CLOSURE EVALUATION

HAZARDOUS WASTE MANAGEMENT UNIT 39

RADFORD ARMY AMMUNITION PLANT
RADFORD, VIRGINIA

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1.0 INTRODUCTION

As discussed during a teleconference on May 22, 2007 between the Radford Army Ammunition Plant (RFAAP) and the Virginia Department of Environmental Quality (VDEQ), RFAAP conducted an evaluation of groundwater monitoring data from Hazardous Waste Management Unit 39 (HWMU-39) to determine whether hazardous waste constituents included on the Unit's hazardous waste constituent list have been released to groundwater in concentrations greater than established Drinking Water Standards (DWSs). Concentrations were compared to U.S. Environmental Protection Agency (USEPA) Maximum Contaminant Levels (MCLs) and VDEQ Alternate Concentration Limits (ACLs). This evaluation was conducted to determine the Unit's eligibility for clean closure for groundwater. RFAAP conducted the evaluation in accordance with procedures discussed during the May 22, 2007 teleconference.

1.1 Unit Description

HWMU-39 is located in the Horseshoe Area of RFAAP and is a closed former incinerator spray pond. The location of HWMU-39 is shown on the site location map included as **Figure 1**. The Unit was a concrete-lined rectangular impoundment and measured approximately 76 feet by 60 feet by 5 feet in depth. The maximum water level was three feet deep for a volume of 102,340 gallons. Groundwater flows to the northeast in the vicinity of the Unit toward the New River, as shown on **Figure 2**.

HWMU-39 received clean closure for soils in 1998. The approval letter for clean closure for soils is included in **Appendix A**. The Unit is in interim status.

1.2 Unit History

HWMU-39 was operated from 1979 to May 1992 and received clean closure for soils in 1998; the Unit has been in interim status since that time. No waste has been processed through the Unit since closure. As demonstrated in this Closure Evaluation, the Unit has not impacted groundwater.

In 1979, two incinerators were constructed for incineration of waste and off-specification explosives and propellants. During operation, HWMU-39 received incinerator scrubber wastewater, which was then reused as scrubber water for the incinerators. The wastewater contained lead from the incinerated propellants, and the sludges that formed in the spray pond met the definition of characteristic hazardous waste under the Virginia Hazardous Waste Management Regulations (VHWMR).

During closure, wastewater was pumped to the on-site wastewater treatment plant, and sludges were drummed and sent off-site for disposal as hazardous waste. The concrete basin was demolished and removed. Soil present underneath the concrete basin was tested at various depths, and a total of 18 to 24 inches of soil was removed from beneath the former concrete liner and disposed of as non-hazardous waste at the Montgomery County Landfill in Christiansburg, Virginia. The excavation was backfilled with eight to nine feet of clean soil and seeded.

1.3 Groundwater Monitoring Network

The groundwater monitoring network at HWMU-39 consists of five monitoring wells, including upgradient wells 39MW1 and 39MW4 and downgradient wells 39MW3, 39MW5, and 39MW6. Monitoring wells 39MW1, 39MW2, and 39MW3 are screened within carbonate bedrock, and wells 39MW4, 39MW5, and 39MW6 are screened in weathered bedrock and overburden. As shown on **Figure 2**, groundwater beneath the site flows to the northeast from the area around upgradient monitoring well 39MW4. Wells 39MW1, 39MW2, and 39MW3 were installed on June 2-4, 1993; and wells 39MW4, 39MW5, and 39MW6 were installed on September 23-25, 1997.

Additional information is available in annual groundwater monitoring reports submitted for the Unit along with the *Closure, Contingent Closure, and Contingent Post-Closure Plans for Radford Army Ammunition Plant's Incinerator Spray Pond (HWMU-39)* submitted in August 1995 and the *Closure Report* for the Unit submitted in June 1998 and revised in October 1998.

2.0 CLEAN CLOSURE EVALUATION

The groundwater beneath HWMU-39 has historically been monitored on a quarterly basis. VDEQ authorized semiannual groundwater monitoring at HWMU-39 in a letter dated June 14, 2007. Historical data for constituents listed on the groundwater monitoring list for HWMU-39 were evaluated and compared to established DWSs (USEPA MCLs and VDEQ ACLs). The clean closure evaluation focuses on data collected from Second Quarter 2003 to Second Quarter 2007, which are summarized in **Table 1**. Data collected prior to Second Quarter 2003 were not used as no quality control information was available and the data could not be validated. Historical data from First Quarter 1998 to First Quarter 2003 are included in **Appendix B**.

