DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

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

Facility Name: Virginia Department of Transportation (VDOT) Elko Materials Lab
Facility Address: 6200 Elko Tract Road
Facility EPA ID #: VAD980918189

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 ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

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

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

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

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

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

Rationale and Reference(s):

The 2012 "*Interim Measures Progress Report*" identified 25 constituents of concern that exceeded applicable standards US EPA Maximum Contaminant Levels (MCLs) and US EPA Region III Risk-Based Regional Screening Levels (Tap Water Standards) in groundwater beneath the site. Follow-up site investigations conducted in 2012 augment the data collected in the Progress Report. The detected constituents appear related to industrial solvents released from the on-site former waste management unit. **Table 1** below summarizes the constituents, maximum detected concentration of detected chemicals on and off site with comparisons to regulatory and health based screening levels. The table composites results from three groundwater sampling events undertaken between March and July 2012.

CoCs occur at their highest concentrations in on-site groundwater directly beneath the former waste management unit **(Map 1)**. Recent cleanup efforts have focused on removing free product and high concentration residuals from the waste unit sub-liner horizon. Impacts in the underlying water table aquifer extend from 10 to 25 feet below grade. A plume of impacted groundwater extends down-gradient from the unit off-site towards the southwest for a distance of at least 330 feet. The off-site area above this impacted groundwater is occupied by a four-lane public roadway and right of way with no occupied buildings. There is no indication the constituents have moved into deeper aquifers including that from which VDOT withdraws water for selective non-potable testing at its lab facilities. No off-site groundwater supplies are threatened. The nearest residence is 2,000 feet up gradient and the nearest down gradient residence is 4,200 feet away. To date no samples of surface water have been collected although groundwater sampling near the down-gradient edge of the plume indicates surface water concentrations are not likely to exceed applicable standards.

Table 1 Summary of Volatile Organic Compounds Detected in Water Table Aquifer Beneath the VDOT Elko Lab Site March – July 2012					
Constituent	Maximum On-Site Concentration (µg/L)	Maximum Off-Site Concentration (µg/L)	US EPA Region III RSL Tap Water (µg/L)	US EPA MCL (µg/L)	Exceeds One or Both Limits?
Acetone	235	4.9	22,000	NES	No
Benzene	464	<1	0.41	5	Yes
1,1-Dichloroethane	1,790	32.5	2.4	NES	Yes
1,1-Dichloroethylene	29,900	107	340	7	Yes
1,2-Dichloroethane	77.1	<1	0.43	75	Yes
1,4-Dioxane	423	<1	6.1	NES	Yes
2-Butanone (MEK)	514	3.4	7,100	NES	No
Carbon Disulfide	10	<1	1,000	NES	No
Carbon Tetrachloride	32.7	<1	0.20	5	Yes
Chlorobenzene	16.7	<1	91	100	No
Chloroethane (Ethyl Chloride)	228	<1	21,000	NES	No
Chloroform	34.4	<1	0.19	80	Yes
cis-1,2-Dichloroethylene	11.1	<1	73	70	No
Ethylbenzene	4.7	<1	1.5	700	Yes
m,p-Xylenes	19.8	<2	1,200	NES	No
Methyl Cyclohexane	11.7	<1	NES	NES	No
Methylene Chloride	17.8	<4	4.8	5	Yes
Methyl-tert-butyl ether (MTBE)	6.8	6.8	12	NES	No
4-Methyl-2-pentanone (MIBK)	10	<1	2,000	NES	No
o-Xylene	6.9	<1	1,200	NES	No
Tetrachloroethylene (PCE)	41.3	<1	0.11	5	Yes
Toluene	469	1	2,300	1,000	No
1,1,1-Trichloroethane	135,000	55.9	9,100	200	Yes
Trichloroethylene (TCE)	374	1.4	2	5	Yes
Vinyl Chloride	5.9	<1	0.016	2	Yes
Xylenes, Totals	26.8	<3	200	10,000	No
Note: NES = No established regulatory limit; MCL=Maximum Contaminant Limit; RSL=Regional Screening Level					

References:

Marshall Miller and Associates, 2012, Amendment to VDOT Elko Materials Lab, Facility Lead Agreement – Interim Measures – Sub-liner Horizon Surfactant Washing, Virginia Department of Transportation, US EPA ID No. VAD9800118189, Submitted to US EPA Region III July 26, 2012.

