**DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION**

**Interim Final 2/5/99**

**RCRA Corrective Action**
**Environmental Indicator (EI) RCRIS Code (CA 750)**

**Migration of Contaminated Groundwater Under Control**

**Facility Name:** Johnson Controls
**Facility Address:** Fowlerville, Michigan
**Facility EPA ID#:** MID-099-124-299

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 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 groundwater and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPL's). 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, where practicable, contaminated groundwater to be suitable for its designated current and future uses.

**Duration/Applicability of EI Documentation**

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 an "IN" status code.

Rationale and Reference (s):

Groundwater is known to be contaminated above the National Primary Drinking Water Regulations Maximum Contaminant Levels (MCL's) and the applicable sections of the Michigan Act 451, Part 201 generic cleanup criteria for groundwater. Although there are no present on-site users of groundwater, there are no groundwater use restrictions for the property nor for properties surrounding the site. Hence, the Part 201 Generic Residential Drinking Water Criteria are applicable promulgated standards for on-site groundwater. It should be noted however, that there are no supply wells within 2,500 feet of the site, with the exception of a single house approximately 950 feet due west of the Red Cedar River that has a water well.

Groundwater contaminants exceeding the MCL's based upon groundwater monitoring well samples collected on-site and off-site during November 2003, are comprised of chlorinated volatile organic compounds (VOC's) including trichloroethylene (TCE), cis-1,2-dichloroethene, and vinyl chloride, metals including arsenic, cadmium, and hexavalent chromium, and free cyanide.

Groundwater contaminants exceeding Drinking Water Criteria include vinyl chloride (330 ug/l in November 2003) at monitoring well MW-17 located immediately west of the Red Cedar River, and trichloroethene (3400 ug/l and 2900 ug/l) at monitoring wells MW-02 and MW-01 respectively, located in the southeastern quadrant of the site.

The table below highlights contaminants in the groundwater medium that exceeded Maximum Contaminant Levels (MCL's)

| Constituent | Highest Conc. 11/2003 ug/L | Maximum Concentration Level (MCL) ug/L | Well Location with Highest Conc. (11/2003) | Other Well Locations Exceeding MCL (11/2003) | MI Part 201 Drinking Water Criteria ug/L |
|---|---|---|---|---|---|
| cis-1,2-dichloroethene (DCE) | 600 | 70 | MW-01 | MW-02, 03, 05, 06, 08, 17, 25, | 70 |
| Trichloroethylene (TCE) | 3400 | 5 | MW-02 | MW-01, 03, 05, 06, 10, 17, 18, 25, #OE-2, #OE-3 | 5.0 |
| Vinyl Chloride | 330 | 2 | MW-17 | MW-02, 12, 08, 09, **0S-3, 10, 11, 18, 19, 23, 26, | 2.0 |
| | | | | | |
| Constituent | Highest Conc. 11/2003 mg/L | Maximum Concentration Level (MCL) mg/L | Well Location with Highest Conc. (11/2003) | Other Well Locations Exceeding MCL (11/2003) | MI Part 201 Drinking Water Criteria mg/L |
| Arsenic | .131 | .010 | MW-22 | MW-2, | .050 |
| Cadmium | .013* | .005 | MW-J2 * | | .005 |
| Lead | .0044 | .015 *** | MW-28 (12/03) | | .004 |
| | | | | | |

* indicates that sample was collected 10/2003      ** indicates off-site well (11/2003)
\# indicates geoprobe sampling locations (3/2003 – 10/2003)
***Action level concentration given for lead (Pb); no MCL available for Pb. Action level is based on a Treatment Technique that requires public water systems to control the corrosiveness of their water. Action level is not based on groundwater potability.

Reference (s): Summary Report RCRA Facility Investigation, October 2001
Groundwater Environmental Indicators Support Document, Former Stanley Tools, Fowlerville, MI Feb 2004

Footnotes:

"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 an "IN" status code.