2.1 Constituents Not Detected Above LOQ

As summarized in **Table 1**, a total of 17 hazardous constituents have not been detected above the Limit of Quantitation (LOQ) since Second Quarter 2003. The LOQs for these constituents are all less than their respective DWSs. These constituents are as follows:

- Antimony
- Beryllium
- Cadmium
- Mercury
- Selenium
- Silver
- Thallium
- gamma-BHC
- 2,4-Dichlorophenoxyacetic acid
- Di-n-butyl phthalate
- Diethyl phthalate
- 2,4-Dinitrotoluene
- 2,6-Dinitrotoluene
- Endrin
- Methoxychlor
- Silvex
- Toxaphene

2.2 Constituents Detected Above LOQ

As summarized in **Table 1**, no organic constituents have historically been detected at HWMU-39. A total of five hazardous metal constituents and three hazardous radiological constituents have been detected above the LOQ since Second Quarter 2003. These constituents are as follows:

- **Arsenic**
  Arsenic was detected during Fourth Quarter 2003 in well 39MW5 at a concentration of 7.4 ug/l, and during First Quarter 2004 and Second Quarter 2005 in well 39MW6 at concentrations of 7.8 ug/l and 5.8 ug/l, respectively, which are just above the LOQ of 5 ug/l.
- **Barium**
  Barium has been detected in every well, including the background wells (39MW1 and 39MW4), during every event. Barium is naturally occurring and is consistently detected in groundwater across RFAAP.
- **Chromium**
  Chromium has been detected sporadically in background well 39MW4 and in the three downgradient wells (39MW3, 39MW5, and 39MW6). Chromium was detected in background well 39MW4 during Fourth Quarter 2005 at a concentration of 7.1 ug/l and Second Quarter 2007 at a concentration of 7.52 ug/l. Chromium was detected in well 39MW3 during Fourth Quarter 2005, First Quarter 2006, and First and Second Quarters 2007 at concentrations of 5.2 ug/l, 5.5 ug/l, 5.4 ug/l, and 7.1 ug/l, respectively, which are just above the LOQ of 5 ug/l. Chromium was detected once in well 39MW5 during Fourth Quarter 2003 at a concentration of 24.5 ug/l. Chromium was detected in well 39MW6 during Fourth Quarter 2003, First and Second Quarters 2004, and Second Quarter 2005 at concentrations of 28.4 ug/l, 29.1 ug/l, 15.9 ug/l, and 30.2 ug/l, respectively.
- **Lead**
  Lead was detected in background well 39MW4 at concentrations of 5.9 ug/l and 10.1 ug/l, respectively, during Fourth Quarter 2005 and Second Quarter 2007, and in well 39MW6 at 5.3 ug/l during Second Quarter 2005. These detections were at concentrations just above the LOQ of 5 ug/l. Lead was detected in Fourth Quarter 2003 in well 39MW5 at a concentration of 19.4 ug/l, which exceeded the USEPA MCL of 15 ug/l; however, all samples collected subsequently in well 39MW5 have been below the LOQ of 5 ug/l.
- **Nickel**
  Nickel was detected in background well 39MW4 during Fourth Quarter 2005 at a concentration of 6.3 ug/l, which is just above the LOQ of 5 ug/l. Nickel was also detected once in well 39MW5 during Fourth Quarter 2003 at a concentration of 15.3 ug/l. Nickel was detected in well 39MW6 during Fourth Quarter 2003, First and Second Quarters 2004, and Second Quarter 2005 at concentrations of 17.4 ug/l, 19.8 ug/l, 10.8 ug/l, and 21.8 ug/l, respectively.
- **Gross Alpha**
  Gross alpha particles were detected in background well 39MW4 at concentrations above the LOQ of 3 pCi/l during Fourth Quarter 2005, Second and Third Quarters 2006, and First and Second Quarters 2007. Gross alpha particles were also detected once in well 39MW3 during Second Quarter 2007 at a concentration of 3.7 ug/l. Gross alpha particles have been detected consistently in wells 39MW5 and 39MW6 at concentrations above the LOQ of 3 pCi/l.
- **Gross Beta**
  Gross beta particles have been detected during every monitoring event from Second Quarter 2003 to Second Quarter 2007 in background well 39MW4 and wells 39MW3

and 39MW5 at concentrations exceeding the LOQ of 4 millirems/yr. Gross beta particles have been detected in well 39MW6 at concentrations above the LOQ during every event from Second Quarter 2003 to Second Quarter 2007 with the exception of Third and Fourth Quarters 2003 and Fourth Quarter 2006.

