UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
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July 21, 2009

Reply To: OEA-095

MEMORANDUM

SUBJECT: Review of the OIG Hotline Report, Contaminated Soil Waste Repository at East Mission Flats, Idaho, June 8, 2009 and Appendix G and Q of the 90% Design Report

FROM: Bernie Zavala, Hydrogeologist LG, LHG
EPA-Region 10, Office of Environmental Assessment

TO: Ed Moreen, RPM Coeur d'Alene Field Office
EPA-Region 10

CC: Angela Chung
EPA-Region 10

The EPA-Region 10 Office of Environmental Assessment was tasked to review the Office of Inspector General (OIG) Hotline report dated June 8, 2009, and to respond to OIG's recommendation regarding the analysis of the geochemical and physical conditions that might lead to contaminants dissolving near the base of a soil repository. This repository is referred to as the East Mission Flats (EMF) Repository located near Cataldo, Idaho.

This request also included the review of Appendix G and Q of the 90% Design Report of the EMF soil repository. These appendices assess whether or not a release of metals would occur and could have an impact on the surrounding quality of the groundwater. As mentioned above, the OIG when reviewing both the 60 and 90% design report, provided an overall recommendation to EPA-Region 10 "to finish the geochemical and physical conditions that may lead to contaminants dissolving near the repository base". The EPA's Remedial Project Manager Ed Moreen requested a technical review from Dr. Richard Wilkin, Environmental Geochemist, EPA/ Office of Research and Development. The conclusion from Dr. Wilkin's review can be found in a Memorandum dated May 12, 2009. Dr. Wilkin's findings were that no additional testing or assessments were needed regarding the potential concerns for metal mobilization. Ed Moreen then contacted me, Bernie Zavala, Hydrogeologist, R-10 to provide him a technical review of the above mentioned documents. Upon my review of the documents, I have concluded that the draft 90% Design Report, Appendix G, and Appendix Q have **completed** the assessment of the geochemical and physical conditions of the repository.

The findings from this design report of the repository at East Mission Flats shows no potential for a groundwater releases up to a 12-year flood event and it may be unlikely from a larger flood event due to a increase in oxygen in the water from a rise in groundwater elevations or from the flood water moving through the repository. If the conditions in the repository become anaerobic and the leachate reaches the groundwater, the potential for release of contaminants (metals) will be minimized due to the lithology of the soils below the repository containing both clay and silt. The text below is a description of my analysis or conclusions which were drawn from the 90% Design Report. The OIG's June 2009 report requested an additional review that would cover the work related to the physical infiltration of water into the proposed repository. The following is my review.

The physical infiltration of water into the repository was examined in Appendix Q, with support information found in Appendix G. The infiltration of water into the repository will take three different pathways **(1)** downward vertical migration through the evapotranspiration (ET) cap **(2)** lateral infiltration or flow through the repository due to contact with flood water and **(3)** upward vertical migration from the groundwater into the base of the repository. The assessment of the (1) downward vertical migration through the ET cover regarding water infiltration would be minimized or eliminated by the construction of an ET cover and this assessment was accepted by the OIG. No further analysis or discussion is needed for this pathway. The comments from the OIG only took issue with the assessment regarding the other two pathways, which I discuss further in the next paragraph.

The second pathway (2) lateral migration of flood water into the repository was investigated through a model simulation using a two-dimensional USGS variable flow code called VS2DT. The model input through the repository was a 12-year flood event similar to the spring 2008 flood that occurred at the location of the repository. The model runs and results indicated a 15 to 17 feet surface water intrusion into the repository with a saturated lateral thickness of 0.5 to 0.7 feet of flood water during the 75 days of standing water at the ground surface of the repository location. This volume of water is a small percentage of the total volume of the repository (the model indicates saturation of only 0.05% of total volume of repository). Based of the transitory nature of the flood events, short duration of saturation, and the small volume of saturated thickness within the repository, the potential for releases of metals leaching to groundwater is minimal, if at all. The third pathway (3) upward vertical migration from the groundwater to the base of repository was addressed in Appendix Q. The OIG took issue with the reduction in hydraulic conductivity (K) based on the consolidation from soil placement in the repository. The calculated reduction for hydraulic conductivity was 550%. This large reduction of hydraulic conductivity throughout the entire repository may have uncertainties and it may be good to look at a range of reductions when calculating the migration of rising groundwater elevations. It should be noted that Appendix Q discussed a reduction for hydraulic conductivity of 550% based on consolidation of the repository material and ground surface, I believe the report meant a reduction factor of 550.