Rationale and Reference (s):

The migration of groundwater has stabilized as evidenced by a reduction in the size of the plume of VOC constituent concentrations detected in the shallow aquifer. Hydrostratigraphic cross-sections, a top of bedrock contour map, potentiometric surface maps, and groundwater quality data were used to assess groundwater flow and transport conditions and potential groundwater contaminant migration/stabilization. In addition, historical groundwater sampling data was geospatially compared, i.e., in both vertical and horizontal dimensions, to that of more recent groundwater sampling data. Constituents of concern or constituents that exceeded MCL's are cis-1,2-dichloroethene, (cis-1,2-DCE), TCE, vinyl chloride, arsenic, and cadmium. Analysis of these data sets revealed the following: historical TCE, cis-1,2 DCE and vinyl chloride contamination could be geospatially defined by an east-west band extending from the southeastern quadrant of the site to southwestern quadrant of the site extending southwest to the banks of the Red Cedar River. Historical concentrations of TCE in the southeastern quadrant had concentrations of TCE as taken from geoprobe sampling locations of 4800 ug/L (TCE1), to 16000 ug/L (TCE15). Sample location TCE15 was located in the approximate center of the southeast - southwest band. Historical monitoring well and geoprobe groundwater samples for cis-1,2-DCE could also be defined by geoprobe sampling locations TCE-1 (1100 ug/L), TCE-15 (1900 ug/L). In addition, geoprobe groundwater sample locations TCE-16 (1200 ug/L), TCE-37 (8200 ug/L), and TCE-8 (1100 ug/L) all collected in July 2000 exceeded the State of Michigan Part 201 groundwater/surface water interface criteria (GSI), of 620 ppb. More recent groundwater samples collected in November 2003 revealed that the TCE and cis-1,2-DCE plume can be defined by the same well locations (see proceeding table below). TCE samples collected from within this area had concentrations ranging from 1300 ug/L (MW-03), to 3400 ug/L (MW-02) and cis-1,2-DCE ranging from 91 ug/L at MW-06, to 410 ug/L at MW-17. Hence the reduction of concentration as well as the reduction of a geospatial horizontal dimension of TCE and cis-1,2 DCE contaminant distributions appears to indicate that the cis-1,2-DCE plume and TCE plume is shrinking.

Vinyl chloride which is a daughter product of TCE is also shown possibly migrating to the Red Cedar River more specifically, MW-17, and MW-08 had concentrations of 330 ug/L and 130 ug/L, respectively, both collected in November 2003. Monitoring well B-1 collected in October 2003 had a concentration of 250 ug/L. November 2003 groundwater sampling data also indicated that MW-OS3 which is located on the western side of the Red Cedar River had a vinyl chloride concentration of 29 ppb. Because there has not been any data collected from west of the Red Cedar River at MW-OS3 nor from any other monitoring wells west of the Red Cedar River from any historical groundwater sampling events prior to July 2003, (off-site to the west), it is inconclusive whether the plume has migrated beyond its original defined dimensions. The MCL for vinyl chloride is 2 ug/L, hence 10x the MCL is 20 ug/L, and the GSI standard is 15ug/L. The data does not show that there has been any vertical migration of vinyl chloride in any of the monitoring wells because vinyl chloride has been found primarily in the shallow aquifer. There is one deep well (MW-B2) where vinyl chloride was detected in the most recent rounds of sampling, 38 ug/L. However the screening level depth as discerned from well construction diagrams and pieziometric surface map show that the well screen was installed at two distinct geological regions (i.e., shallow and intermediate aquifers).

Groundwater monitoring well sample locations that exceed groundwater quality standards are presented below.

