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: **INTERMET Radford and New River Foundries**
Facility Address: **1605 West Main Street and 1701 West Main Street, Radford, Virginia, 24141**
Facility EPA ID #: **VAD010063006 and VAD981730930**

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 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?

__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.

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).

Rationale and Reference(s):

The April 2003 Description of Current Conditions identified 74 Solid Waste Management Units (SWMUs) at the Radford and New River Foundry facilities in Radford, Virginia. Based on evaluations of the operational histories and current status of the units, 34 SWMUs were designated as requiring additional investigation, and 40 SWMUs were designated as needing No Further Action (NFA).

The 34 SWMUs were to be investigated using a phased approach under the RCRA Corrective Action Program. The Phase I RFI Workplan approved by USEPA in December 2003 contained two primary components:

1) Collection of soil samples at ten SWMUs; and
2) Installation of six groundwater monitoring wells, and collection of site-wide groundwater samples.

These proposed investigative activities were designed to collect the information necessary for evaluation of the two Environmental Indicators. The remaining 24 SWMUs will be investigated under Corrective Action under a future RFI Phase, but are not expected to impact the EIs.

The Phase I field activities were performed in January 2004, and the Phase I Investigative Summary Report was submitted to USEPA in April 2004. The screening criteria used for evaluation of the analytical data were proposed and approved under the Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) contained in the approved Phase I RFI Workplan. Groundwater sampling data from Phase I were initially screened against USEPA Region III Risk-based Concentrations (RBCs) for Tap Water (using a hazard index of 0.1 for noncarcinogens), and primary drinking water Maximum Contaminant Levels (MCLs). The following constituents were detected above the Tap Water RBC criteria in at least one monitoring well. Constituents noted with an asterisk (*) were also detected above the MCLs in at least one monitoring well; however, benzene was only detected above the MCL in an upgradient monitoring well, LFMW-9.

Volatile Organic Compounds (VOCs):

- 1,2-dibromo-3-chloropropane*,
- Acrolein,
- Benzene*,
- Chloroform, and
- Xylenes.

Semivolatile Organic Compounds (SVOCs):

- 2-methylnaphthalene,
- Benzo(a)anthracene,
- Benzo(a)pyrene*,
- Benzo(k)fluoranthene,
- Dibenzofuran, and
- Naphthalene.

Inorganics:

- Antimony*,
- Arsenic*,
- Barium,
- Chromium,
- Cobalt,
- Iron,
- Lead*,
- Manganese,
- Selenium*, and
- Thallium*

Detection tables showing the screening exceedances and the locations of the various monitoring wells sampled during the Phase I field investigation can be found in the Phase I Investigation Summary Report dated April 2004.

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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)?

__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.

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.

Rationale and Reference(s):

The site lies within the New River Basin, situated in the Valley and Ridge Physiographic Province. The New River forms much of the site property's northern and western boundary, and the surface topography generally slopes towards the northwest in the direction of the river. The natural subsurface soils underlying the site are part of widespread alluvial and terrace deposits created by the historic migration and down-cutting of the New River and its floodplain. These soils are composed of deeply weathered layers of loose, unconsolidated clay, sand, and rounded pebbles and cobbles, and are generally 15 to 25 feet in thickness. The terrace deposits are underlain by the sedimentary rocks of the Cambrian-age Elbrook Formation, consisting primarily of gray, fine-grained dolomite with argillaceous laminations. The formation also contains considerable amounts of bluish-gray limestone, shale, and siltstone.

The hydraulic information collected during the January 2004 groundwater monitoring event indicated the following:

1) The uppermost aquifer is unconfined, and is situated primarily in the terrace deposits, especially in the areas approaching the river;
2) Groundwater in the uppermost aquifer flows in a northwestern direction towards the New River, at an average hydraulic gradient of 0.036 ft/ft.
3) Piezometer head measurements in monitoring wells screened in the bedrock indicate that the prevalent flow direction in the bedrock is to the northwest towards the river.

