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: Air Force Plant 3
Facility Address: Tulsa, Oklahoma
Facility EPA ID #: OK 9570000001

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

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

   _____ If no - re-evaluate existing data, or

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

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two 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 EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy

requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

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

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

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

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

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

Rationale and Reference(s): *IRP RCRA Facility Investigation, January 1996 (Earth Tech, Inc.); IRP Phase II RCRA Facility Investigation, November 1998 (Earth Tech, Inc.); and IRP Baseline Risk Assessment for SWMUs 5 & 8 and AOC 1, August 1998 (Earth Tech, Inc.).*

Media	*Contaminant*	*Max Detected*	*Location*
Groundwater	*1,1–DCA* 810 µg/L	*1400 µg/L*	*5-5*
Groundwater	*2,3–DCA* Not listed by EPA	*270 µg/L*	*8-8*
Groundwater	*1,1–DCE* 7 µg/L	*2900 µg/L*	*8-17*
Groundwater	*cis–1,2–DCE* 70 µg/L	*3300 µg/L*	*8-8*
Groundwater	*1,1,1–TCA* 200 µg/L	*940 µg/L*	*8-17*
Groundwater	*TCE* 5 µg/L	*24000 µg/L*	*8-20*
Groundwater	*Methylene chloride* 5 µg/L	*1100 µg/L*	*8-17*
Groundwater	*Vinyl chloride* 2 µg/L	*270 µg/L*	*8-DG2*

Footnotes:

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

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

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

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

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

Rationale and Reference(s):

SWMU 5

Source Description. SWMU 5, also called the Hardfill Area, is located in the northeast corner of AFP3. From 1942 to 1946, the Hardfill Area was reportedly used as a burning area and as a disposal site for miscellaneous trash and incinerator ash. In the 1950's, the area was used as a disposal site for construction debris, fuel filters, incinerator ash, and sludge from the cleaning of fuel tanks. In 1959, when a concrete apron was extended north of Building 1, SWMU 5 was covered with soil and revegetated.

A surface impoundment was constructed at SWMU 5 in 1967 and used as disposal for rinse water produced during the desealing of internal joints during cleaning of aircraft and cleaning of fuel tanks. These rinse waters contained chlorinated hydrocarbons and sealant sludge. The surface impoundment was eventually filled.

Site Investigation. During the IRP, geophysical investigations and soil and groundwater sampling concluded chlorinated VOCs had been released, that the contamination source area is most likely the former holding basin, and that the contaminants are moving through the permeable strata and fill. **A reconnaissance survey conducted as part of the Stage 3 RI defined the areal extent of groundwater contamination in the shallow water-bearing zone** and the results were used to locate ten additional monitoring wells at SWMU 5. **In order to determine the vertical extent of contamination, two bedrock monitoring wells were installed in the shallowest aquifer at SWMU 5 during the RFI.** A groundwater sample collected from 5MW23, an open hole drilled into competent bedrock, was analyzed for VOCs. No VOCs were detected in 5MW23, despite the elevated concentrations of chlorinated VOCs in the overlying shallow water-bearing zone at SWMU 5. **This result emphasizes the sealing capacity of the Nowata Shale bedrock that underlies AFP3. It indicates that there is little potential for the vertical migration of contamination from the shallow water-bearing zone at AFP3 to deeper groundwater in bedrock.**

An interceptor trench and groundwater treatment system was constructed in 1995 as an interim corrective measure at SWMU 5. The interim corrective measure (ICM) was implemented to mitigate the additional off-plant migration of contaminated groundwater in the shallow water- bearing zone at SWMU 5. An Industrial Wastewater Discharge Permit was obtained from the City of Tulsa for disposal of treated effluent from the treatment system to the City of Tulsa sanitary sewer system. Influent and effluent samples are collected semi-annually from the treatment system and analyzed to demonstrate that the system is operating properly and meeting the requirements of the permit. The treatment system has successfully treated more than 8 million gallons of contaminated

groundwater. It continued to operate until June 30, 1999, at which time the U.S. Air Force began a five-year groundwater monitoring program for the SWMU.

A baseline risk assessment was completed for SWMU 5 in 1998. As part of the risk assessment, two additional soil samples and twenty soil gas samples were collected at the SWMU and analyzed for VOCs. The purpose of the baseline risk assessment was to estimate the risk posed to human health and the environment as a result of the release of VOCs under baseline conditions (without the ICM operating). The risk assessment was used to determine whether additional corrective actions were necessary at SWMU 5. The baseline risk assessment concluded that there was an acceptable level of risk associated with this SWMU.