| Constituent | Highest Conc. 11/2003 ug/L | Maximum Contaminant Level (MCL) ug/L | Applicable GSI Criteria ug/L | Well Locations exceeding GSI (11/2003) | Well Locations Exceeding MCL (11/2003) |
|---|---|---|---|---|---|
| cis-1,2-dichloroethane (DCE) | 600 (MW-01) | 70 | 620 | --- | MW-02, 03, 05, 06, 08, 17, 25, |
| Trichloroethylene (TCE) | 3400 (MW-02) | 5 | 200 | MW-01, 02, 03 05, 06, 17, 25, | MW-01, 02, 03, 05, 06, 10, 17, 18, 25, |
| Vinyl Chloride | 330 (MW-17) | 2 | 15 | MW-02, 08, OS3, 10, | MW-02, 08, 09, OS-3, 10, 11, 12, 18, 19, 23, 26, |
| | | | | | |
| Constituent | Highest Conc. 11/2003 mg/L | Maximum Contaminant Level (MCL) mg/L | Applicable GSI Criteria mg/L | Well Locations exceeding GSI (11/2003) | Well Locations Exceeding MCL (11/2003) |
| Arsenic | .131 (MW-22) | .010 | .15 | None | MW-22, MW-23, |
| Cadmium | .013* (MW-J2) | .005 | .0062 | MW-J2 | MW-J2 |
| Copper | .148 (MW-08) | 1.3 | .029 | MW-08, 18, 20, | None |
| Nickel | 1.07 (MW-25) | 3.6 (PRG)** | .17 | MW- 08, 25, | None |
| Chromium | .02 (MW-08, & 22) | 0.1 | .011 | MW-08, 22 | None |
| Cyanide | .04 (MW-18) | 0.2 | .005 | MW-05, 06, 08, 09, 13, 13C, 14, 14C, 15, 15C, 17, 18, 19, 22, 23, Os1, OS3C | None |

The groundwater flow conceptual model for the study area is comprised primarily by groundwater flowing towards and discharging to the Red Cedar River. Shallow groundwater from uplands east and west of the Red Cedar River flows toward the Red Cedar River, located on the western site boundary.

There are four significant conditions that can be used to establish and verify the stability of the current area of shallow aquifer groundwater contamination. The first condition is the low permeability soils and resulting aquitard that underlies the shallow aquifer and restricts the downward migration of groundwater contaminants.

The second condition is the westerly groundwater flow direction of the shallow aquifer across the site, with groundwater discharging into the Red Cedar River bordering the western site boundary. The Red Cedar River is a local groundwater discharge area that functions as a natural hydraulic barrier preventing the westerly migration of contaminants beyond the local discharge area. Contaminants in the lower unconsolidated deposits are less subject to groundwater transport due to lower hydraulic conductivities, but the ultimate destination for mobile constituents is the river's lowland/floodplain discharge area.

The third condition is the source excavation project that was conducted during the summer and fall of 2003. Approximately 83,900 tons of contaminated soil was excavated across the site to water table depth at approximately 95% of the site. This effort effectively removed all remaining contaminants formerly present within the vadose zone, capillary fringe, and top portion of the saturated zone across the site. Included in this massive excavation was the elimination of phase-separated hydrocarbons beneath SWMU C. The excavated area was backfilled with clean fill material consisting of various grades of sand, some silt, and lenses of clay materials.

The fourth condition is the absence of a dense non-aqueous phase liquid (DNAPL) at the site, which is demonstrated based on several site characteristics. No VOC groundwater concentrations meet or exceed 1% of their respective solubility's in water, a *rule of thumb* benchmark indicating potential DNAPL. Wells with the highest VOC detections are all located within the eastern half of the site, and each of these well screens extends to the aquitard, thereby providing "worst-case" groundwater chemistry data that would indicate whether DNAPL is present along the aquitard surface. The monitoring well network within and adjacent to the VOC plume footprint is comprised of at least 10 wells having screens at or straddling the aquifer-aquitard contact, which provides excellent groundwater and DNAPL monitoring capabilities. Geoprobe sampling depths of up to 17.5 feet have characterized groundwater quality to within two feet of the aquitard surface. The aquitard surface is relatively flat across the majority of the eastern on-site area, with aquitard surface elevations decreasing (i.e. sloping toward) the south and west of MW-01. Further off-site to the east, the aquitard surface elevation decreases toward new monitoring well MW-28, which did not exhibit any VOC detections indicative of DNAPL. Shallow groundwater samples were collected at 8 locations east of the site during 2003. While the clay aquitard surface was not encountered, the highest VOC detection from those samples was 9.2 ppb of TCE, indicating DNAPL ( if ever present) has not migrated via gravity flow eastward from the MW-02 area.

In summary, based on groundwater discharge to the Red Cedar River, the aquitard underlying the shallow aquifer, the close proximity of the contaminated groundwater to the discharge area, the removal of contaminant source materials across the site using interim remedial measures, and the lack of a continuing contaminant source due to the demonstrated absence of any DNAPL beneath the site, contaminated groundwater is expected to remain within the current horizontal and vertical dimensions of the existing area of groundwater contamination.