Based on the size and regional presence of the New River and its watershed, and on the site-specific hydrogeological evidence obtained from the Phase I investigation, the river is believed to serve as both discharge point and hydraulic barrier for the site property. All groundwater beneath the site ultimately discharges to the river, preventing any lateral or vertical migration of groundwater beyond the river.

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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 relationship between water levels collected from the three surface water monitoring points in the New River (SWMP-1, 2, and 3) and the nearby groundwater monitoring wells confirm that the New River is the ultimate discharge point for groundwater beneath the site property.

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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)?

_____ If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration[3] of key contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or 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.

Footnotes:

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

Rationale and Reference(s):

The groundwater monitoring analytical results* identify several compounds with maximum detected concentrations greater than 10 times the project screening criteria (MCL, or Tap Water RBC if no MCL exists), including benzo(a)pyrene, dibenz(a,h)anthracene, naphthalene, acrolein, benzene, chloroform, iron, and manganese. Of these compounds, only acrolein was detected at a groundwater concentration greater than 100 times the project screening criteria (120 ug/L vs. RBC of 0.0042 ug/L). However, acrolein was only detected in sample GW-FD-2 (a blind field duplicate sample from monitoring well LFMW-7) and was non-detect in the parent sample from LFMW-7. Since acrolein is also not one of the primary constituents of concern at the site, and was not detected in any other monitoring well sample, a total mass loading has not been calculated. Future groundwater sampling events will be used to confirm that this detection of acrolein is not representative of the actual site groundwater conditions.

* Groundwater sample results can be found in the Phase I Investigation Summary Report dated April 2004

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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])?

__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 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.

Footnotes:

[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.

Rationale and Reference(s):

As described above, groundwater at the site discharges into the New River. Initial evaluation of the potential impacts to surface water was performed by comparing the detections in groundwater to 10x the National Recommended Water Quality Criteria (November 2002) for Organisms and Water + Organisms. ***Tables 2, 3, and 4*** show the calculated criteria and resulting screening. Of the constituents exceeding the project groundwater criteria, one (1) VOC (benzene), four (4) SVOCs, (benzo(a)pyrene, benzo(k)fluoroanthene, chrysene, and dibenz(a,h)anthracene), and three (3) inorganics, (arsenic, iron, and manganese), exceed at least one of the modified Water Quality criteria.

However, the actual dilution capacity of the New River is believed to be significantly greater than provided by the generic 10x dilution criteria. Based on gauging data from the USGS Radford, Virginia gauge (#03171000), the VADEQ has estimated the 7Q10 flow of the New River at the INTERMET site property to be 919 cfs. A copy of the September 26, 1995 memorandum describing the 7Q10 derivation has been included in ***Attachment A***. Using

the 7Q10 flow and the available hydrogeologic information from the site, the actual dilution is conservatively estimated to be greater than 17,000X. The dilution factor calculation worksheet, including documentation of assumptions and information sources, is included in ***Attachment B***. At this anticipated groundwater-to-surface water dilution, all detected constituents are well below the National Recommended Water Quality Criteria, and no unacceptable impacts to surface water, sediments, or ecological receptors are believed to be present.

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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?"

__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):

During the RCRA Corrective Action Program at the site, additional water level measurements and groundwater samples will be collected from some or all of the following eight monitoring wells located along the New River (RFIMW-2, 3, 4, 5, and 7, and LFMW-6, 10, and 11). The list of analyzed constituents will be based on the list used for the Phase I sampling event, but may be modified to eliminate unnecessary analyses. Although the frequency and timing of sampling will be impacted by the progress of the Corrective Action program, groundwater data collection is expected to occur at least annually for the first three years. Groundwater sampling requirements may also be satisfied in whole or in part by sampling events required by other regulatory programs – e.g. landfill or wastewater system monitoring.

The sampling of the above-described monitoring wells will be sufficient to continue monitoring of site-wide groundwater. During any groundwater sampling event, side-wide groundwater and surface water elevation data will also be collected from all existing groundwater monitoring wells and surface water monitoring points (SWMPs).

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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).