Footnotes:

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

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

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

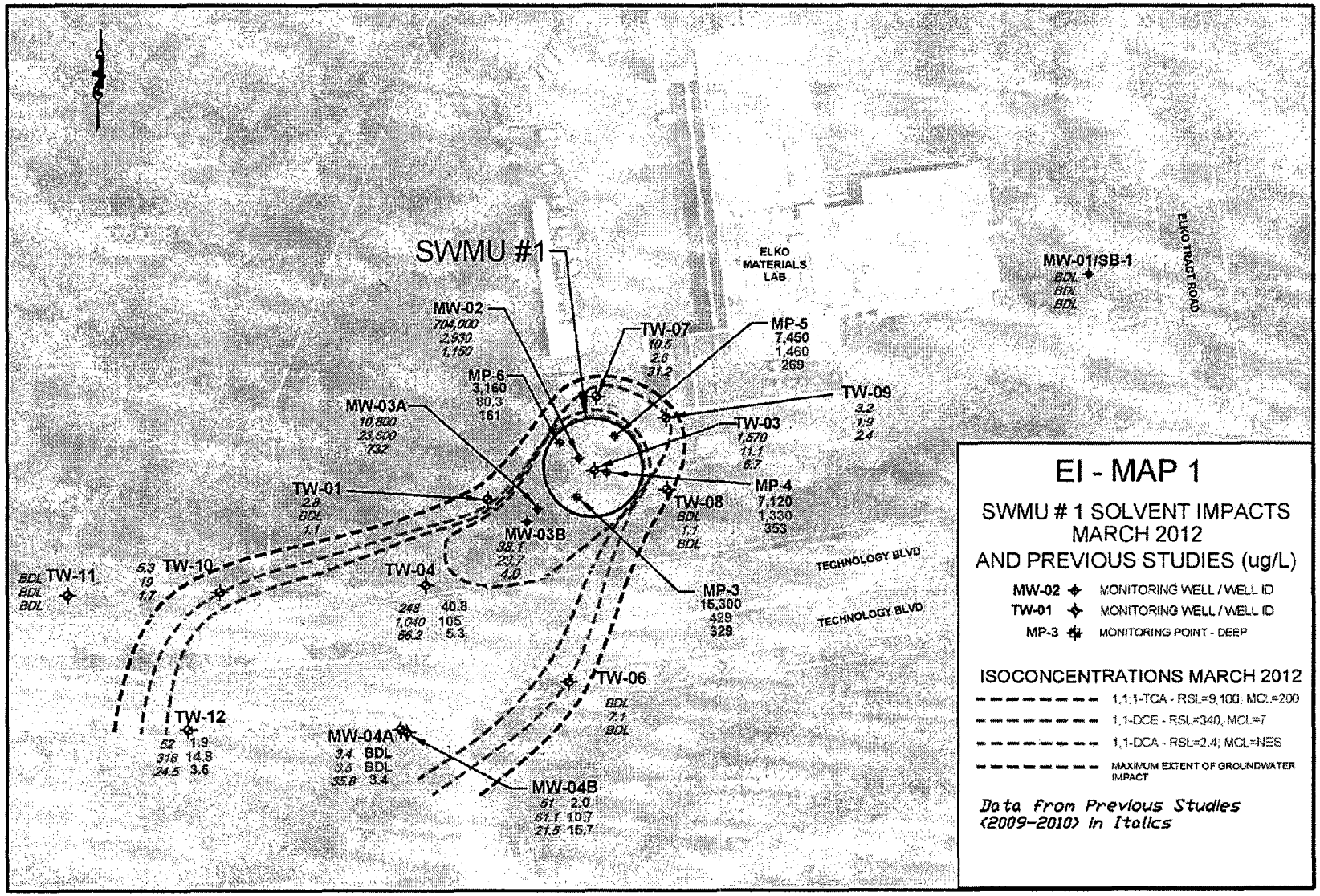
☐ If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"[2]) – skip to #8 and enter "NO" status code, after providing an explanation.

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

Rationale and Reference(s):
The dissolved groundwater plume extends down-gradient from the unit for a distance of at least 330 feet **(Map 1)**. Within this area, the most recently collected sampling results indicate the extent of groundwater impacts exceeding MCLs and/or Risk-based Standards is stable or contracting. As of March 13, 2012 only two constituents (1,1-DCA and 1,1-DCE) detected in groundwater beyond the boundaries (off-site) of property controlled by VDOT exceed applicable standards. These and other constituents detected in earlier sampling events in 2009 and 2010 occurred at significantly lower (factor of 10) concentrations in the March 2012 event.

References:
Marshall Miller and Associates, 2012, Amendment to VDOT Elko Materials Lab, Facility Lead Agreement – Interim Measures – Sub-liner Horizon Surfactant Washing, Virginia Department of Transportation, US EPA ID No. VAD9800118189, Submitted to US EPA Region III July 26, 2012.

[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.