Reference (s): Summary Report RCRA Facility Investigation, October 2001
Groundwater Environmental Indicators Support Document, Former Stanley Tools, Fowlerville, MI Feb 2004
JCI Fowlerville Teamlink Website, https://westonproject.net/

Footnotes:

[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?

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

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

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

Rationale and Reference(s):

The site is located on the eastern bank of the Red Cedar River. Impacted groundwater from the site discharges to the Red Cedar River.

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 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.

__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 and Reference(s):

The discharge of contaminated groundwater into surface water is of significance due to the detections of three constituents in concentrations greater than ten times their respective maximum contaminant levels. TCE: seven groundwater monitoring installations located primarily in southeastern and southwestern quadrants of the site had detections of trichloroethylene (TCE), greater than 50 ug/L. (Note the MCL for TCE is 5 ug/L). These samples were collected in the November 2003 sampling round and are representative of groundwater quality conditions of the shallow aquifer; Vinyl Chloride: vinyl chloride was detected in six groundwater monitoring wells collected during the November 2003 sampling round. Monitoring well locations, MW-09 to MW-08 form a north-south band extending approximately 250 feet wide from the north central area of the site down to the southwestern quadrant of the site. The concentration of vinyl chloride detected in these six wells range from 28 ug/L to 338 ug/L. The MCL for vinyl chloride is 2 ug/L; Arsenic: only one groundwater monitoring well location (MW-22) exceeded ten times the MCL (As MCL = .010 mg/L). The concentration detected during the November 2003 sampling round was .13 mg/L. MW-22 is located in the upper northwestern quadrant of the site near the Red Cedar River. The table below list well locations that were detected with significant concentrations of contaminants, i.e., ten times the maximum contaminant level.

| Constituent | MCL | 10X MCL | Location (ug/L) | Aquifer | Date of Sample |
|---|---|---|---|---|---|
| TCE | 5 ug/L | 50 ug/L | MW-02 (3400)<br>MW-01 (2900)<br>MW-05 (2100)<br>MW-03 (1300)<br>MW-17 (300) | Shallow | Nov. 2003 |
| | | | | | |
| Vinyl Chloride | 2 ug/L | 20 ug/L | MW-02 (28)<br>MW-08 (130)<br>MW-09 (2.9)<br>MW-OS3 (29)<br>MW-10 (23)<br>MW-11 (2.5)<br>MW-17 (330)<br>MW-18 (14)<br>MW-19 (7.5) | Shallow | Nov. 2003 |
| | | | | | |
| Arsenic | 10 ug/L | 100 ug/L | MW-22 (131) | Shallow | Nov. 2003 |
| | | | | | |

<u>Reference</u>: Summary Report RCRA Facility Investigation, October 2001
Groundwater Environmental Indicators Support Document, Former Stanley Tools, Fowlerville, MI Feb 2004
JCI Fowlerville Teamlink Website, https://westonproject.net

[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])?

__X__ If yes - continue and 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-system), 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 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 cannot be shown to be **"currently acceptable"**) - skip to #8 and enter the "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):

A Groundwater-surface water mixing zone determination was computed for the three constituents of concern whose concentrations in groundwater were determined to be "significant" based on the constituent's concentrations exceeding "ten times" their respective appropriate groundwater quality level, as indicated in question #5. The constituents are TCE, vinyl chloride and arsenic. Since vinyl chloride represents the worst-case site specific constituent concentration having probability for groundwater-surface water discharge, vinyl chloride in groundwater at MW-17 will be evaluated for its acceptability in discharging into the Red Cedar River. Based on the vinyl chloride concentration calculated in the mixing zone model, the resulting calculated mixing zone concentration i.e., groundwater to surface water discharge, will be compared to the appropriate surface water protection criteria.

