baseline Ecological Evaluation (BEE) completed in 2005 states that groundwater discharge to the Brook is possible (Ref. 2). However, it is not very deep and it is known that VOC contamination migrated under Peters Brook which resulted in significant PCE contamination discussed in response to Question 3.

There is significant evidence that PCE concentrations are decreasing as a result of the Enhanced Reductive De-chlorination (ERD) system. This consists of molasses injection into the shallow and deep zones in the source area and an in-situ reactive zone (IRZ) treatment barrier at the property line, adjacent to Peters Brook. Ethicon also injected ZVI along with the molasses through the source area to maximize the rate of contaminant destruction in, and downgradient of the source area. Data collected over the past several years indicate that the ERD system has effectively cut off dissolved shallow groundwater plume at the property boundary (Ref. 4). Although PCE concentrations in MW-5, located east of the source area, continue to reflect PCE concentrations in the ppm range, PCE concentrations in MW-6 and MW-50, east and southeast (respectively) of the source area have decreased. However, although PCE concentrations have diminished in MW-6 and MW-50, concentrations of vinyl chloride, a breakdown product of PCE, have increased. So, the ERD system is working to decrease PCE concentrations, migration of VOC contamination in groundwater is continuing.

Due to a limited number of water level data points, the direction of groundwater flow from the source area is somewhat unclear. But, groundwater migration is generally from the source area towards Peters Brook. The conceptual site model submitted by Ethicon (Ref. 5) indicates that groundwater migrates to the southeast. If this is true, MW-50 is downgradient of both MW-5 and MW-6, which would provide evidence that PCE is not potentially migrating to Peters Brook since there is minimal PCE in MW-50. However, there are insufficient water level data points to rule out that migration is towards the east, in which case contamination noted in MW-5, MW-6 and MW-50 (PCE and vinyl chloride) are potentially contributing to the contamination of Peters Brook.

Based on its review of the 2005 BEE, NJDEP does not believe that there is significant migration to Peters Brook (Ref. 6), so Ethicon was not required to take surface water or sediment samples. However, there is some migration of vinyl chloride and possibly PCE into Peters Brook.

References:

1. Baseline Ecological Evaluation. Prepared by ARCADIS. Dated March 8, 2005.
2. Environmental Investigation- Phase I. Prepared by Dames and Moore. Dated September 1984.
3. E-mail from Eric Killenbeck, ARCADIS U.S., Inc., to Barry Tornick and Sameh Abdellatif, USEPA Dated September 29, 2008.

4. Memorandum from Renee Bancroft, NJDEP, to Sylvia Pearce, NJDEP, re: 2007 Annual Groundwater Cleanup Monitoring/Progress Report Dated March 2008.
5. Conceptual Site Model. Prepared by ARCADIS. Dated June 30, 2008.
6. E-Mail from Sylvia Pearce, NJDEP, to Sameh Abdellatif, USEPA, Dated September 24, 2008.

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 judgment/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:

No surface water samples were taken during the BEE, so the extent of any groundwater impact to Peters Brook has not been documented. In the 2005 BEE, the concentrations of VOCs from the 2004 groundwater data in the two monitoring wells closest to Peters Brook, MW-50 and MW-51 were utilized. New Jersey surface water quality criteria are based on human health so Michigan Department of Environmental Quality Final Chronic Values (FCVs) were used as a basis for comparison because NJDEP does not have analogous screening values for adverse impacts to aquatic organisms (Ref. 1). All concentrations were lower than applicable FCVs. However, 2007 groundwater data from these wells noted significant increases in vinyl chloride concentrations (Ref. 2). Furthermore, MW-5 and MW-6 were not considered in the BEE since they were determined by NJDEP to be upgradient of MW-50. Since the concentration of PCE in MW-5 and concentrations of vinyl chloride in MW-6 and MW-50 are in the ppm range and the 2007 data from MW-50 and MW-51 indicated increases from 2004, there could potentially be significant impacts to Peters Brook. In addition, based on the 2007 data, 1,2 DCE and PCE concentrations in MW-5 and MW-6 exceed the FCV of 620 ug/l and 45 ug/l, respectively.

References:

1. Baseline Ecological Evaluation, prepared by ARCADIS, Dated March 8, 2005.
2. 2007 Annual Groundwater Cleanup Monitoring/Progress Report. Dated March 2008.