__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 **INTERMET Radford** and **New River** facilities, EPA IDs # **VAD010063006** and **VAD981730930**, located at **1605 West Main Street** and **1701 West Main Street, Radford, Virginia, 24141**. 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) /s/ Date 9/30/04

(print)

(title)

Supervisor (signature) /s/ Date 9/30/04

(print)

(title)

(EPA Region or State)

Locations where References may be found:

EPA Region III, Philadelphia, PA

EPA Contact Wanda Martinez (email) martinez.wanda@epa.gov
215-814-3434

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434 237-8726

EIForm1.doc

LIST OF ATTACHMENTS:

Table 2
OW/NRMW/USTMW-series Groundwater Results

Specific Analyte List	(C/N)[1]	Region III Tap Water RBCs[2]	MCLs	MDL	RL	10x Water Quality Criteria - Water + Organism	10x Water Quality Criteria - Organism	OW-1A	OW-1B	OW-1B (Dissolved)	OW-2A	OW-2B	NRMW-1	USTMW-4	USTMW-5	USTMW-6
Appendix IX Volatile Organic Compounds (ug/L)																
1,2-Dibromo-3-chloropropane	C	0.047	0.2	0.22	1.0	~	~	1 U	1 U	NM	1 U	1.2	1 U	1 U	1 U	1 U
Benzene	C	0.34	5	0.096	1.0	22	510	1 U	1 U	NM	1 U	1 U	1.7	1 U	1 U	1 U
Chloroform	C	0.15	~	0.12	1.0	57	4,700	1 U	1 U	NM	1 U	1 U	1 U	1.3	1 U	1 U
Ethylbenzene	N	130	700	0.11	1.0	31,000	290,000	1 U	1 U	NM	1 U	1 U	**3.4**	1 U	1 U	1 U
Appendix IX Semi-Volatile Organic Compounds (ug/L)																
2-Methylnaphthalene	N	12	~	2.1	10	~	~	10 U	10 U	NM	10 U	10 U	80	10 U	18	110
Acenapthene	N	37	~	1.0	10	6,700	9,900	**6.4 J**	10 U	NM	10 U	10 U	**8.5 J**	10 U	**4.1 J**	**6.4 J**
Anthracene	N	180	~	0.50	10	83,000	400,000	10 U	10 U	NM	10 U	10 U	**1 J**	10 U	10 U	10 U
Benzo(a)anthracene	C	0.092	~	0.80	10	0.038	0.18	10 U	**1 J**	NM	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)pyrene	C	0.0092	0.2	0.59	10	0.038	0.18	10 U	**0.73 J**	NM	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	~	~	~	0.62	10	~	~	10 U	**0.75 J**	NM	10 U	10 U	10 U	10 U	10 U	10 U
Chrysene	C	9.2	~	0.78	10	0.038	0.18	10 U	**1.2 J**	NM	10 U	10 U	10 U	10 U	10 U	10 U
Dibenzofuran	N	1.2	~	1.0	10	~	~	10 U	10 U	NM	10 U	10 U	**6 J**	10 U	10 U	**3 J**
Fluoranthene	N	150	~	0.61	10	1,300	1,400	10 U	**1.7 J**	NM	10 U	10 U	10 U	10 U	10 U	10 U
Fluorene	N	24	~	1.0	10	11,000	53,000	**1.4 J**	10 U	NM	10 U	10 U	**8.2 J**	10 U	**5.9 J**	**11**
Naphthalene	N	0.65	~	1.0	10	~	~	10 U	10 U	NM	10 U	10 U	55	10 U	10 U	14