Areas of Groundwater Discharge Associated With Current Exceedences in Groundwater

The discharge area is being computed from a horizontal distance of 280', which is the length of the vinyl chloride contamination found in well locations contiguous to the Red Cedar River subsequent to the soil excavation project completed during the summer and fall of 2003. This horizontal plume band can be defined by a northern boundary that extends from 30' north of MW-26, to a southern boundary that extends south to an area just south of the southern drainage ditch. Monitoring well MW-17 located on the northern boundary had a vinyl chloride concentration of 330 ug/L and the south ditch represents an intermediate point between MW-08 and MW-14 (MW-08 had a vinyl chloride concentration of 130 ug/L and MW-14 located on the southern boundary had a concentration of 1.2 ug/.L. Since vinyl chloride was found on both sides of the River, the discharge area will be approximated by a horizontal length of 280' x 8' + 8' or 280' x 16' of wetted perimeter = 4480 ft2

$A_{VOC} = 280\text{ft} \times 16 \text{ ft} = 4{,}400 \text{ ft}^2$

State of Michigan Department of Environmental Quality (MDEQ) Flow Measurements and Prescribed Low Flow Discharge ($Q_{SW}$) For the Red Cedar River

The MDEQ completes mixing zone determinations using conservatively derived stream flow values representing a 90-day once in 10-year flow (90Q10). The mean harmonic flow value for the Red Cedar River based on MDEQ measurements taken at the site boundary is 12 cfs. The MDEQ 90Q10 value is 3.8 cfs. For purposes of this EI 750 Determination, the more conservative MDEQ 90Q10 value of 3.8cfs will be used.

$(Q_{SW}) = (3.8\ ft^2/sec)\ (86{,}400\ sec/day) = 328{,}320\ ft^3/day$

Average Value of Horizontal Hydraulic Gradient for the Shallow Aquifer (i)

i = 0.032 ft/ft (the actual gradient measured from MW-17 to the Red Cedar River)

Hydraulic Conductivity (K) From RFI Permeability Tests

K = 3.17 ft/day (geometric mean of all K measurements)

Calculated Groundwater Flux ($Q_{gw}$)

$Q_{gw} = (K)\ (i)\ (A)$

$Q_{gw} = (3.17\ ft/day)\ (0.032\ ft/ft)\ (4{,}400\ ft^2) = 446\ ft^3/day$

Estimated Surface Water Concentrations ($C_{sw}$) After Discharge

Concentrations in surface water computed using the following model:

$(C_{gw})\ (Qgw) = (Csw)\ \{(Qgw + (0.1)\ (Qsw)\}$

Cgw = vinyl chloride concentration in groundwater at MW-17 330 ug/L
Qgw = 446 $ft^3$/day, calculated groundwater flux

Csw = X (concentration of vinyl chloride in surface water body i.e., Red Cedar River)

Qsw = = 328,320 $ft^3$/day, surface water body flow rate

The table below illustrates the resulting surface water concentrations of the three site-specific constituents of concern using the mixing-zone model. The modeled concentrations are then compared to most recent surface water quality data as well as the State of Michigan, Part 4, Rule 57 Water Quality Values which are the appropriate surface water quality criteria for the JCI site. The State of Michigan, Part 4, Rule 57 Water Quality Standards are calculated surface water quality values to protect human, wildlife and aquatic life.

| Constituent | Groundwater Sample (ug/L) | Surface Water Sample ug/L | MI Rule 57 Water Quality Value ug/L | Calculated Groundwater Discharge (Mixing Zone) ug/L | Conc. Acceptable Passes or Fails MI Rule 57 Water Quality Criteria |
|---|---|---|---|---|---|
| Vinyl Chloride | 330 | .62J | 13 (HCV non-drink) | 4.42 (a) | Passes Criteria |
| | | | | | |
| TCE | 300 | 11 | 550 HNV non-drink) | 4.02 (a) | Passes Criteria |
| | | | | | |
| Arsenic | 131 | 2.3 – 4.5 | 280 HNV (non-drink) | 1.75 (a) | Passes Criteria |

The resulting estimated surface water constituent concentrations computed from the mixing zone model, illustrates that all three constituents of concern, i.e., vinyl chloride, TCE, and As, are all within the State of Michigan Part 4, Rule 57 Water Quality Criteria. Hence the current groundwater discharge of vinyl chloride can be considered currently acceptable.