Conclusions and Recommendations. A baseline risk assessment of SWMUs 5, 8, and AOC 1 was competed in 1998. It concluded that there was no risk associated with soil contamination and an acceptable level of risk associated with the groundwater contamination at these sites. A five year monitoring program was implemented as part of the Class 3 Modification to the Part B permit to insure contmainant levels remain relatively stable. A groundwater monitoring program began at SWMU 5 on June 30, 1999 and will continue for a minimum of five years. The monitoring will be used to demonstrate that the SWMU continues to pose an acceptable level of risk to human health and the environment. The ODEQ will assess the compiled groundwater monitoring data and determine any additional requirements at that time.

SWMU 8

Source Description. SWMU 8 represents the underground waste lines at Building 3. The two south bays were used historically for painting. The north bay has been used for stripping aircraft parts and for surface treatment operations.

Building 3 was constructed in 1942. A floor drain collection system (consisting of a network of surface drains and the waste lines) was installed in 1969 to collect paint and paint stripper wastes and contaminated water. The wastes were transported through the underground waste lines and collected in a RCRA-regulated, underground separator (SWMU E) at the northeast corner of Building 3. Waste collected in the underground separator was regularly pumped from the separator and transported to an off-plant, RCRA-regulated facility for disposal.

Site Investigation. Soil and groundwater contamination at SWMU 8 has been evaluated in four separate environmental investigations at the SWMU. A reconnaissance survey conducted as part of the Stage 3 RI **defined the areal extent** of groundwater chlorinated VOC contamination in the shallow water-bearing zone and the results were used to locate ten additional monitoring wells at SWMU 8. One bedrock monitoring well (8MW24) was installed in the shallowest aquifer in bedrock at SWMU 8 during the RFI. It was installed beneath the groundwater contaminant plume at SWMU 8 to **evaluate the potential for the vertical migration of contaminants** from the plume in the shallow water-bearing zone to deeper groundwater in bedrock. Acetone was the only VOC detected in the groundwater sample collected from 8MW24. The detection of acetone is believed to be the result of handling procedures at the analytical laboratory and blank contamination (i.e., a laboratory artifact).

The absence of chlorinated VOCs in 8MW24 emphasizes the sealing capacity of the Nowata Shale bedrock that underlies AFP3. **These results indicate that there is little potential for the vertical migration of contamination in the shallow water-bearing zone** at AFP3 into deeper groundwater in bedrock.

TPH were the only organic compounds detected above their respective PQLs in bedrock monitoring well BMW24. However, TPH was present in the potable water supply that was used for field activities, and as a result, the potable water supply is a likely source of TPH detected in BMW24.

An interceptor trench and groundwater treatment system was constructed in 1995 as an ICM at SWMU 8. The ICM was implemented to mitigate the additional off-plant migration of contaminated groundwater in the shallow water-bearing zone at SWMU 8. The treatment system has successfully treated more than 8M gallons of contaminated groundwater. It operated until June 30, 1999, at which time the U.S. Air Force began a five-year groundwater monitoring program for the SWMU.

A baseline risk assessment was completed for SWMU 8 in 1998. As part of the risk assessment, two additional soil samples and twenty soil gas samples were collected at the SWMU and analyzed for VOCs. The purpose of the baseline risk assessment was to estimate the risk posed to human health and the environment as a result of the release of VOCs under baseline conditions (without the ICM operating). The risk assessment was used to determine whether additional corrective actions were necessary at SWMU 8. The baseline risk assessment concluded that there was an acceptable level of risk associated with this SWMU.

Conclusions and Recommendations. A baseline risk assessment of SWMUs 5, 8, and AOC 1 was competed in 1998. It concluded that there was no risk associated with soil contamination and an acceptable level of risk associated with the groundwater contamination at these sites. A five year monitoring program was implemented as part of the Class 3 Modification to the Part B permit to insure contmainant levels remain relatively stable. A groundwater monitoring program began at SWMU 8 on June 30, 1999 and will continue for a minimum of five years. The monitoring will be used to demonstrate that the SWMU continues to pose an acceptable level of risk to human health and the environment. The ODEQ will assess the compiled groundwater monitoring data and determine any additional requirements at that time.