Phenanthrene	~	~	~	1.0	10	~	~	10 U	10 U	NM	10 U	10 U	**12**	10 U	**5.1 J**	**11**
Pyrene	N	18	~	1.0	10	8,300	40,000	10 U	**1.5 J**	NM	10 U	10 U	10 U	10 U	10 U	10 U
TAL Metals (mg/L)																
Aluminum	N	3.7	~	0.014	0.2	~	~	**0.37 ***	7.7 *	**0.028 B***	0.2 U	0.2 U	**0.29 ***	0.2 U	0.2 U	**0.14 B**
Antimony	N	0.0015	0.006	0.0037	0.02	0.056	6.4	**0.0039 B**	**0.0077 B**	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Arsenic	C	0.000045	0.01	0.005	0.01	0.00018	0.0014	0.01 U	0.01	0.01 U	0.01 U	0.01 U	**0.007 B**	0.01 U	0.01 U	0.01 U
Barium	N	0.26	2	0.001	0.01	10	~	0.59	**0.17**	**0.11**	0.29	**0.1**	1.1	**0.16**	0.58	0.72
Beryllium	N	0.0073	0.004	0.0004	0.004	~	~	0.004 U	**0.00072 B**	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U
Cadmium	N	0.0018	0.005	0.00086	0.005	~	~	0.005 U	**0.0021 B**	0.005 U	0.005 U	**0.0011 B**	0.005 U	0.005 U	0.005 U	0.005 U
Calcium	~	~	~	0.05	0.5	~	~	**98**	**130**	**100**	**110**	**96**	**60**	**100**	**120**	**110**
Chromium (assumes hexavalent)	N	0.011	0.1	0.0011	0.01	~	~	**0.0025 B**	0.029	0.01 U	0.01 U	**0.0036 B**	**0.0032 B**	**0.0028 B**	**0.0025 B**	0.01 U
Cobalt	N	0.073	~	0.0014	0.01	~	~	0.01 U	**0.0084 B**	0.01 U	**0.0017 B**	0.01 U	**0.0018 B**	0.01 U	0.01 U	0.01 U
Copper	N	0.15	1.3	0.0027	0.02	13	~	0.02 U	**0.12**	**0.0075 B**	0.02 U	**0.0028 B**	0.02 U	0.02 U	0.02 U	0.02 U
Iron	N	1.1	~	0.024	0.05	3	~	10	18	0.05 U	7.5	**0.1**	3.1	**0.038 B**	7.7	11
Lead	~	~	0.015	0.0025	0.005	~	~	**0.0025 B**	0.12	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Magnesium	~	~	~	0.05	0.5	~	~	**47**	**97**	**83**	**53**	**52**	**35**	**31**	**49**	**50**
Manganese	N	0.073	~	0.001	0.01	0.5	1	0.45	1.2	**0.0076 B**	2.3 *	0.22 *	0.35	**0.0025 B***	1 *	0.58 *
Nickel	N	0.073	~	0.0022	0.04	6.1	46	0.04 U	**0.016 B**	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
Potassium	~	~	~	0.1	1	~	~	**2.9**	**24**	**22**	**2.9**	**4.9**	**2.6**	**2.5**	**2.9**	**2.8**
Sodium	~	~	~	0.18	0.5	~	~	**38**	**57**	**56**	**71**	**270**	**150**	**16**	**16**	**15**
Vanadium	N	0.026	~	0.0007	0.01	~	~	0.01 U	**0.019**	0.01 U	0.01 U	0.01 U	**0.0013 B**	0.01 U	0.01 U	0.01 U
Zinc	N	1.1	~	0.0013	0.02	74	260	**0.0093 B**	**0.58**	**0.055**	**0.0063 B**	**0.03**	**0.012 B**	**0.0083 B**	**0.0058 B**	**0.0056 B**
Mercury (assumes mercuric chloride)	N	0.0011	0.002	0.000078	0.0002	~	~	**0.00012 B**	**0.000085 B**	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U

