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RESPONSES TO OHIO EPA COMMENTS ON REVISION 4 OF THE SOUTH PLUME GROUNDWATER MODELING REPORT

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Department of Energy
Fernald Environmental Management Project
P.O. Box 398705
Cincinnati, Ohio 45239-8705
(513) 738-6357

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DOE-2388-93

Mr. James A. Saric, Remedial Project Manager
U.S. Environmental Protection Agency
Region V - 5HRE-8J
77 W. Jackson Boulevard
Chicago, Illinois 60604-3590

Mr. Graham E. Mitchell, Project Manager
Southwest District Office
Ohio Environmental Protection Agency
Dayton, Ohio 45402-2086

Dear Mr. Saric and Mr. Mitchell:

RESPONSE TO OHIOE ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON REVISION 4 OF THE SOUTH PLUME GROUNDWATER MODELING REPORT

Reference: Letter, G. E. Mitchell to J. R. Craig, dated June 3, 1993

This letter serves to transmit responses to Ohio Environmental Protection Agency (OEPA) comments on Revision 4 of the South Plume Groundwater Modeling Report.

If you or your staff have questions, please contact Jack Craig at (513) 648-3107 or Pete Yerace at (513) 648-3161.

Sincerely,

Johnny Reising

for Jack R. Craig
Fernald Remedial Action
Project Manager

FN:Yerace

Enclosure: As Stated

Recycled and Recyclable

cc w/enc:

K. A. Chaney, EM-424, TREV
D. R. Kozlowski, EM-424 TREV
G. Jablonowski, USEPA-V, AT-18J
J. Kwasniewski, OEPA-Columbus
P. Harris, OEPA-Dayton
M. Proffitt, OEPA-Dayton
T. Schneider, OEPA-Dayton
J. Michaels, PRC
L. August, GeoTrans
K. L. Alkema, FERMCO
P. F. Clay, FERMCO/19
F. Bell, ATSDR
AR Coordinator, FERMCO

cc w/o enc:

R. L. Glenn, Parsons
D. Dubois, FERMCO/65-2
J. W. Thiesing, FERMCO/2

RESPONSE TO OHIO EPA COMMENTS
SOUTH PLUME GROUNDWATER MODELING REPORT

GENERAL

Some of the comments below request that additional modeling output be provided in a revised report. It is questionable though, given the current status of the removal action project and the fate and transport model, how much value the additional requested information would add to the overall project if the information is produced now and added to this report. The recovery system is in the process of being installed and the model is being re-calibrated. At this point in time the requested information is needed more for system optimization then it is for initial design and location selection.

As the responses below indicate, we would like to incorporate production of this requested information into the model improvement work currently underway, as outlined in the Groundwater Modeling Evaluation Report and Improvement Plan. We do not wish to create another revision of the South Plume Modeling Report using information generated from the currently calibrated models.

Conservatism and flexibility have been built into the design of the barrier system (see the DMEPP, Rev. 1, dtd. April 1993) and a monitoring and response program has been created which will respond with system changes should unforeseen conditions occur. An important variable over which we will have control is pumping rate. Thus, the pumping rate can be varied to compensate for other variables. New wells may also be added to the system based on findings in the monitoring and response program (see the DMEPP, Rev. 1, dtd. April 1993).

SPECIFIC RESPONSES

1. Commenting Organization: Ohio EPA Commentor:
   Section #: 4.5.3 Page #: 4-9 Line #: 27 Code:

   Original Comment #: 1 A graph/table of the simulated dissolved and sorbed uranium mass-in-place as a faction of time should be presented. This is available from the model output in the mass balance summary. This would be useful for several reasons. First, the mass-in-place presented in the form of time vs log of uranium mass would provide an effective display of the mass removed and the mass not captured. This could be augmented with the results of Figure 4-24 (cumulative well field uranium removal vs time) to provide a better overall display of the removal effectiveness. This appears to be done, in part, in the figure except the secondary y-axis is in percentage. This figure indicates that 56% of the mass (approximately 11,000 lbs.) is removed and 44% is not captured after 80 years.

   Secondly, the model output provides summaries over time of the uranium mass on a layer-by-layer basis. This would be very informative in understanding the "underflow" beneath the wells. Based on the results presented, it is not clear as to exactly how much of the 44% not captured is simply too far to the south of the capture zone and how much mass travels beneath the wells and is not captured.

Response:
A graph/table of the simulated dissolved and sorbed uranium mass-in-place as a function of time as well as a summary of model output over time of uranium mass on a layer by layer basis, compiled using the current calibrated transport model would not add any value to the South Plume Recovery project at this point in time. Although, as explained below, both outputs would add value to the project if the output is produced from a re-calibrated transport model. Once the transport model has been re-calibrated, the requested output will be produced.