- **Total Radium**

  Total radium was detected in well 39MW5 during First and Fourth Quarters 2004, First and Second Quarters 2006, and Second Quarter 2007 at concentrations of 1.35 pCi/l, 4.2 pCi/l, 1.5 pCi/l, 1.7 pCi/l, and 1.8 pCi/l, respectively. Total radium was detected in well 39MW6 during First Quarter 2004 at a concentration of 12.1 pCi/l and from Third Quarter 2004 through Third Quarter 2005 at concentrations of 1.1 pCi/l, 1.1 pCi/l, 2.2 pCi/l, 7.9 pCi/l, and 1.1 pCi/l, respectively. The LOQ for total radium is 1 pCi/l.

2.3 Comparison to Drinking Water Standards

Per discussions with VDEQ, groundwater impact related to HWMU-39 is evaluated by comparison of concentrations of constituents detected in wells at the Unit to established DWSs (USEPA MCLs and VDEQ ACLs). As shown on **Table 1**, the following exceedances of DWSs are noted:

- **Lead**

Lead was detected in Fourth Quarter 2003 in well 39MW5 at a concentration of 19.4 ug/l, which exceeded the USEPA Action Level of 15 ug/l. However, all samples collected subsequently in well 39MW5 have been below the LOQ of 5 ug/l.

- **Gross Alpha**

Detected concentrations of gross alpha particles exceeded the USEPA MCL of 15 pCi/l in well 39MW5 during Fourth Quarter 2004 (24.8 pCi/l). Gross alpha particles were detected in well 39MW6 during First Quarter 2004 and Second Quarter 2006 at concentrations of 15.4 pCi/l and 15.6 pCi/l, which exceed the MCL of 15 pCi/l. All other detections of gross alpha particles at the Unit have been at concentrations below the MCL. Gross alpha particles have also been detected at similar concentrations below the MCL in upgradient well 39MW4.

- **Gross Beta**

In Second Quarter 2006, gross beta particles were detected in well 39MW6 at a concentration of 54.9 pCi/l, which exceeded the USEPA level of concern of 50 pCi/l. However, concentrations in all other samples collected in upgradient well 39MW4 and wells 39MW3, 39MW5, and 39MW6 have been below 50 pCi/l.

- **Total Radium**

Total radium was detected in well 39MW6 at concentrations exceeding the USEPA MCL of 5 pCi/l during First Quarter 2004 and Second Quarter 2005. All other concentrations detected in well 39MW6 have been just above or below the LOQ of 1 pCi/l.

No other DWSs have been exceeded at the Unit during the period between Second Quarter 2003 and Second Quarter 2007.

3.0 CONCLUSIONS

RFAAP conducted an evaluation of groundwater monitoring data from HWMU-39 to determine the Unit's eligibility for clean closure for groundwater. Data collected from Second Quarter 2003 to Second Quarter 2007 were evaluated to determine whether hazardous waste constituents included on the Unit's groundwater monitoring constituent list have been released to groundwater in concentrations greater than USEPA MCLs and VDEQ ACLs. The evaluation was conducted in accordance with procedures discussed during the May 22, 2007 teleconference with VDEQ.

Based on results of the evaluation, hazardous waste constituents have not been detected in groundwater at concentrations exceeding USEPA MCLs or VDEQ ACLs with the exception of lead, gross alpha particles, gross beta particles, and total radium. Exceedances of DWSs have been sporadic and do not reflect overall groundwater quality at the Unit. No DWSs have been exceeded at the Unit since Second Quarter 2006.

In conclusion, HWMU-39 has not adversely impacted groundwater at the site. RFAAP respectfully requests that the Unit be granted clean closure for groundwater.

SIGNATURE/CERTIFICATION

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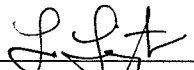
Signature: 

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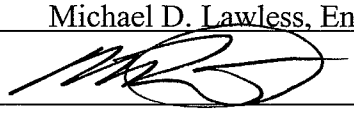
Signature: 

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