Red - Indicates an exceedance of the Maximum Contaminant Level (MCL)
Blue - Indicates an exceedance of the EPA Region III Tap Water RBCs dated April 2003
Indicates detection that exceeds Water + Organism criteria
Indicates detection that exceeds Organism criteria

[1]Carcinogen/Non-Carcinogen taken from EPA Region III RBC table (April 2003)
[2]Tap Water RBCs for noncarcinogens have been multiplied by a Hazard Quotient of 0.1 to account for cumulative effects on target organs.

Qualifiers

U - Indicates that the compound was analyzed for but not detected.
B (Inorganic) - Indicates the reported value was obtained from a reading less than the RL but greater than or equal to the MDL
* - Sample duplicate %RPD exceeded acceptance limits.
J - Indicates the presence of a compound that meets the identification criteria, but the result is less than the sample RL and greater than the MDL.

Table 3
LF-series Groundwater Results

Specific Analyte List	(C/N)[1]	Region III Tap Water RBCs[2]	MCLs	MDL	RL	10x Water Quality Criteria - Water + Organism	10x Water Quality Criteria - Organism	LFMW-5	LFMW-6	LFMW-7	GW-FD-2 (LFMW-7)	LFMW-8	LFMW-9	GW-FD-1 (LFMW-9)	LFMW-10	LFMW-11
Appendix IX Volatile Organic Compounds (ug/L)																
Acrolein	N	0.0042	~	6.6	20	1,900	2,900	20 U	20 U	20 U	**120**	20 U	200 U	20 U	20 U	20 U
Benzene	C	0.34	5	0.096	1.0	22	510	1 U	1 U	1 U	1 U	1 U	**240**	**190 D**	1 U	1 U
Chloroform	C	0.15	~	0.12	1.0	57	4,700	1 U	1 U	1 U	1 U	1 U	10 U	1 U	**5**	1 U
Ethylbenzene	N	130	700	0.11	1.0	31,000	290,000	1 U	1 U	1 U	1 U	1 U	**17**	**16**	1 U	1 U
Tetrachloroethene	C	0.53	5	0.43	1.0	6.9	33	1 U	**0.49 J**	1 U	1 U	1 U	10 U	1 U	1 U	1 U
Toluene	N	75	1,000	0.065	1.0	68,000	2,000,000	1 U	1 U	1 U	1 U	1 U	**5.7 J**	**5.3**	1 U	1 U
Xylene (total)	N	21	10,000	0.28	2.0	~	~	2 U	2 U	2 U	2 U	2 U	**74**	**71**	2 U	2 U
Appendix IX Semi-Volatile Organic Compounds (ug/L)																
2-Methylnaphthalene	N	12	~	2.1	10	~	~	10 U	10 U	10 U	10 U	10 U	**19**	**20**	10 U	10 U
Benzo(g,h,i)perylene	~	~	~	0.62	10	~	~	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**0.97 J**	10 U
TAL Metals (mg/L)																
Aluminum	N	3.7	~	0.014	0.2	~	~	**0.031 B**	**0.22**	**0.11 B**	**0.076 B**	**0.43**	0.2 U	0.2 U	0.2 U	**0.12 B**
Arsenic	C	0.000045	0.01	0.005	0.01	0.00018	0.0014	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	**0.0069 B**	**0.0053 B**	0.01 U	0.01 U
Barium	N	0.26	2	0.001	0.01	10	~	**0.098**	**0.19**	**0.48**	**0.47**	**0.12**	**0.22**	**0.23**	**0.13**	**0.11**
Cadmium	N	0.0018	0.005	0.00086	0.005	~	~	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	**0.00087 B**	0.005 U	0.005 U
Calcium	~	~	~	0.05	0.5	~	~	**62**	**120**	**120**	**120**	**110**	**130**	**130**	**75**	**83**
Chromium (assumes hexavalent)	N	0.011	0.1	0.0011	0.01	~	~	**0.0086 B**	0.01 U	0.01 U	0.01 U	**0.0011 B**	**0.0012 B**	0.01 U	0.01 U	**0.0012 B**
Cobalt	N	0.073	~	0.0014	0.01	~	~	0.01 U	**0.0016 B**	**0.0015 B**	**0.0021 B**	**0.0033 B**	**0.0019 B**	**0.0016 B**	0.01 U	0.01 U
Iron	N	1.1	~	0.024	0.05	3	~	**0.13**	**0.5**	**7.6**	**7.8**	**1.3**	**21**	**22**	**0.038 B**	**0.13**
Magnesium	~	~	~	0.05	0.5	~	~	**24**	**43**	**49**	**48**	**40**	**47**	**49**	**28**	**32**
Manganese	N	0.073	~	0.001	0.01	0.5	1	**0.012 ***	**0.54 ***	**2.2 ***	**2.2 ***	**1.1 ***	**1.5 ***	**1.6 ***	0.01 U*	**0.0025 B***
Nickel	N	0.073	~	0.0022	0.04	6.1	46	**0.006 B**	0.04 U	0.04 U	0.04 U	**0.0034 B**	0.04 U	0.04 U	0.04 U	0.04 U
Potassium	~	~	~	0.1	1	~	~	**1.9**	**2.3**	**2.3**	**2.3**	**2.8**	**2.5**	**2.6**	**2.3**	**2**
Sodium	~	~	~	0.18	0.5	~	~	**3.8**	**4.7**	**16**	**15**	**20**	**10**	**11**	**6.7**	**5.3**
Vanadium	N	0.026	~	0.0007	0.01	~	~	0.01 U	**0.00084 B**	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Zinc	N	1.1	~	0.0013	0.02	74	260	**0.0072 B**	**0.0075 B**	**0.0069 B**	**0.0074 B**	**0.0063 B**	**0.0061 B**	**0.0082 B**	**0.0053 B**	**0.0076 B**