In addition, vinyl chloride, TCE and As concentrations are expected to decline over subsequent groundwater sampling events due to the massive excavation of contaminated soil in 2003 that effectively removed the most significant continuing source area of chlorinated solvents to shallow groundwater at the site. In addition, groundwater remediation activities may be implemented in the future, if necessary, should increased concentrations, newly identified Rule 57 exceedences, or plume rebound effects be identified during the groundwater monitoring program.

Reference (s): Summary Report RCRA Facility Investigation, October 2001
Groundwater Environmental Indicators Support Document, Former Stanley Tools, Fowlerville, MI Feb 2004
JCI Fowlerville Teamlink Website, https://westonproject.net

Footnotes:
a - mixing zone calculated using 90 day once in ten year flow (90Q10) of 3.8 ft3/sec
HNV – Human noncancer cancer value, drinking and non-drinking as per Rule 57 Water Quality Values
HCV – Human cancer cancer value, drinking and non-drinking as per State of Michigan Rule 57 Water Quality Values

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 a "NO" status code in #8.

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

Rationale and Reference(s):

Groundwater monitoring/measurement data will be collected in the future to verify that contaminated groundwater has remained within the horizontal and vertical dimensions of the existing area. Future groundwater sampling will be conducted both on-site and off-site to confirm the findings of the 2003 groundwater study and to further characterize the nature and extent of groundwater contamination over time. Long-term groundwater sampling will also allow the assessment of anticipated beneficial effects resulting directly from the massive removal of the contaminated soil from the site during 2003. A groundwater monitoring program consisting of a total of seventeen monitoring wells will be established to monitor the existing contaminated groundwater area. Of the seventeen groundwater monitoring wells, two wells are located upgradient of the facility and the remaining fifteen wells are located to monitor down and side gradients of the former regulated units and solid waste management units (SWMU's).

Future groundwater sampling will be conducted on a semi-annual basis for the next two-year period. Groundwater sample analyses will include metals, including arsenic, cadmium, copper, nickel, chromium and lead, cyanide, polychlorinated biphenyls, semi-volatile organic compounds including cis-1,2-DCE, and VOC's, including TCE and vinyl chloride on selected well samples. Following the two-year sampling period, the frequency of sampling and parameters selected for analysis will be re-evaluated based on an assessment of past water quality data.

Groundwater level measurements will be conducted for the next two-year period on a semi-annual basis. The groundwater level measurements will be evaluated and groundwater flow direction confirmed to verify that contaminated groundwater flow paths remain within the horizontal and vertical dimensions of the existing area of contaminated groundwater. The table below summarizes the groundwater monitoring wells for the proposed groundwater monitoring program and the attached map illustrates their locations.

| Monitoring Well Identification | Location |
|---|---|
| | |
| MW-02 | Shallow |
| MW-11 | Shallow |
| MW-14 | Shallow |
| MW-17 | Shallow |
| MW-21 | Shallow |
| MW-22 | Shallow |
| MW-24 | Shallow |
| MW-25 | Shallow |
| MW-26 | Shallow |
| MW-28 | Shallow |
| MW-B1 | Shallow |
| MW-OS3 | Shallow |
| MW-OS3C | Deep |
| MW-28C | Deep |
| MW-B2 | Deep |
| MW-J2 | Deep |
| MW-OS1C | Deep |

Reference (s): Summary Report RCRA Facility Investigation, October 2001
Groundwater Environmental Indicators Support Document, Former Stanley Tools, Fowlerville, MI Feb 2004
JCI Fowlerville Teamlink Website, https://westonproject.net
Final Corrective Measures Proposal Former Stanley Tools Fowlerville, MI, February 2004

8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

__X__ YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the Former Stanley Too facility, EPA ID# MID099124299, located at 425 Frank Street, Fowlerville, Michigan. 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) [signature] Date 9/30/2004
(print) Juan Thomas
~~Ge~~ geologist (title) Environmental Scientist

Supervisor (signature) [signature] Date 9-30-04
(print) George J. Hamper
(title) Chief CA Section, ECAB
(EPA Region or State) Region 5

Locations where References may be found:

USEPA Region 5
Records Center, 7th Floor
77 W. Jackson
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