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: *Allegany Ballistics Laboratory*
Facility Address : *210 State Route 956, Rocket Center, West Virginia 26726-3548*
Facility EPA ID#: *WVO170023691*

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

The following discussion provides a brief background and overview of information collected to date regarding known or reasonably suspected releases to groundwater.

Allegany Ballistics Laboratory (ABL) is located in Rocket Center, West Virginia, along the North Branch Potomac River. ABL is comprised of Plant 1 and Plant 2. The United States Navy (Navy) owns Plant 1; all solid waste management units (SWMUs) and areas of concern (AOCs) located within Plant 1 will be addressed pursuant to the January 1998 Federal Facilities Agreement (FFA) between the United States Environmental Protection Agency (EPA) and the Navy. Plant 2 is owned and operated by Alliant Techsystems Company LLC; the SWMUs and AOCs located within Plant 2 will be addressed under the RCRA Corrective Action Program.

Plant 2 comprises of about 56 acres, of which more than half are developed. The land surrounding the facility is primarily rural agricultural and forest. Several residences along US Route 220 in Maryland, 0.5 mile west of the facility, obtain potable water from private wells. In addition, approximately three residences across the North Branch Potomac River from Plant 1 and several residences south of ABL in West Virginia, obtain water from private wells. The latter private well users are separated from the facility by mountains. Potable water for ABL is obtained from water supply wells located in the undeveloped portions of Plant 1, approximately 0.5 mile south of Plant 2.

ABL's primary activities are the development and production of solid propellant rocket motors, gas generators, war heads, and laser initiation systems for the United States Department of Defense (DOD). Other activities conducted at ABL include development and production of metal parts, metal components, and filament wound composite structures, and testing of automobile component products.

In 1942, Kelly Springfield Engineering Company acquired the approximately 400-acres that the process and operations area are located on. The United States Army (Army) purchased the site in 1943. George Washington University assumed management of the facility for the Army Office of Scientific Research and Development in 1944 and conducted research and development activities until 1945. The Navy acquired ownership of the 400-acre Plant 1 portion of the facility in 1945 and the Aerospace Division of Hercules assumed management of the facility. In 1962, the Navy acquired

an additional 1,177 acres of undeveloped land adjacent to Plant 1. In 1964, Hercules signed a Facilities Use Contract and began operating ABL under its own direction. In 1967, Hercules purchased 56-acres of land adjoining Plant 1 and built a propellant production facility, the Hercopel Plant (Plant 2). In 1995, Alliant Techsystems, Inc. acquired the Aerospace division of Hercules and assumed operation of ABL.

Currently, approximately 40 buildings exist at Plant 2. More than half of Plant 2 has been developed for operations that currently include rocket motor case preparation, propellant mixing, casting and machining, ammonium perchlorate grinding, and motor finishing. Load and pack operations and product and tooling storage also occur at Plant 2. Primary utilities at Plant 2 include two oil-fired boilers for steam generation and a small wastewater treatment plant for processing of onsite sanitary waste. Although the majority of Plant 2 is located in the 500-year floodplain of the North Branch Potomac River, a dike was constructed to prevent flooding in the event of a 500-year flood.

Definition of Environmental Indicators (for the RCRA Corrective Action)

EIs 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 Determination 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 providing or 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)

Previous Investigations

Groundwater samples have been collected at Plant 2 during historical field investigations. Groundwater samples were collected using direct push sampling technology in December 2005, January 2006, and November 2006 from across Plant 2. Based on the results of this groundwater sampling, seven alluvial monitoring wells were installed for use in a pilot groundwater study in March 2007 and eight alluvial and five bedrock monitoring wells were installed across Plant 2 from August 2009 through June 2010. Two screened sampling intervals were installed in four of the five bedrock monitoring wells. Groundwater samples were collected from the monitoring wells in June and September 2010 and January 2012.

Groundwater analytical results for Plant 2 monitoring wells from groundwater sampling conducted during June and September 2010 and January 2012 were compared to the Drinking Water Maximum Contaminant Level (MCL), or the May 2012 United States Environmental Protection Agency (USEPA) Regional Screening Level (RSL) for tap water where no MCL exists. Tap water RSLs based on non-carcinogenic effects were adjusted by dividing by 10 to account for exposure to more than one constituent that affects the same target organ.

Groundwater at Plant 2 is contaminated with VOCs, perchlorate, and metals at concentrations that exceed MCLs or RSLs. Table 1 shows the maximum detected concentration for each constituent that exceeded the screening level during the June and September 2010 or January 2012 sampling events. The VOCs detected at concentrations above the screening level in Plant 2 groundwater are primarily chlorinated VOCs, which include cis-1,2-dichloroethene (cis-1,2-DCE), trichloroethene (TCE), and vinyl chloride. The highest concentrations of VOCs in groundwater were detected in monitoring well MW10A, near SWMU 37S02 in the southern portion of Plant 2. Elevated levels of these chlorinated VOCs were also detected in monitoring wells associated with SWMUs 37U02, 37T02, and 25F. The highest concentration of perchlorate detected in Plant 2 groundwater was detected in MW02A, in the northwest corner of Plant 2 and downgradient from SWMU 37R, the primary source of perchlorate at the site. A number of metals were detected across Plant 2 at concentrations exceeding the screening levels, with the highest concentrations generally occurring in MW10A, near SMWU 37S02 in the southern portion of Plant 2, and MW04A in the central portion of Plant 2.