SWMU #1
ELKO MATERIALS LAB
ELKO TRACT ROAD
MW-01/SB-1
BDL
BDL
BDL
MW-02
704,000
2,930
1,150
TW-07
10.5
2.6
31.2
MP-5
7,450
1,460
269
MP-6
3,160
80.3
161
TW-09
3.2
1.9
2.4
MW-03A
10,800
23,600
732
TW-03
1,570
11.1
6.7
TW-01
2.8
BDL
1.1
MP-4
7,120
1,330
353
TW-08
BDL
1.1
BDL
MW-03B
38.1
23.7
4.0
TECHNOLOGY BLVD
TECHNOLOGY BLVD
BDL TW-11
BDL
BDL
5.3 TW-10
19
1.7
TW-04
248 40.8
1,040 105
56.2 5.3
MP-3
15,300
429
329
TW-06
BDL
7.1
BDL
TW-12
52 1.9
318 14.8
24.5 3.6
MW-04A
3.4 BDL
3.5 BDL
35.8 3.4
MW-04B
51 2.0
61.1 10.7
21.5 15.7
EI - MAP 1
SWMU # 1 SOLVENT IMPACTS
MARCH 2012
AND PREVIOUS STUDIES (ug/L)
MW-02 MONITORING WELL / WELL ID
TW-01 MONITORING WELL / WELL ID
MP-3 MONITORING POINT - DEEP
ISOCONCENTRATIONS MARCH 2012
1,1,1-TCA - RSL=9,100; MCL=200
1,1-DCE - RSL=340; MCL=7
1,1-DCA - RSL=2.4; MCL=NES
MAXIMUM EXTENT OF GROUNDWATER IMPACT
Data from Previous Studies
(2009-2010) in Italics

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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):

To date, no samples of surface water have been collected on or off-site. Surface water occurs on site in storm water drainage channels that flow through and off the site parallel to the direction of groundwater flow. Intermittent springs down gradient of the site feed a man-made storm water retention pond located 550 feet to the southwest. Based on groundwater samples collected from monitoring wells located near the down gradient extent of the plume it is unlikely contaminants would discharge into nearby surface waters at levels exceeding applicable standards.

References:

Google Earth Imagery Dated July 3, 2010 and field reconnaissance

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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)?

[X] If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentrations 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 concentrations 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 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):

Table 2 below compares the maximum concentration of constituents detected in groundwater monitoring wells located near the down-gradient edge of the plume with applicable surface water standards. Of the detected constituents, none exceeded Virginia Surface Water Criteria (9 VAC 25-260-140) for human health, either for public water supplies or other surface waters. Likewise none of the detected constituents exceeded the lower of ten times the US EPA Risk-based Regional Screening Levels (RSLs) for tap water. Although, in one case, the concentration of 1,1-DCE exceeds 10 times (10X) the MCL in the lower portion of the water table aquifer near the down-gradient plume limit, the sample collected in the upper portion of the aquifer contained just over the same limit. It is expected that this level would decline to less than the 10X MCL limit before reaching the nearest spring located 250 feet further down gradient.

Table 2
Comparison of Volatile Organic Compounds Detected in Water Table With Virginia Surface Water Criteria – 9 VAC 25-260-140, MCLs and Risk Based Criteria for Tap Water

Constituent	Concentration at Down-gradient Plume Edge (MW-4A/4B, TW-10 or TW-12) (µg/L)	Surface Water - Human Health		Groundwater	Exceeds One or More Limits at Down-gradient Well?
		Public Water Supplies (µg/L)	All Other Surface Waters (µg/L)	10X lower of Tap Water RSL or MCL (µg/L)	
1,1-Dichloroethane	21.8	NES	NES	24	No
1,1-Dichloroethylene	107/79.7*	330	7,100	70	Yes
Methyl-tert-butyl ether (MTBE)	6.8	NES	NES	120	No
1,1,1-Trichloroethane	55.9	NES	NES	2,000	No
Trichloroethylene (TCE)	1.4	25	300	20	No

*Note: NES = No established regulatory limit; *1,1-DCE concentrations – lower/upper water table aquifer; MCL – Maximum Contaminant Level; RSL – US EPA Regional Screening level – April 2012*

References:

Marshall Miller and Associates, 2012, Amendment to VDOT Elko Materials Lab, Facility Lead Agreement – Interim Measures – Sub-liner Horizon Surfactant Washing, Virginia Department of Transportation, US EPA ID No. VAD9800118189, Submitted to US EPA Region III July 26, 2012.

Virginia Surface Water Quality Standards, Virginia Administrative Code Title 9 VAC 25-260-140, January 2011

US EPA Regional Screening Level (RSL) Table from April, 2012.

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

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

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

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

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

Rationale and Reference(s):

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

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

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

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

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

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

Rationale and Reference(s):

Biennial monitoring of down gradient wells TWs-4, -6, -10, -12, MWs- 3A, -3B, -4A and -4B will provide a basis for monitoring changes in dissolved concentrations. Wells MW-3A and -4B will monitor the lower water table aquifer (25-30 feet) and the remaining wells the upper portion (10-20 feet). These wells are located either on site or in public rights of way and should remain accessible over the long term. The wells will be monitored for volatile organic compounds including the chemicals of concern 1,1,1-TCA, 1,1-DCE, 1,1-DCA and TCE. In the event significant changes in concentrations occur over a one year period, the monitoring array may be adjusted to include additional wells.

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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 Elko Materials Lab facility, EPA ID # VAD980018189, located at 6200 Elko Tract Road, Sandston, Virginia 23150. 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) Estena McGhee Date 9/30/13
(print) Estena McGhee
(title) RPM, Environmental Engineer

Supervisor (signature) Date 10/21/13
(print) Luis Pizarro
(title)
(EPA Region or State)