[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 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:

Any impacts would be related to ecological degradation due to migration from groundwater to surface water. As noted above, NJDEP considered conservative Michigan Department of Environmental Quality Final Chronic Values (FCV) for surface water as the applicable criteria. The VOCs that would be of potential concern from MW-5, MW-6 MW-50 and MW-51 include vinyl chloride, PCE and 1,2 DCE. Persistence and bio-accumulation would be the primary potential concerns. However, it is noted that chemicals with log octanol-water partition coefficients (Log kow) of less than 3.5 are not considered persistent or bio-accumulative (Ref. 1). None of the above constituents exceed 3.5. The maximum vinyl chloride concentrations for MW-50 and MW-51 in the 2007 groundwater data was 79 ug/l. While this is much higher than the 2004 data upon which the conclusions of the BEE were based (<.5 ug/l), it is still lower than the FCV for vinyl chloride, which is 930 ug/l.

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[4] Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, an 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.

1,2 DCE and PCE concentrations in MW-5 and MW-6 exceed the FCVs. However, groundwater flow is believed to be migrating more to the southeast (rather than east), so these wells are actually upgradient of MW-50, which is not contaminated with 1,2 DCE or PCE above FCVs (Ref. 2). In addition, both MW-5 and MW-6 are at least 100 feet from Peters Brook and any VOC concentrations are expected to substantially decrease as a result of attenuation. There would also be significant dilution and volatilization within the stream's mixing zone (Ref.1), so concentrations of VOCs in Peters Brook are likely much lower than has been observed in these monitoring wells. Also, Peters Brook is relatively shallow and it is known that a significant component of the groundwater flows under the surface water body (Ref. 2). In addition, NJDEP has concluded that although groundwater discharge to the Brook is possible and potentially significant, the current groundwater remediation system has effectively cut off the dissolved shallow groundwater plume at the property boundary, reducing VOCs to harmless byproducts upgradient of Peters Brook (Ref.1).

Overall groundwater quality at the site has improved dramatically with the numerous remedial actions that have occurred since 1984. These remedial activities have resulted in improved water quality on site and off site (across Peters Brook). Currently onsite there is no exposure risk related to human health, since no recreational use of the Brook is allowed. In addition, it is not anticipated that there are concentrations of COCs above the Ecological Screening levels (ESLs) in the Brook based on past observation made of the area's vegetation and wildlife survey completed during the BEE (Ref. 3). NJDEP therefore, concluded that the discharge of contaminated groundwater to Peters Brook is acceptable (Ref. 2).

Moreover, as part of the on-going remedial efforts for the site, a new injection well in the vicinity of MW-5 will be installed. It is expected that this injection well will further address COCs upgradient and in the vicinity of MW-5, thus further mitigating any potential groundwater flux in the area (Ref. 3).

References:

1. Baseline Ecological Evaluation, Prepared by ARCADIS, dated March 8, 2005.
2. Conceptual Site Model. Prepared by ARCADIS, Dated June 30, 2008.
3. E-mail from Eric Killenbeck, ARCADIS U.S., Inc., , to Barry Tornick and Sameh Abdellatif, USEPA Dated September 29, 2008.

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:

Groundwater quality will be monitored at on-site and off-site monitoring wells as part of the ongoing Semi-Annual Compliance and Performance Monitoring program, and results will be reported in the Annual Groundwater Cleanup Monitoring/Progress reports. The program includes water level measurements and water quality analyses at 19 monitoring wells and two injection wells, as indicated in Table 1 of the 2007 Annual Groundwater Cleanup Monitoring/Progress Report (Ref. 1). The compliance and performance monitoring network includes seven wells located in the source area (IW-14, IW-18, MW-20S, MW-20D, MW-35, MW-53, VE-2D), seven treatment line wells (MW-4, MW-5, MW-6, MW-40, MW-42, MW-43, MW-50), and five medial/distal wells (MW-9, MW-15, MW-29, MW-31, MW-51).

References:

1. 2007 Annual Groundwater Cleanup Monitoring/Progress Report. Prepared by ARCADIS. Dated March 2008.

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."

___ NO - Unacceptable migration of contaminated groundwater is observed or expected.

___ IN - More information is needed to make a determination as to whether migration of "contaminated" groundwater is under control at the ETHICON site, EPA ID# NJD002144145, located at Route 22 West in Bridgewater, New Jersey. This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

Completed by: _____ Date: _____
Lucas Kingston
Environmental Consultant
Booz Allen Hamilton

Reviewed by: _____ Date: _____
Michele Benchouk
Environmental Consultant
Booz Allen Hamilton

Also reviewed by: _____ Date: _____
Sameh Abdellatif, RPM
RCRA Programs Branch
EPA Region 2

_____ Date: _____
Barry Tornick, New Jersey Section Chief
RCRA Programs Branch
EPA Region 2

Approved by: Original signed by: _____ Date: September 30, 2008
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 U.S. EPA, Region 2.

