**DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION**
Interim Final 2/5/99
**RCRA Corrective Action**
**Environmental Indicator (EI) RCRIS code (CA750)**
**Migration of Contaminated Groundwater Under Control**

**Facility Name:** **Boehringer Ingelheim Chemicals, Inc.**
**Facility Address:** **2820 North Normandy Drive, Petersburg, VA 23805**
**Facility EPA ID #:** **VAD093561652**

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?

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

   ☐ If no - re-evaluate existing data, or

   ☐ If data are not available, skip to #8 and enter "IN" (more information needed) status code.

**BACKGROUND**

The Beohringer Ingelheim, Inc. site is a 200 acre continued use facility located at 2820 North Normandy Dr. in Petersburg, Virginia. The facility is largely comprised of undeveloped forest areas with approximately 25 percent developed for production facilities and associated services including manufacturing buildings, process buildings, storage buildings, office space, parking lots, waste water treatment facilities, and landscaped areas. The Facility manufactures active pharmaceutical ingredients and intermediates for the pharmaceutical industry. Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) at the Facility include underground storage tanks, above ground storage tanks, components of the waste water treatment systems and associated piping, former hazardous waste storage area, and areas at which releases have been documented and/or cleaned up in the past. Current land use at the site remains industrial.

**Definition of Environmental Indicators (for the RCRA Corrective Action)**

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

**Definition of "Migration of Contaminated Groundwater Under Control" EI**

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

**Relationship of EI to Final Remedies**

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

**Duration / Applicability of EI Determinations**

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

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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?

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

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

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

**Rationale and Reference(s):**

The following conclusions are based on groundwater analytical data that has been collected since 1995 in support of environmental cleanup activities, the facility's RCRA Facility Investigation (RFI), conceptual site model, and quantitative risk assessment. Historical cleanup activities occurred in association with a broken sewer pipe discovered in 1995 (AOC 1), a toluene release (SWMU 16), and a manhole release from a hairline crack in 2008 (AOC 2). Groundwater data collected during and subsequent to these cleanup activities indicate that the actions taken were appropriate and effective. Most notably, in response to the toluene release at SWMU 16, contaminated soil was removed and the excavation area was treated with ORC, an oxygen releasing compound, to accelerate the biodegradation of toluene in groundwater. Groundwater monitoring data from 2000 to 2004 indicate that toluene was effectively reduced in groundwater to below drinking water standards. Cleanup activities for AOC 1 and AOC 2 consisted of soil excavation. Subsequent groundwater sampling associated with these areas was conducted during the RFI process.

Based on the previous cleanup activities and results from additional groundwater monitoring conducted site wide during the RFI process, the facility initially identified the following constituents in groundwater above drinking water standards (MCLs and/or tap water RSLs) in at least one sample: barium, mercury, methylene chloride, Methyl Tertiary Butyl Ether (MTBE), and 1,2,3-trichlorobenzene. MTBE was detected consistently across the central portion of the site and was observed during the 2011 sampling at 53 ug/L in MW-4, which is the most down gradient monitoring location at which it was detected. Methylene chloride was detected above its MCL at AOC 1, which was associated with the broken sewer pipe cleanup. Barium and mercury were detected in only one direct push grab sample at concentrations slightly above their respective MCL, but they are not considered representative of site conditions due to poor sample quality (turbidity) as a result of direct push sampling methods. Groundwater samples collected from properly constructed groundwater monitoring wells located within vicinity of the area indicated that barium and mercury were below drinking water standards. 1,2,3-trichlorobenzene was detected above its RSL in one groundwater sample in 2009, but was not detected at any other sample locations at that time and since then. In addition, halomethane compounds, most notably chloroform, were detected intermittently or inconsistently at several monitoring locations from 2004 to 2009 above RSLs, but below the combined MCL of 80 ug/L for the halomethane compounds.

In 2013, the facility completed verification sampling of MTBE and methylene chloride in support of a quantitative risk assessment. Sample locations targeted the areas at which these constituents were previously detected. Subsequently, the most recent groundwater data from each SWMU and AOC were screened using MCLs and tap water RSLs. Results of this screening confirmed previous results presented in the 2012 CSM. Results also indicated that MTBE in MW-4 was observed at a concentration of 21.4 ug/L, which is less than the previous result of 53 ug/L seen in 2011, and methylene chloride at AOC 1 was detected at 4.54 ug/l, which is below its MCL of 5 ug/L and lower than previous results. In comparison to historical groundwater results, it appears that there are no longer any sources present at the facility and that constituents observed in groundwater have attenuated. Based on the most recent groundwater sampling results, there are no groundwater concentrations above MCL remaining at the site.

The facility also conducted a quantitative risk assessment, included in the 2013 RFI Report, which demonstrated that groundwater is not contaminated above appropriately protective levels for current industrial and future unrestricted use. It concluded that the excess lifetime cancer risk (ELCR) is 3E-06 for an adult resident, 2E-06 for a child resident, and 6E-08 for adult site workers, which are at or below EPA's acceptable risk range of 1E-06 to 1E-04. It also concluded that the

toxicity hazard indices (HI) for cumulative lifetime exposure to non-carcinogenic chemicals was 0.06 for an adult resident, 0.1 for a child resident, and 0.002 for an adult site worker, which are below EPA's target HI of 1.

**Supporting Documentation**:

1. Conceptual Site Model Report by Arcadis, March 13, 2012
2. RCRA Facility Investigation Report by Arcadis, October 2013
3. Quantitative Risk Assessment, Section 7 RCRA Facility Investigation Report by Arcadis, January 14, 2014

Footnotes:

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

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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)?

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

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

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

**Rationale and Reference(s):**

**References**:

[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.

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4. Does "contaminated" groundwater **discharge** into **surface water** bodies?

   ☐ If yes - continue after identifying potentially affected surface water bodies.

   ☐ If no - skip to #7 (and enter a "YE" status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater "contamination" does not enter surface water bodies.

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

**Rationale and Reference(s):**

**References**:

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5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (i.e., the maximum concentration[3] of each contaminant discharging into surface water is less than 10 times their appropriate groundwater "level," and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

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☐ If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting:
1) the maximum known or reasonably suspected concentration[3] of key contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and
2) provide a statement of professional 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 eco-system.

☐ If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting:
1) the maximum known or reasonably suspected concentration[3] of each contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and
2) for any contaminants discharging into surface water in concentrations[3] greater than 100 times their appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

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

**Rationale and Reference(s):**

**References**:

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

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

☐ If yes - continue after either:
1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater;
OR
2) providing or referencing an interim-assessment[5], appropriate to the potential for impact that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

☐ If no - (the discharge of "contaminated" groundwater can not be shown to be "**currently acceptable**") - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.

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

**Rationale and Reference(s):**

[4] Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

[5] The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

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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?"

☐ If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations, which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."

☐ If no - enter "NO" status code in #8.

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

**Rationale and Reference(s):**

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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).

☒ 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 Boehringer Ingelheim Chemicals, Inc. facility, EPA ID # VAD093561652, at 2820 North Normandy Dr., Petersburg, Virginia 23805. This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

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

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

Completed by (signature) Brett Fisher Date 3-6-2014
(print) Brett Fisher, P.G.
(title) RCRA CA Project Manager

Supervisor (signature) Jutta Schneider Date 3-6-2014
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Locations where References may be found:

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