Red - Indicates an exceedance of the Maximum Contaminant Level (MCL)
Blue - Indicates an exceedance of the EPA Region III Tap Water RBCs dated April 2003
Indicates detection that exceeds Water + Organism criteria
Indicates detection that exceeds Organism criteria

[1]Carcinogen/Non-Carcinogen taken from EPA Region III RBC table (April 2003)
[2]Tap Water RBCs for noncarcinogens have been multiplied by a Hazard Quotient of 0.1 to account for cumulative effects on target organs.

Qualifiers

U - Indicates that the compound was analyzed for but not detected.
B (Inorganic) - Indicates the reported value was obtained from a reading less than the RL but greater than or equal to the MDL
* - Sample duplicate %RPD exceeded acceptance limits.
J - Indicates the presence of a compound that meets the identification criteria, but the result is less than the sample RL and greater than the MDL.
D - Result is from a secondary dilution.

Specific Analyte List	(C/N)[1]	Region III Tap Water RBCs	MCLs	MDL	RL	10x Water Quality Criteria - Water + Organism	10x Water Quality Criteria - Organism	RFIMW-2	RFIMW-3	RFIMW-4	RFIMW-5	RFIMW-6	RFIMW-7	WTMW-1	WTMW-2	WTMW-3
Appendix IX Volatile Organic Compounds (ug/L)																
Acetone	N	61	~	2.3	25	~	~	**16 J**	25 U	25 U	25 U	25 U	**27**	25 U	25 U	25 U
Chloroform	C	0.15	~	0.12	1.0	57	4,700	1 U	1 U	1 U	**0.52 J**	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	N	130	~	0.27	1.0	~	~	1 U	1 U	1 U	1 U	**2.7**	1 U	1 U	1 U	1 U
Appendix IX, Semi-Volatile Organic Compounds (ug/L)																
3-Methylcholanthrene	~	~	~	0.72	10	~	~	10 U	10 U	10 U	10 U	10 U	**0.8 J**	10 U	10 U	10 U
Benzo(a)pyrene	C	0.0092	0.2	0.59	10	0.038	0.18	10 U	10 U	**2 J**	10 U	10 U	**1 J**	10 U	10 U	10 U
Benzo(g,h,i)perylene	~	~	~	0.62	10	~	~	10 U	10 U	**0.62 J**	10 U	10 U	**0.77 J**	10 U	10 U	10 U
Benzo(k)fluoranthene	C	0.92	~	1.2	10	0.038	0.18	10 U	10 U	**2.3 J**	10 U	10 U	10 U	10 U	10 U	10 U
Chrysene	C	9.2	~	0.78	10	0.038	0.18	10 U	10 U	**3.5 J**	10 U	10 U	**0.79 J**	10 U	10 U	10 U
Dibenz(a,h)anthracene	C	0.0092	~	0.64	10	0.038	0.18	10 U	10 U	10 U	10 U	10 U	**0.66 J**	10 U	10 U	10 U
Fluoranthene	N	150	~	0.61	10	1,300	1,400	10 U	10 U	**1.1 J**	10 U	10 U	10 U	10 U	10 U	10 U
Phenanthrene	~	~	~	1.0	10	~	~	10 U	10 U	**1.5 J**	10 U	10 U	10 U	10 U	10 U	10 U
Pyrene	N	18	~	1.0	10	8,300	40,000	10 U	10 U	**1.4 J**	10 U	10 U	10 U	10 U	10 U	10 U
TAL Metals (mg/L)																