The metal concentrations in Plant 2 groundwater are consistent with those observed elsewhere at ABL where groundwater is not believed to be impacted by sites or other point sources, with the exception of total and dissolved barium in bedrock monitoring wells MW07B, MW08B, and MW10B, and total and dissolved manganese primarily in alluvial monitoring wells 25F-MW03, MW09A, and MW10A. Barium and manganese are not associated with any process or SWMUs at Plant 2 and are likely attributable to background conditions.

Table 1
Plant 2 Maximum Groundwater Concentrations Compared to Screening Criteria for Constituents that Exceed Screening Criteria

Constituent	Maximum Concentration (ug/L)	Sample Location	Screening Criteria (ug/L)	Source of Criteria
Carbon disulfide	251	ATK-GW-10A	72	RSL
cis-1,2-Dichloroethene	5,500	ATK-GW-10A	70	MCL
Trichloroethene	3,360	ATK-GW-10A	5	MCL
Vinyl Chloride	474	ATK-GW-10A	2	MCL
3-Nitrotoluene	0.91	ATK-GW-05A	0.13	RSL
Perchlorate	8.1	ATK-GW-02A	1.1	RSL
Aluminum, total	29,200	ATK-GW-04A	1,600	RSL
Arsenic, total	179	ATK-GW-04A	10	MCL
Arsenic, dissolved	20.6	ATK-GW-03A	10	MCL
Barium, total	55,000	ATK-GW-08B-D	2,000	MCL
Barium, dissolved	42,000	ATK-GW-08B-D	2,000	MCL
Cobalt, total	32.4	ATK-GW-04A	0.47	RSL
Cobalt, dissolved	7.95	ATK-GW-08B-D	0.47	RSL
Iron, total	110,00	ATK-GW-05A	1,100	RSL
Iron, dissolved	22,300	ATK-25F-GW03	1,100	RSL
Lead, total	43.4	ATK-GW-04A	15	[1]
Manganese, total	14,700	ATK-GW-10A	32	RSL
Manganese, dissolved	14,900	ATK-GW-10A	32	RSL
Nickel, total	79.2	ATK-GW-04A	30	RSL
Thallium, total	2.45	ATK-GW-04A	2	MCL
Vanadium, total	53.8	ATK-GW-04A	7.8	RSL
Vanadium, dissolved	9.3	ATK-GW-01B-D	7.8	RSL

ug/L – micrograms per Liter

Notes:

[1] EPA Safe Drinking Water Act Lead Action Level

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

X	If yes – continue after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the "existing area of groundwater contamination"[2]).
_____	If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"[2]) – skip to #8 and enter "NO" status code, after providing an explanation.
_____	If unknown – skip to #8 and enter "IN" status code

Rationale and Reference(s):

Based on the available information, the area of contaminated groundwater at Plant 2 is considered to be stabilized or decreasing. This conclusion is based on the results of monitoring well sampling conducted at Plant 2, the interim removal actions conducted for four source areas at Plant 2, and because the North Branch Potomac River prevents further groundwater plume migration.

Groundwater sampling conducted in June and September 2010 and January 2012 show similar concentration levels. Additionally, concentrations detected in monitoring well groundwater samples collected during an enhanced reductive dechlorination (ERD) pilot test (June 2007 through August 2008) indicated decreasing concentrations during the pilot test. Concentrations detected in the wells re-sampled in June and September 2010 and January 2012 have generally remained at those decreased levels or have decreased further.

Five primary source areas have been identified at Plant 2 based on site background and information, as well as soil, groundwater, surface water, and sediment sample data. These source areas include four former waste water sumps (SWMUs 37R, 37S02, 37T02, and 37U02) and a former solvent recovery still (SWMU 25F). The four sumps and associated contaminated soil (about 15 cubic yards at each sump) were removed in January 2006. Based on confirmation soil samples collected during the interim removal action in January 2006, additional soil was excavated from the sump locations in April 2006 (about 23 cubic yards from SWMU 37R, 15 cubic yards from 37T02, 15 cubic yards from 37S02, and 5 cubic yards from 37U02). An ERD pilot study was conducted for groundwater associated with SWMU 25F. The concentrations of TCE in monitoring well groundwater samples decreased during the pilot study, from June 2007 to August 2009.

