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Duke Power
Environment, Health & Safety
526 South Church Street
P.O. Box 1006
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January 27, 1999

Subject : Meeting with Division of Solid Waste Hydrogeologist
Marshall Steam Station, Catawba County
Industrial Solid Waste Landfill Permit #18-04

Dear Mr. Coffey:

In a letter dated December 18, 1998, the NC Department of Environment and Natural Resources Solid Waste Section requested that Duke Power contact the section to discuss compliance concerns with groundwater analysis results for monitoring wells at the Marshall ash landfill. In response to that request, a meeting was held in Raleigh on January 13, 1999, with the attendees listed below:

Attendees: Allen Stowe, Duke Power Group EHS, Environmental Protection
Bill Miller, Duke Power Group EHS, Environmental Engineering
Ellen Lorscheider, NCDENR, Solid Waste

At this meeting the following items were discussed:

1. Marshall MW-3 compliance concerns expressed in the Dec. 18, 1998 DSW letter.
2. Requirements for installing an observation well and two additional monitoring wells at Marshall.
3. Review of the Duke Compliance Demonstration Report (Nov. 24, 1997) and modeling.

The results of the meeting are:

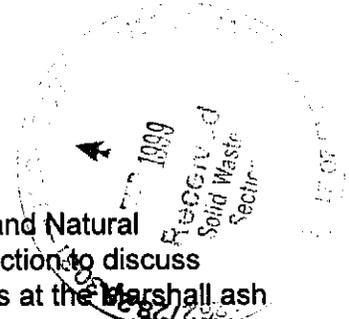
MW-3 Compliance Concerns – The Duke plan for investigation of the source for the manganese and pH is attached. Duke believes that this investigation will show that the impacts are from the farm operations of the adjacent property owner and are not from the ash landfill. Ms. Lorscheider indicated that resolution of this issue was critical to acceptance of the demonstration report. This plan was discussed and Ms. Lorscheider agreed with the proposed approach.

A report on results of this investigation will be submitted to Ms. Lorscheider for review by the end of February 1999.

Installation of Observation Well and of Additional Monitoring Wells – The State had requested that one observation well (used to measure water levels only) and two or more additional monitoring wells be installed in order to adequately characterize and monitor groundwater at the ash landfill.

Drawing M-10A shows the topography in the ash landfill area. This drawing was reviewed and the relationship of the ash landfill to the property line, the compliance boundary, the ash basin, and the asbestos landfill was discussed. The ash basin bounds the landfill to the east. No wells will be installed in this area. The asbestos landfill bounds the ash landfill to the north-west. No wells will be installed in this area.

Ms. Lorscheider and Duke agreed that two additional monitoring wells would be installed to monitor the surficial aquifer. One monitoring well will be installed slightly east of the C&D



landfill, and a second monitoring well will be installed on the east side of the ash landfill (near where the filled-in portion of the ash basin splits).

One observation well will be installed in the completed portion of the landfill to determine the water elevation in the ash and will assist in understanding the flow in the saturated zone in and around the landfill.

Duke will determine the actual field location of these wells based on access and FAX a map showing the well locations, with proposed screen elevations, to Ms. Lorscheider prior to installation. During installation of these wells, the following will be collected:

- Standard penetration - resistance
- soil particle size
- soil classifications
- undisturbed soil samples taken for void ratio, porosity
- water level at 24 hours

Additionally, slug tests will be performed on the monitoring wells to determine the hydraulic conductivity.

Review of the Duke Compliance Demonstration Report (Nov. 24, 1997) and Discussion on Modeling - A brief review of the information included in the Duke Compliance Demonstration Report (Nov. 24, 1997) was conducted. A summary of these discussions follows:

FOWL-GH

FOWL-GH was selected as the model to determine the ash leachate concentrations and quantities over time. FOWL-GH couples the HELP (US Army Corps of Engineers) model with the GMIN model (a geochemical equilibrium model). HELP provides the water balance analysis and calculates the quantity of rainwater infiltrating through the ash. The geochemical model GMIN uses this infiltration quantity, along with chemical information on the rainwater and ash, to model the chemical reactions occurring in the ash. The GMIN module then calculates concentrations of selected constituents in the ash leachate. This concentration represents the leachate concentration at the ash landfill/soil interface.

Iron and manganese are not included as constituents modeled by FOWL-GH. Ms. Lorscheider inquired if the model could be modified to include iron and manganese. The Duke response was that modifying FOWL-GH to include iron and manganese would not be possible since these constituents had not been included in the model calibration or verification process.