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Attachments

The following attachments have been provided to support this EI determination.

- Attachment 1 – Area of Concern Status Summary (prepared by ARCADIS)
- Attachment 2 - Summary of Media Impacts Table

TABLE 1. AREA OF CONCERN STATUS SUMMARY
ETHICON, INC., SOMERVILLE, NJ.

AOC ID	AOC Description	Status	Reference	NFA Information
A (ECRA # 87263)	Areas near former MW-24, MW-9, TP-14	Closed	1	NFA in 1993
B (ECRA # 87263)	Former Engineering Area/Waste Area	Closed	2	NFA in 1993
C (ECRA # 87263)	*Encompassed in Area A*	NA		NA
D (ECRA # 87263)	Chemical Spill Holding Tanks/Soils (TK-37, 38)	Closed	3, 14	No NFA letter located in historic files. NFA in NJDEP record in 1992.
E (ECRA # 87263)	Storage Shed	Closed	3, 14	No NFA letter located in historic files. NFA in NJDEP record in 1992.
F	Former Wastewater Treatment Plant Clarifier	Closed	4, 14	No NFA letter located in historic files. NFA in NJDEP record in 1992.
G	Solvent Recovery Plant	Closed	5	NFA in 1993
H	Gel Track Area	Closed	6	NFA in 1992
I	Hazardous Waste Drum Staging Area	Excavated, drain cleaned	7	NFA in 1993
J	*Later referred to 'Area W'*	NA		NA
K	Former Hazardous Waste Handling Area	Closed	5	NFA in 1993
L	Former Hazardous Waste Handling Area	Closed	5	NFA in 1993
N	Non-contact Cooling Water Outfall	Closed	5	NFA in 1993
O	Two former 550 gal. PCE Tanks (Virgin/Waste)	Open	14	NFA for soils under Area Y. Groundwater remediation ongoing.
Q	Tank Farm (TK-15, 16, 17, 18, 19, 20, 21, 22)	Closed	7,8	NFA in 1993
R	UST Area (TK-31, 32, 33)	Closed	7,8	NFA in 1993
S	TK-24, TK-25	Closed	8	NFA in 1993
T	Former 500 gal. Waste Acetone UST (TK-26)	Closed	8	NFA in 1993
U	Former 500 gal. Waste Acetone UST (TK-27)	Closed	8	NFA in 1993
V (ISRA# 86001)	Former 1,000 gal. Xylol AST (TK-30)	Closed	7	NFA in 1995
W	Former Acid Neutralization Pit (TK-34)	Closed		NFA in 1993
X	Former Propane UST (TK-23)	Closed	13	NFA in 1994.
Y	Two former 110 gal. Chemical Spill Holding Tanks (TK-28, 29)	Removed/Excavated/Closed	7,9	NFA in 1993
Z	Former 1,000 gal. Spill Holding UST (TK-45)	Removed/Closed	7	NFA in 1993
TANKS				
E1	Former 30,000 gal. #4 fuel oil UST	Removed/Excavated/Closed	10, 14	Compliance Statement for removal in 1990. NFA in NJDEP record in 1992.
E2	Former 30,000 gal. #4 fuel oil UST	Removed/Excavated/Closed	10, 14	Compliance Statement for removal in 1990. NFA in NJDEP record in 1992.
E3	Former 30,000 gal. #4 fuel oil UST	Removed/Excavated/Closed	10, 14	Compliance Statement for removal in 1990. NFA in NJDEP record in 1992.
E4	Former 30,000 gal. #4 fuel oil UST	Removed/Excavated/Closed	10, 14	Compliance Statement for removal in 1990. NFA in NJDEP record in 1992.
E5	Former 30,000 gal. #4 fuel oil UST	Removed/Excavated/Closed	10, 14	Compliance Statement for removal in 1990. NFA in NJDEP record in 1992.
E6	Former 30,000 gal. #4 fuel oil UST	Removed/Excavated/Closed	10, 14	Compliance Statement for removal in 1990. NFA in NJDEP record in 1992.
TK-7 (E7)	Former 15,000 gal. #4 fuel oil UST	Removed/Excavated/Closed	12, 14	Compliance Statement for removal in 1989. NFA in NJDEP record in 1992.
TK-8 (E8)	Former 15,000 gal. #4 fuel oil UST	Removed/Excavated/Closed	12, 14	Compliance Statement for removal in 1989. NFA in NJDEP record in 1992.
E9	Former 15,000 gal. #4 fuel oil UST	Closed in place	11, 14	Compliance Statement for abandonment in 1990. NFA in NJDEP record in 1993.
E10	Former 15,000 gal. #4 fuel oil UST	Closed in place	11, 14	Compliance Statement for abandonment in 1990. NFA in NJDEP record in 1993.
E11	Former 7,500 gal. #4 fuel oil UST	Closed in place	11	Compliance Statement for abandonment in 1990
TK-12 (E12)	Former 5,000 gal. #2 Diessel Oil UST	Removed/Excavated/Closed		Standard reporting form for removal in 1989
E13	Former 1,000 gal. #2 Diesel Oil UST	Removed/Excavated/Closed	10, 14	Compliance Statement for removal in 1990. NFA in NJDEP record.
TK-35	Former 250 gal. Waste Ammonia AST	Removed/Closed	8, 14	NFA as part of Area U in NJDEP record in 1992.
TK-36	Former 300 gal. Waste Ammonia AST	Removed/Closed	8, 14	NFA as part of Area U in NJDEP record in 1992.
Former Private Disposal Area (G&M)	East of Peter's Brook	Investigation concluded	2	No NFA letter located. Area not included in NJDEP record.
Observed Surface Debris (G&M)	East of Peter's Brook	Investigation concluded	2	No NFA letter located. Area not included in NJDEP record.
Area around G&M B-29	East of Peter's Brook	Investigation concluded	2	No NFA letter located. Area not included in NJDEP record.
Area around G&M B-43	East of Peter's Brook	Investigation concluded	2	No NFA letter located. Area not included in NJDEP record.