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 location 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 groundwater beneath the ABL, in both the alluvium and at least the upper bedrock, has a dominant flow direction toward the North Branch Potomac River and hydraulic studies have indicated it discharges to the North Branch Potomac 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)?

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

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

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

Rationale and Reference(s):

Water-level and hydraulic testing data suggest groundwater from ABL alluvium and at least the upper bedrock flows toward and discharges to the North Branch Potomac River.

Groundwater concentrations in the monitoring wells closest to the North Branch Potomac River (MW01A, MW01B-S, MW01B-D, MW02A, and MW03A) were compared to 10 times the groundwater screening levels (10 times the MCLs, or if an MCL was not available, 10 times the adjusted tap water RSL). As shown in Table 2, iron and manganese are the only constituents detected in groundwater that exceed the screening level. Manganese and iron concentrations detected in the monitoring wells closest to the North Branch Potomac River are consistent with those observed elsewhere at ABL where groundwater is not believed to be impacted by sites or other point source.

Surface water samples have been collected from the North Branch Potomac River during a number of investigations at ABL. Two surface water samples have been collected from a location slightly downgradient of Plant 2 (SW-1 in August 1992 and June 1994). These samples were analyzed for VOCs, semi-volatile organic compounds (SVOC), and metals. Metals were the only constituents detected in these two samples. The detected concentrations were compared to 10 times the MCL (if an MCL was not available, compared to the adjusted tap water RSL) and the West Virginia Surface Water Standard for human health for water and fish ingestion. As shown in Table 3, the metals were all detected at concentrations less than the 10 times MCL (if an MCL was not available, compared to the adjusted tap water RSL). The maximum detected concentration of mercury exceeds the West Virginia Surface Water Standard for human health for water and fish ingestion; however, it is below 10 times the MCL. Mercury was detected in the June 1994 surface water sample, but was not detected in the August 1992 sample.

Surface water samples were collected from the North Branch Potomac River from locations upgradient of Plant 2 between November 1994 and October 2011. The surface water samples were analyzed for metals, and some of the samples were also analyzed for VOCs, SVOCs, and/or

perchlorate. As shown in Table 4, detected concentrations in these surface water samples were below 10 times the MCL (or adjusted tap water RSL if MCL not available) and the West Virginia Surface Water Standard, if available, for all constituents except beryllium, cobalt, iron, manganese, mercury, and thallium. Beryllium was detected in one sample and the concentration exceeded the surface water standard, but did not exceed the MCL. There is no MCL or surface water standard available for cobalt, however, the concentration detected in one sample exceeded the 10 times the tap water RSL. Two of the detected concentrations of iron exceeded the surface water standard, but did not exceed 10 times the adjusted tap water RSL (there is no MCL for iron). Three of the detected concentrations of manganese exceeded 10 times the adjusted tap water RSL (there is no MCL for manganese) but did not exceed the surface water standard. Mercury was detected at a concentration above the surface water standard in two of the samples, but did not exceed MCL in any of the samples. Thallium was detected in one surface water sample, and the detected concentration exceeded the surface water standard but not 10 times the MCL.

Table 2
Plant 2 Maximum Detected Groundwater Concentrations in Monitoring Wells Closest to the North Branch Potomac River Compared to Screening Levels for Constituents that Exceed Screening Levels

Constituent	Maximum Concentration (ug/L)	Sample Location	Screening Level (ug/L)	10 x Screening Level (ug/L)	Source of Level
Iron, total	36,000	ATK-GW-02A	1,100	11,000	RSL
Manganese, total	4,100	ATK-MW-01A	32	320	RSL

MCL - Maximum Contaminant Level
RSL – Regional Screening Level, tap water
ug/L – micrograms per Liter

Table 3
Summary of Constituent Concentrations in the North Branch Potomac River Downgradient of Plant 2 Compared to Screening Levels for Constituents that Exceed Screening Levels

Constituent	MCL[1] (ug/L)	WV SW Standard (ug/L)	10 x MCL[1] (ug/L)	Maximum Conc. (ug/L)
Mercury	2	0.14	20	0.65

MCL - Maximum Contaminant Level
ug/L – micrograms per Liter
WV SW Standard – West Virginia Surface Water Standard for human health, drinking water, and fish consumption
Notes:
[1] If MCL not available, value is adjusted tap water RSL

Footnotes:

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

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

   _____ If yes – continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR

   2) providing or referencing an interim-assessment[5], appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, us/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.

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):

Currently, an RCRA Facility Investigation/Corrective Measures Study (RFI/CMS) is being prepared for Plant 2. It is likely that based on the findings in the RFI/CMS, groundwater contamination will be part of an ongoing evaluation at the facility and, if necessary, future corrective action.

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 *Allegany Ballistics Laboratory*, EPA ID *WV0170023691*, located at *210 State Route 956, Rocket Center, West Virginia 26726-358.* 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: 10-7-13

(print) Catherine Guynn

(title) Project Manager

Supervisor: (signature) *-s-* Date: 10-7-13

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