As explained in the South Plume Modeling Report the recovery system was designed to create and maintain a hydraulic barrier. The selection of a location for this barrier, the number of wells needed to create the barrier, and their pumping rate, was determined using flow modeling, particle tracking, drilling data, and water quality field data; both from the FERMCO RI/FS and the Paddys Run Roadsite RI/FS. The use of uranium transport modeling was not-emphasized because the current calibrated model contains several technical weaknesses. Work is proceeding on improving the transport model as outlined in the Groundwater Modeling Evaluation Report and Improvement Plan, dtd. April 1993. This work includes recalibration of the transport model.

Action:
The output requested will be provided for the objective of barrier system evaluation. The output will be produced once the current transport model has been recalibrated and included in the Model Improvement Summary Report.

2. Commenting Organization: Ohio EPA Commentor:
Section #: 4.5.4 Page #: 4-10 Line #: 32 Code:

Original Comment #: 2 All of the capture zones appear to be significantly influenced by the boundary condition used to represent Paddy's Run. The pumpage creates drawdown of 1 to 2 feet in this area, and the validity of the boundary condition must be revisited. For example, where the 522 ft. contour (Figure 2-9) crosses Paddy's Run (approximately the point where the river becomes effluent under "average conditions"), a 2 ft. drop in the water level could cause this point to shift over 1000 ft. downstream. (Based on Figure 3-12 of the Groundwater Modeling Report, Summary of Development, IT Corp. April 1993). In other words, under pumping conditions, the stream may be adequately represented by simply applying 32 in/yr of recharge everywhere. The capture zone could be significantly reduced in the western region. Note: Recharge from Paddy's Run upgradient of Willey Road in the model is on the order of 80 gpm. Has a reality check been performed?

Response:
It is our opinion that the recharge boundary condition used in the model for Paddys Run is valid. Paddys Run impact on the aquifer is simulated in the steady state model by increased recharge in blocks intersected by Paddys Run. The recharge rate of Paddys Run is simulated in the solute transport grid by block values of 32 in/yr everywhere south of the Silos

where Paddys Run cuts through the till onto the aquifer. This same value of recharge is used where Paddys Run streambed is above and below the water table, thus the model already has recharge values of 32 in/yr along Paddys Run in the area of interest.

In our opinion, the capture zone is not significantly reduced because of the recharge boundary condition of Paddys Run. The capture to the west is not based upon the recharge boundary condition at Paddys Run, but rather due to general eastward flow patterns in the vicinity (see Figure 6-7 of the Groundwater Modeling Report - Summary of Model Development). Based upon our analysis and use of the model, this recharge has a relatively small effect on groundwater elevations in the vicinity, i.e., the model is fairly insensitive to recharge. For example, there is no visible impact on water level contours crossing Paddys Run by this increased recharge. A 2 foot drop in the water elevation caused by pumping is also within the range of seasonal variation of water elevations estimated to be on the order of 6 to 10 feet. The steady state model obviously has the limitation of not taking into effect Paddys Run seasonal and transient effects.

We calculated a value for recharge from Paddys Run north of Willey Road of about 35 gpm compared to the 80 gpm stated in the comment. We do realize that Paddys Run is an important part of the hydrologic system of the area from both flow and solute transport perspective and therefore a model improvement activity is underway to further assess Paddys Run infiltration on a more detailed level. Results of the assessment will be included in the Model Improvement Summary Report.

Action:
As stated in the above response.

3. Commenting Organization: Ohio EPA Commentor:
Section #: 4.5.4 Page #: 4-11 Line #: 12 Code:

Original Comment #: 3 In Figure 4-32, there should be a better explanation of significant vertical movement. This is especially true for movement near the y-coordinate of 7,500 ft. Is this associated with the large number of recharge blocks used to represent Paddy's Run (see GWMR Summary of Model Development, IT, April 1993, Figure 6-8) just west of waste storage area? The pathlines are not "spurious", but rather demonstrate the impact of boundary condition and need for careful review, analysis and understanding.

Response:
The significant vertical movement of the particles depicted in Figure 4-32 has been examined. Current opinion is that the lines are caused by numerical dispersion factors in the model and are not due to a boundary condition. Additional work is needed to better explain the particle tracks and as explained below, additional work will be conducted.

The primary purpose of Figure 4-32 is to show particle tracks in the y-z plane when the recovery wells are pumping. This objective is met with the

figure even without completely explaining the vertical pathlines in question.

The vertical movement associated with particles tracked on Figure 4-32 will be further reviewed and analyzed as part of the flow model recalibration. This recalibration will be performed as part of the Model Improvement Program.

Action:
As stated in response.