Duke Adsorption Spreadsheet Model

The FOWL-GH leachate concentrations and leachate quantities were entered into a spreadsheet model. This spreadsheet was used to calculate the quantity of soil required to adsorb the concentration and to calculate the constituent concentration leaving a given volume of soil. This spreadsheet is essentially a 1-D model. This approach was used to determine if the leachate would be attenuated in a short distance beneath the ash or if additional modeling would be warranted. This analysis found that the ash leachate is attenuated within the compliance boundary.

Only the constituents with concentrations above the 2L standard were evaluated in this manner. These adsorption coefficients used in this spreadsheet were selected from an EPRI document that contained adsorption values obtained from an extensive literature search. The adsorption coefficients were selected based on site soil properties (cation exchange capacity, pH, iron content, clay content, etc.) and leachate concentrations.

Other Models

Other models were discussed as a means of demonstrating compliance at the 2L boundary. Ms. Lorscheider had indicated that MULTIMED or MODFLOW might be other appropriate models. Duke indicated that FOWL-GH is the only verified model for calculating ash leachate concentrations.

The Duke selection of the spreadsheet model had been based largely on the concern of Jim Bateson (formerly of the DSW) that most transport models utilize linear Kd terms. The Duke spreadsheet model utilized non-linear K values (Langmuir and Freundlich isotherms). This approach considers the fact that adsorption sites become "filled" at higher concentrations, resulting in reduced adsorption. MULTIMED uses linear Kd terms.

MODFLOW has 3-D capabilities and can be used with MT3D (a transport model) to calculate concentrations at specific locations, but requires considerable data to correctly calibrate and verify the model. Duke's opinion is that MODFLOW/MT3D would produce similar results to the Duke spreadsheet model.

Other Items

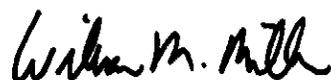
Ms. Lorscheider stated that a person in Jim Coffey's section is reviewing models that may be used in determining acceptability of mixing other types of ash in structural fill projects.

Duke offered to arrange a information session on FOWL-GH for the Solid Waste Section where Solid Waste personnel could ask specific questions on FOWL-GH. Duke would arrange for individuals involved in the development of FOWL-GH to be present. Duke feels this session would facilitate the review of the Marshall and Belews Creek landfill demonstrations, as well as other ash demonstrations that the state will review.

Conclusions

Ms. Lorscheider stated that the MW-3 compliance issue was critical to resolution of the demonstration report and that the decision on model selection should be postponed until this issue was resolved. Duke believes that the MW-3 issue can be resolved by the investigation described (see Attachment) and that the Duke spreadsheet model is an appropriate means of demonstrating compliance with 2L standards.

If you have questions on these issues, please contact me at 704-373-7900.



William M. Miller, PE
Duke Power Group Environment, Health & Safety

Attachment

CC

✓ Bill Sessoms, NCDENR, Solid Waste Section
Ellen Lorscheider, NCDENR, Solid Waste Section

Attachment

Plan for Addressing Monitoring Well MW-3 Compliance Questions

State concerns were centered on pH and manganese (Mn) levels in excess of 2L standards. They expressed concerns that these parameters may be an indicator of future impact from the landfill.

MW-3 is located on the north side of the landfill, approximately 30' from the property line. The well was installed across the filled in portion of the ash basin and likely is monitoring off-site groundwater. The adjacent (upgradient) property owner has an animal operation, which is likely the source of the nitrates that are being found in MW-3.

The plan is to prove to the State that the well is monitoring water from off site, not from the landfill. This plan will be accomplished by:

1. Sampling MW-3. In addition to the normal parameters, analyze for fecal coliform and chlorides (indicators of animal operations). (Ron Santini)
2. Preparation of a report showing historical analysis results from MW-3. This report will include a narrative explaining the sampling and analytical procedures and discuss the bases for the Mn and pH readings. (Ron Santini)
3. Developing a profile drawing showing the relationship between MW-3's location, the well screen, property line, compliance boundary, and landfill. Due to the proximity of MW-3 to the property line, have Real Estate survey department locate the well with respect to the property line. They also will be requested to profile the ground surface between the property line and the toe of the ash landfill (approximately 100 feet). (Bill Miller)

If additional investigation is needed after the items above are completed, a temporary well(s) may be installed in the vicinity of MW-3 to determine groundwater flow in the area.

This information will be submitted in a report to the Division of Solid Waste. The target date for submittal of this report is Feb 26, 1999.