Notes
NA Not applicable

Reference Number	Reference Title
1	ECRA Cleanup Plan Implementation. November 17, 1987. (Dames and Moore)
2	Progress Report, June 30 to August 28, 1987. ECRA Cleanup Plan Implementation. September 3, 1987. (Dames and Moore)
3	Results of ECRA Cleanup Areas D and E, Land East of Peter's Brook. October, 1987. (BCM Engineers)
4	Summary Report, Decommissioned Wastewater Treatment Plan Cleanup - ECRA Area F. March 13, 1991. (Dames and Moore)
5	Sampling Plan Results Report, West Side of Peters Brook. March 2, 1987, updated July 19, 1987. (Dames and Moore)
6	Monthly Cleanup Progress Report. December 30, 1991. (Dames and Moore)
7	Partial ECRA Cleanup Plan, Report 1: Soil Cleanup Plan (BCM); Report II: Groundwater Cleanup Plan (Dames and Moore). April 1989.
8	Results of RCRA Closure Hazardous Waste Storage Tanks. July 1989. (BCM)
9	Interim Report on Soil Cleanup Activities for Ethicon, Inc. July 1989. (BCM)
10	Cleanup Plan Progress Report - June 1990. July 6, 1990. (Recon Systems, Inc.)
11	Closure of Tanks E9, E10 and E11. July 12, 1990. (Recon Systems, Inc.)
12	Report of Cleanup Activities for Tanks TK-7 and TK-8. July 6, 1989 (Recon Systems, Inc.)
13	Progress Report. October 29, 1993. (Dames and Moore)
14	NJDEP Environmental Concerns Tracking Sheet ISRA Case #E86001

Attachment 2: Summary of Media Impacts Table

ETHICON, Inc.
NJD002144145

AEC or SWMU	GW	AIR (Indoors)	SURF SOIL	SURF WATER	SED	SUB SURF SOIL	AIR (Outdoors)	CORRECTIVE ACTION MEASURE	KEY CONTAMINANTS
Site-Wide Groundwater	Yes	No	No	No	No	No	No	Starting in 1987, remediation consisted of a groundwater pump and treat system in the source area that discharged pumped water to the sanitary sewer without pre-treatment. The system was improved several years later to add pre-treatment operations. A dual-phase vapor extraction system was added in 1993 and shut down in 1999. The pump and treat system was transitioned to an enhanced bioremediation approach from 1998 to 2002. In 2002, an in-situ reactive zone plume cutoff system (referred to as Treatment Lines #1 and #2) was added downgradient of the source area and along the property boundary to control plume migration. Implementation of this system led to the termination of off-site capture wells. Treatment Line #1 is ongoing, and currently receives six molasses injections per year at eight injection points. Use of Treatment Line #2 was discontinued in March 2006 due to the effectiveness of upgradient Treatment Line #1, and COC concentrations at Treatment Line #2 have not rebounded since that time. Additional mass removal has been performed in the source area using complementary technologies such as pneumatic fracturing, coupled with injection of nano-scale ZVI. The NJDEP-approved groundwater remedy for off-site groundwater is MNA.	VOCs