Area of Concern 1

Source Description. Historical records for Building 1 (AOC 1) indicate that two former vapor degreasers (AOC 1) were located in the vicinity of column 97. Chemical constituents detected in soil and groundwater samples collected at AOC 1 were considered part of SWMU 8 during previous environmental investigations.

Site Investigation. As part of the Phase II EBS, twenty-three groundwater samples and two soil samples were collected. Sixteen direct push locations were placed along a northeast-southwest trending line to provide groundwater data from locations up-gradient of the vapor degreasers that where located in the vicinity of column 97 in Building 1. The purpose was to discriminate between groundwater contamination that might be related to upgradient source such as Building 3 and the former vapor degreasers.

Analytical results from the groundwater sample collected in Building 1 indicate that elevated concentrations of chlorinated hydrocarbons exist immediately downgradient of the former vapor degreaser located in the vicinity of column 97. TCE was detected at high concentrations in groundwater samples, which indicates that the former vapor degreaser is the likely source of the TCE contamination at AOC 1.

The baseline risk assessment required soil, groundwater and soil gas sample collection. No VOCs were detected in the soil or soil gas samples, but TCE was detected in all eight soil samples.

Conclusions and Recommendations. A baseline risk assessment of SWMUs 5, 8, and AOC 1 was competed in 1998. It concluded that there was no risk associated with soil contamination and an acceptable level of risk associated with the groundwater contamination at these sites. A five year monitoring program was implemented as part of the Class 3 Modification to the Part B permit to insure contmainant levels remain relatively stable. Based on the approved baseline risk assessment, no further action was recommended, however, the AOC is subject to a groundwater monitoring program that began June 30, 1999 and will continue for a minimum of five (5) years. The monitoring will be used to demonstrate that the site continues to pose no threat to human health or

the environment. The ODEQ will assess the compiled groundwater monitoring data to determine any additional requirements at that time.

[2] "existing area of contaminated groundwater" is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of "contamination" that can and will be sampled/tested in the future to physically verify that all "contaminated" groundwater remains within this area, and that the further migration of "contaminated" groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

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

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

__X__ 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): *Per the IRP Baseline Risk Assessment for SWMU 5, SWMU 8 and AOC 1 (Earth Tech, Inc., August 1998), there is no current exposure to groundwater contamination (on the basis of analytical data collected from downgradient monitoring wells) because the contaminants in the shallow water-bearing zone have not reached Mingo Creek or the northern Unnamed Tributary and the groundwater is not used for residential, agricultural, or municipal water supply. Although VOC-contaminated groundwater may reach the Northern Unnamed Tributary and wetlands east of Mingo Road (all of which feed Mingo Creek), the IRP Baseline Risk Assessment indicated that inhalation of VOCs released from migrating groundwater by recreational users, workers, residents, or terrestrial animals is expected to be insignificant. This is due to the low rate of groundwater discharge to surface water compared with the relatively large volume of surface water that is available to dilute the discharged groundwater.*

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)?

_____ If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration3 of key contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.

_____ If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration3 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 concentrations3 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): _____

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

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

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

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

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

Rationale and Reference(s): _____

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_____

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

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

7. Will groundwater monitoring / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

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

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

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

Rationale and Reference(s): *As per requirements defined in the Class 3 Modification to the RCRA Part B Permit, the groundwater monitoring program at AFP 3 includes the collection of samples from the following monitoring wells:*

- *Monitoring wells 5-5, 5-14, 5-16, 5-19, 5-20, 5-21, and 5-22 for SWMU 5;*
- *Monitoring wells 5-2, 5-13, 8-8, 8-15, 8-DG2, and 8-DG4 for SWMU 8; and*
- *Monitoring wells 8-17, 8-18, 8-20, 8-21, 8-22, 8-23, and 1-1 for AOC 1.*

The groundwater monitoring program will continue for a minimum of five years. All groundwater samples are analyzed for VOCs by USEPA Method SW8260B.

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 — 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 Air Force Plant 3 facility, EPA ID# OK 9570000001, located in Tulsa, Oklahoma. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater" This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

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

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

Completed by (signature) Robert R. Replogle Date 3/31/04
(print) ROBERT REPLOGLE
(title) ENVIRONMENT PROTECTION SPEC

Supervisor (signature) [illegible] Date 1/5/06
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