Aluminum	N	3.7	~	0.014	0.2	~	~	**0.21**	**2 ***	**0.4**	**1.9 ***	0.2 U	**0.65**	0.2 U	0.2 U	0.2 U
Antimony	N	0.0015	0.006	0.0037	0.02	0.056	6.4	0.02 U	**0.013 B**	0.02 U	**0.0047 B**	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Arsenic	C	0.000045	0.01	0.005	0.01	0.00018	0.0014	0.01 U	**0.028**	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Barium	N	0.26	2	0.001	0.01	10	~	**0.1**	**0.094**	**0.17**	**0.078**	**0.31**	**0.22**	**0.26**	**0.053**	**0.088**
Cadmium	N	0.0018	0.005	0.00086	0.005	~	~	0.005 U	**0.001 B**	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Calcium	~	~	~	0.05	0.5	~	~	**88**	**35**	**110**	**43**	**110**	**120**	**92**	**28**	**27**
Chromium (assumes hexavalent)	N	0.011	0.1	0.0011	0.01	~	~	**0.0021 B**	**0.031**	**0.0019 B**	**0.0034 B**	0.01 U	**0.0094 B**	0.01 U	0.01 U	0.01 U
Cobalt	N	0.073	~	0.0014	0.01	~	~	**0.0026 B**	**0.0034 B**	**0.0019 B**	**0.0034 B**	**0.004 B**	**0.0076 B**	**0.0022 B**	0.01 U	0.01 U
Copper	N	0.15	1.3	0.0027	0.02	13	~	0.02 U	**0.0053 B**	0.02 U	**0.0043 B**	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Iron	N	1.1	~	0.024	0.05	3	~	**0.57**	**1.4**	**0.51**	**1.9**	**3.5**	**5.3**	**2.2**	**0.059**	**0.28**
Lead	~	~	0.015	0.0025	0.005	~	~	0.005 U	**0.024**	0.005 U	**0.0058**	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Magnesium	~	~	~	0.05	0.5	~	~	**33**	**28**	**66**	**21**	**47**	**58**	**47**	**8.2**	**9.7**
Manganese	N	0.073	~	0.001	0.01	0.5	1	**4.7 ***	**0.77**	**0.48**	**0.74**	**3.2 ***	**11**	**2.9**	**0.12**	**0.83 ***
Nickel	N	0.073	~	0.0022	0.04	6.1	46	0.04 U	**0.017 B**	0.04 U	**0.0068 B**	0.04 U	**0.0097 B**	0.04 U	0.04 U	0.04 U
Potassium	~	~	~	0.1	1	~	~	**0.55 B**	**190**	**1.2**	**10**	**2.3**	**2**	**4.7**	**2.2**	**0.57 B**
Selenium	N	0.018	0.05	0.0053	0.01	1.7	42	0.01 U	**0.15**	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Sodium	~	~	~	0.18	0.5	~	~	**54**	**270**	**72**	**400**	**12**	**43**	**93**	**6**	**11**
Thallium	N	0.00026	0.002	0.0057	0.01	0.017	0.063	0.01 U	0.01 U	0.01 U	0.01 U	**0.0071 B**	0.01 U	0.01 U	0.01 U	0.01 U
Vanadium	N	0.026	~	0.0007	0.01	~	~	0.01 U	**0.0087 B**	**0.0018 B**	**0.0071 B**	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Zinc	N	1.1	~	0.0013	0.02	74	260	**0.009 B**	**0.14**	**0.0093 B**	**0.04**	**0.016 B**	**0.019 B**	**0.0064 B**	**0.011 B**	**0.019 B**

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