The OIG agrees that consolidation from soil placement will reduce the hydraulic conductivity. Using a low and mid range of reduction for (K) of 10% and 50% and then calculating the rise in groundwater elevation using Darcy's law, rearranged by Fetter (1980) for seepage velocity that was cited in appendix Q for MW-C for the Spring (May)

2008, a new estimate can be made. This calculation for a rise in groundwater elevation from the previous depth to water measurement in February 2008 for MW-C with a 10% reduction in K reveals a rise of 5.8 feet or a groundwater elevation at 2,133.40 feet after the flood. This elevation is below the existing ground surface at 2,133.9 feet. The 50% reduction in K gives a rise of 3.2 feet or a groundwater elevation at 2,130.80 which is 3.17 feet below the ground surface.

It should be noted that soil column tests were performed in 2008 on two types of soils for its leaching potential: a soil that would represent yard waste soil that would be capped in the repository and the native soil that currently exists within the area of the repository. The column test results show that for the yard waste, leaching occurred for Antimony (0.011 mg/l) which was slightly above the regulatory limit and a detection of Zinc, (0.11 mg/l) was below the regulatory limit. All of the other metals of concern were below the limit of detection. In contrast, the native soil column test results show detection of Cadmium at 0.0048 mg/l and Zinc 10.4 mg/l, which is above the regulatory limit. The rest of the metals of concern were below the limit of detection. This soil data shows slightly higher leaching potential of metals in the native soils within the repository. Also, the water quality for metal concentrations in the groundwater for the four monitoring wells that have been constructed and sampled on a quarterly basis since December 2007, have been below the EPA drinking water standards for Metals.

The continued monitoring of the six monitoring wells for both groundwater elevations and water quality is essential and recommended for verification of the effectiveness of the repository. It is important to develop a set frequency for water quality monitoring with an agreed upon statistical method for the evaluation of the data. Also, the monitoring wells may need some modification to ensure water level collection after a major flood event such as the event that occurred in the spring of 2008. The monitoring wells must be protected during the construction of the repository with the ability for additional monitoring wells to be constructed, if necessary.

Please feel free to contact me at 206-553-1562 if you any questions or comments on this technical review.

Attachment

ATTACHMENT A

<u>Vertical migration of groundwater under a high groundwater event (Spring of 2008) for MW-C with a reduction of 10 and 50% in hydraulic conductivity (K):</u>

The rate of upward migration of water through the sediment (seepage velocity, Vs) as found in appendix Q used the following equation:

$$V_s = \frac{K * i}{N_e} \quad \text{(Fetter, 1980)}$$

Where: V_s = seepage velocity (inches/day)
K= hydraulic conductivity = 0.95 inches per day [1]
i = hydraulic gradient = 1^2
N_e = effective porosity = 0.25 (25%)

1- This value was from field testing of soil from the location of the repository, Strata, 2008b, results from Sample GT-01 flexwall permeability test, ASTM D5084.

Assumptions:
Assuming a low range of reduction for hydraulic conductivity of 10 % yields:
K =0.855 inches per day or 0.072 ft/day;
Assuming a mid range of reduction for (K) of 50% yields:
K = 0.475 inches per day or 0.040 ft/day

The seepage velocity using a 10% reduction in hydraulic conductivity gives:
V_s = 0.072 ft/day * 1^2 / 0.25
= 0.29 ft/day

The seepage velocity using a 50% reduction in hydraulic conductivity gives:
V_s = 0.040 ft/day * 1^2/0.25
= 0.16 ft/day

A calculation was performed to estimate what the groundwater elevation would be at MW-C for the spring 2008, 12-year flood event with a reduced hydraulic conductivity using both 10 and 50%. When making these calculations the following assumptions were made:

- 10% and 50% reduction in K using the results from a field test at the repository.
- The starting groundwater elevation in MW-C was taken from the previous measurement in February 2008, 2127.60 feet.
- The duration of a significant head or standing water was based on a hydrograph near the repository location (Cataldo station). This duration was 20 days. See the following page taken from 90% Design Report, Figure 14

Vertical rise in groundwater = seepage velocity * duration of standing water
A 10% reduction in K
=0.29 ft/day * 20 days
= 5.8 feet

MW-C – groundwater elevation with a 10% reduction in K would be: 2127.60 + 5.8 feet = 2,133.4, the ground surface elevation at MW-C is 2,133.9. **The depth to groundwater would be 0.50 feet below the ground surface.**

Vertical rise in groundwater = seepage velocity * duration of standing water
A 50% reduction in K
=0.16 ft/day * 20 days
= 3.2 feet

MW-C – groundwater elevation with a 50% reduction in K would be: 2127.60 + 3.2 feet = 2,130.80, the ground surface elevation at MW-C is 2,133.9. **The depth to groundwater would be 3.09 feet below the ground surface.**

Figure 14. Water Elevation and Coeur d'Alene River Flowrate

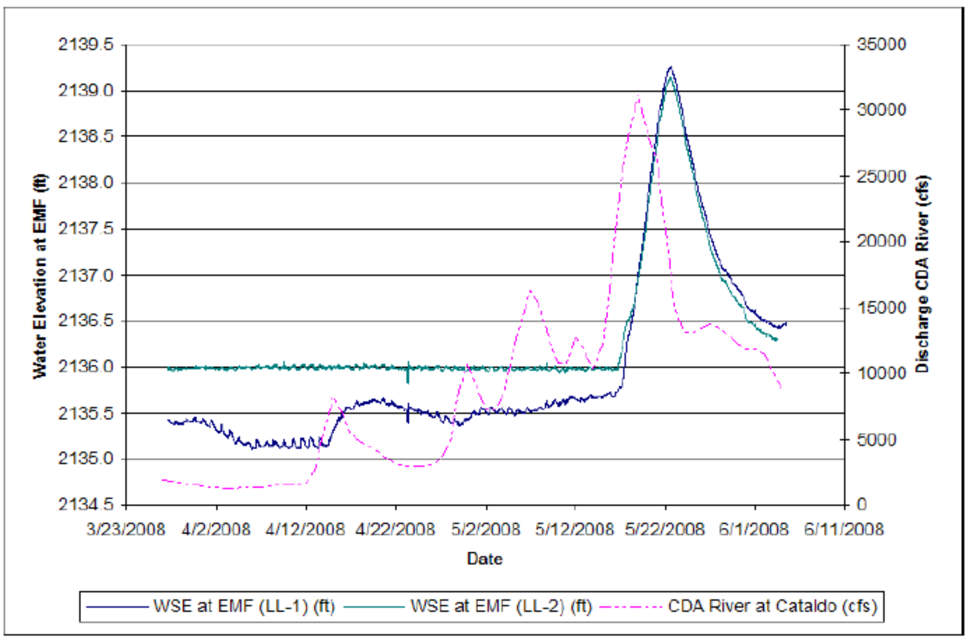

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Figure 14 was taken from the East Mission Flats 90% Design Report, June 2009. This is a hydrograph of the Coeur d'Alene (CDA) River near Cataldo, Idaho. This hydrograph is illustrating the dates (time verses discharge) and the discharge in cubic feet per second (CFS) with the elevation or stage height of the river. The event in question started on May 20, with a maximum discharge rate over 30, 000 CFS. The elevation height, 2,136 feet was chosen for a base flow because it is an approximate elevation of the ground surface and also the beginning of the largest discharge event on the CDA River at the Cataldo station. On approximately June 8th the hydrograph returned to the base flow elevation of 2,136 feet. The duration period was 20 days. The other two hydrographs on figure 14 were measurements of the surface water elevation taken from data logger at the EMF site. To be conservative, the hydrograph from the Cataldo station was chosen it added longer time duration but the three hydrographs are similar. If LL-1 or LL-2 were used the groundwater elevation would have been less due to the shorter time duration.