4. Commenting Organization: Ohio EPA Commentor:
Section #: Page #: Line #: Code:
Original Comment #: 4 Sensitivity of the vertical hydraulic conductivity and clay interbred hydraulic conductivity should be reviewed and discussed. These parameters are nearly as important to the capture zone as the horizontal hydraulic conductivity. It is important to reflect that during the transport model development, recharge over the site area was reduced to 2 in/yr (IT, April 1993, page 5-34). There has been more than a foot head differential across the clay interbred (downward) (IT, page 5-41), but changes in the vertical-to horizontal conductivity by an order of magnitude had a "small adverse effect on the calibration" (IT, page 5-47). The model currently uses 1/10, although 1/100 and 1/1 were evaluated during sensitivity analysis (IT, page 5-49). Locally the anisotropy could be very sensitive to the flow path and should not be easily dismissed.

Response:
As explained in the South Plume Modeling Report the recovery system was designed to create and maintain a hydraulic barrier. The selection of a location for this barrier, the number of wells needed to create the barriers, and their pumping rate, was determined using flow modeling, particle tracking, drilling data, and water quality field data; both from the FERMCO RI/FS and the Paddys Run Roadsite RI/FS.

Water quality field data indicate that uranium contamination is primarily in the 2000 series wells (top of aquifer) with a lesser amount in the 3000 series wells (top of clay layer or equivalent elevation). The objective of the recovery system operation was to provide a barrier to further southward movement of this shallow (2000 to 3000) uranium plume. Design of the barrier system focused on the upper part of the aquifer. We concur that locally the anisotropy could be very sensitive to the flow path but field data indicates that contamination at depth is not a concern. If deeper contamination is detected at a later date, the most cost effective way of dealing with capture of this uranium would be by adding an additional deeper well into the recovery system.

Lower values of vertical hydraulic conductivity would result in more difficulty in pulling water at depth. Conservatism and flexibility have been built into the design of the system (see the DMEPP) and a monitoring and response program has been created which will respond with system changes should unforeseen conditions occur. An important variable over

which we will have control is pumping rate. Thus, the pumping rate can be varied to compensate for other variables. New wells may also be added to the system based on findings in the monitoring and response program (see the DMEPP).

While other variables will affect the capture zone, the effort in the SPMR focused on the horizontal hydraulic conductivity to provide a sense of comfort in using the model to support the design effort. Other variables were not dismissed, but rather the Kh was selected as the primary variable. The clay layer (layer 3) was not looked at because it is absent in the model in the recovery well area (see Figure 5-12 of the Groundwater Modeling Report - Summary of Model Development).

Action:
As part of the model improvement program, sensitivity analysis will be performed on Kv and the clay layer to better understand the impact of variation of these parameters.

5. Commenting Organization: Ohio EPA Commentor:
Section #: 4.4.2 Page #: 4-6 Line #: 15 Code:

Original Comment #: 5 The well spacing varies between 279 ft. (Wells 2-3) and 375 ft. (Wells; 1-2, 3-4) according to the state coordinates in Table 5-1, p. 5-4. This is generally consistent with cones of depression in Figure 4-28, page 4-43. Thus a better average spacing would be 343 ft., not 280 ft./ (Also, correct crossing contours on Figure 4-28).

Response:
The comment indicates that the Ohio EPA is comparing the average spacing of the final selected location (Table 5-1) to the average spacing of an earlier proposed location, which was subsequently deemed inadequate and abandoned (Page 4-6, Line 15). This comparison is inappropriate. The final selected location has a recovery well system designed with 5 wells (not 4) constructed over a 1200 foot distance.

Some of the contours on Figure 4-28 do touch. This is a plotting problem. Although not technically correct, the plotting mistake is not major enough to change the technical interpretation of the figure.

Action:
None

6. Commenting Organization: Ohio EPA Commentor:
Section #: Page #: Line #: Code:
Original Comment #: 6 Time of travel is difficult to confirm. While 5 and 10-yr. capture zones are shown in Figures 4-29 to 4-31, it would be helpful to provide particle location using one-year increments as was provided in Figures A-5.

Response:
The intent of the figure was to show the envelope of 5 and 10 year

capture, not to depict one year time and rates of travel. The computer program that was written to perform the particle tracking would have to be modified to show one year increments of travel.

The capture zone maps will be re-run once the model is recalibrated and included in the Model Improvement Summary Report. Knowing that an interest has been expressed in seeing one-year incremental output, the new particle tracking plots will provide one-year incremental particle locations.

Action:
As noted in response.

7. Commenting Organization: Ohio EPA Commentor:
Section #: 4.5.3 Page #: 4-9 Line #: Code:
Original Comment #: 7 Why are calculations performed to the year 2063? While the simulated concentration, removal rate and mass removed (Figures 4-22 to 4-24) were checked for consistency, there is little justification for extended simulation beyond the first 20 years based on the uncertainty of the model predictions.

Response:
Calculations were performed to the year 2063 in response to a comment received by the Ohio EPA on an earlier draft of this report. The comment was contained within a letter from G.E. Mitchell to J. R. Craig, dtd. May 20, 1992.

Action:
None