STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

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April 9, 1999

Mr. Fred Evans
Department of the Navy
Northern Division
Naval Facilities Engineering Command
10 Industrial Highway, Mailstop 82
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re: Evaluation of Heavy Metal Migration at the Portsmouth Naval Shipyard with Geochemical Modeling, December 31, 1997

Dear Fred:

This letter is a response to a couple outstanding questions regarding the geochemical modeling performed by Dr. Andrew Reeve for the MEDEP.

1) In a September 25, 1999 letter from Fred Evans to Iver McLeod the Navy requested that the MEDEP,

> "Please clarify the results of the geochemical modeling. Prior to distribution of the geochemical modeling report, MEDEP indicated lead carbonate and organic mercury were the only analytes which would migrate to the offshore. Dr. Reeve's response to the Navy's comment no. 1 indicates nickel and mercury are the most likely analytes, which would migrate to the offshore."

Nickel, mercury and lead all reached high concentrations in the geochemical modeling computer simulations.

Lead: Aqueous lead concentrations were reduced, and migration retarded, by surface complexation of charged lead species and high lead concentrations were only present in the first and second cells of the geochemical model.

Nickel: Nickel was retarded by surface complexation, but to a lesser extent than lead indicating that it is more likely to move off site.

It was concluded, based on these simulations, that significant amounts of nickel are more likely to move off site and that charged lead species will sorb to available surfaces. Lead carbonate, an uncharged lead species, does not sorb to surface sites and will move off site. However, simulated concentrations of lead carbonate were very low, orders of magnitude below the concentration of lead sorbed onto surface sites.

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Mercury: The majority of the mercury in the simulations occurred as a zero valent species. This form of mercury is very mobile and, if truly present, will migrate with the ground water. No conclusions about organic mercury were reached with this model.

A review of the four rounds of seep sampling conducted between December 1996 and November 1997 indicate that aluminum, chromium, copper, manganese, nickel, lead, and zinc all exceeded modeling criteria in the seeps. Aluminum, chromium, and lead exceeded modeling criteria at one seep each. Copper, manganese, nickel and zinc each exceeded modeling criteria at several seeps each. It was not possible to evaluate mercury exceedances as the detection limit was an order of magnitude above the modeling criteria. The general lack of lead exceedances in seeps and general widespread occurrence of nickel exceedances in seeps tend to confirm Dr. Reeve's conclusions, though admittedly, the widespread exceedances of copper, zinc, and manganese were not predicted by the geochemical model.

2) In a comment letter dated June 19, 1998, the Navy stated,

"It is assumed that the waste sites are approximately 600 feet from the estuary. At the OU3 the waste material is located a maximum of about 700 feet from the shoreline and extends to the shoreline. This would seem to contradict the assumption in the geochemical model. Will this have a significant effect on the geochemical modeling results (i.e., does the geochemical model assume 600 feet of uncontaminated material between the source and the estuary which would not match the physical characteristics of the site)?"

In our September 9, 1998 response letter, Dr. Reeve replied,

"This will impact modeling results. Metals of concern that are located near the shoreline and are strongly retarded by surface complexation processes may reach the ocean if the distance from the ocean is small. Geochemical modeling transport simulations did not evaluate the impact of direct contact between sea water and waste, an apparent possibility based on this comment."

Based on this response I asked Dr. Reeve if he believed the impact on modeling results would be significant. He replied,

"The concentrations of heavy metals discharging to the ocean, if waste is only 1 ft away, can be determined from the results presented in the geochemical modeling report if it is assumed that salt water does not significantly impact the geochemical processes. Assuming a seepage velocity of 2 ft day and a cell size of 1 ft, each model time step would represent about 12 hours. The results in figures 7 to 12 would represent 50 days at time step 100 about 1 foot from the waste. This would suggest that lead would move off site."

Please note that the MEDEP tasked Dr. Reeve to model geochemical reactions over the greatest possible length of travel by groundwater at the JILF and to determine changes in

geochemical reactions as salinity of groundwater increased. Thus, he used a distance of 600 feet. This distance should be conservative because inorganic contaminants are more likely to go into solution due to pH and redox in the fresh water area of the landfill.

Please note that the MEDEP has completed its contract with Dr. Reeve.

Please feel free to contact me at (207) 287-8010 if you have any questions.

Sincerely,

Iver McLeod
Project Manager
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