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**TRANSMITTAL OF RESPONSES TO USEPA
COMMENTS ON THE GROUNDWATER
MODELING EVALUATION REPORT AND
IMPROVEMENT PLAN**

09/14/93

**DOE-2997-93
DOE-FN/EPA
11
RESPONSES**



Department of Energy
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SEP 14 1993

DOE-2997-93

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
Ohio Environmental Protection Agency
40 South Main Street
Dayton, Ohio 45402-2086

Dear Mr. Saric and Mr. Mitchell:

**TRANSMITTAL OF RESPONSES TO UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
COMMENTS ON THE GROUNDWATER MODELING EVALUATION REPORT AND IMPROVEMENT PLAN**

Reference 1: Letter, J. A. Saric to J. R. Craig, "Comments on the
Groundwater Modeling Evaluation Report and Improvement
Plan," dated June 21, 1993

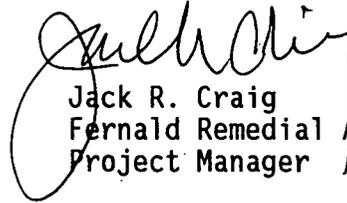
Enclosed for your review are the subject responses and proposed dates for
technical meetings regarding the model improvement process.

Frequent meetings to discuss each improvement task are proposed in response to
requests by both the United States Environmental Protection Agency (U.S. EPA)
and the Ohio Environmental Protection Agency (OEPA) for additional detail
regarding the model improvements. A Task Objective and Technical Approach
Summary will be provided prior to each meeting. It is the Department of
Energy's (DOE) intention that comments and concerns will be discussed and
resolved during these working meetings. A Task Summary in the form of a
letter report will be provided upon completion of each task. The final
Groundwater Modeling Report - Summary of Model Improvements will be submitted
during April, 1994.

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If you should have any questions, please contact Pete Yerace at (513) 648-3161 or Kathleen Nickel at (513) 648-3166.

Sincerely,


Jack R. Craig
Fernald Remedial Action
Project Manager

FN:Nickel

Enclosure: As Stated

cc w/enc:

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**PROPOSED DATES AND TOPICS FOR TECHNICAL MEETINGS
BETWEEN US EPA, OHIO EPA, DOE, AND FERMC
DURING THE GMA MODEL IMPROVEMENT PROCESS**

MEETING ONE - Week of September 27, 1993

- Follow Up for the June TIE
- Overall Approach of the Model Improvement Process
- Preliminary Results of Geostatistical Analyses for Calibration Criteria Development
- Preliminary GMA Model Grid Design
- Preliminary Results of Batch Tests for K_d
- Preliminary Results of Paddys Run Flow and Infiltration Model
- Development and Application of Screening Models

MEETING TWO - Week of October 18, 1993

- Available Data and Data Analysis
- Calibration Criteria
- GMA Model Design

MEETING THREE - Week of December 27, 1993

- Zonation and Values of K_d
- GMA Model Calibration

MEETING FOUR - Week of January 31, 1994

- Glacial Overburden and Upper GMA Model
- Surface Water Model
- Model Sensitivity Analysis
- Model Applications in OU5 RI

MEETING FIVE - Week of February 28, 1994

- Model Applications in OU5 FS
- Standard QA/QC Procedure
- Specification of Future Model Applications

MEETING SIX - Week of April 11, 1994

- Summary of Model Improvements

Notes:

- A Task Objectives and Technical Approach Summary (including task-specific QA/QC requirements) will be provided one month before each technical meeting (except the September 1993 meeting).
- A Task Summary Letter Report will be provided one week before each technical meeting (except the September 1993 meeting).

**RESPONSE TO US EPA'S COMMENTS ON
GROUNDWATER MODELING EVALUATION REPORT AND IMPROVEMENT PLAN**

GENERAL TECHNICAL COMMENTS

USEPA Comment No: 1 Section No: Page No:

Comment: The Groundwater Modeling Evaluation Report and Improvement Plan (the plan) is very general and does not provide specific information on most of the recommendations to improve the model. However, the overall conceptual approach to improving the model does address EPA's previous concerns, and the improved model should provide useful information in future applications.

Response: At the time the plan was written, there were many uncertainties as to the extent of improvement necessary or possible for the model. Therefore, the Groundwater Modeling Evaluation Report and Improvement Plan was written to generally outline the scope of planned model improvements and not limit the model improvements to narrowly defined tasks. Thus, a formal revision of the plan should not be necessary for minor changes in the technical approach of model improvement tasks. Over the past weeks, additional studies (e.g., pump test, slug tests, K_a experiments, and field sampling programs), which are needed for better defining the necessary model improvements, have been conducted. Based on the preliminary results of these studies, a better focus has been obtained on the model improvements and the specific approach for each improvement task. In general, it has been determined that all the tasks outlined in the current improvement plan will be performed. However, most of the data from these studies are still being finalized. Without this final quantitative information, full technical specification of tasks identified in the improvement plan can not be completed.

It is estimated that most of the data necessary for the model improvement activities will not be finalized until early October. Instead of adding additional technical information to the improvement plan and reissuing the plan at this time, the intention of DOE is to provide US and Ohio EPAs with additional technical information in the early stage of each improvement task as it becomes well-defined. This information will be identified as a Task Objectives and Technical Approach Summary. However, DOE does provide more technical information in the following responses to US EPA's specific technical comments on the current improvement plan.

DOE also plans to have frequent technical meetings with US and Ohio EPAs to discuss the progress and preliminary results during the model improvement activities. A revised schedule of the model improvement activities including dates for letter reports and proposed technical meetings is attached. Due to the aggressive schedule for the improvement plan, major comments on each individual improvement task should be given and discussed in these working meetings between technical staffs from US EPA, Ohio EPA, DOE, and FERMCO. Comments should be resolved during and after the technical meetings as soon as possible. Given the aggressive schedule, DOE feels that a formal review and approval process for each improvement task is inefficient and should not be conducted.

DOE will prepare and submit task summaries upon completion of each improvement task. This procedure will expedite the reviewing process of the final model and allow for more upfront input from US and Ohio EPAs. The final overall results of the model improvements will be summarized in "Groundwater Modeling Report - Summary of Model Improvements." This report will be completed and submitted to US and Ohio EPAs in April of 1994 prior to submittal of the Operable Unit 5 RI Report.

Action: DOE will provide US and Ohio EPAs with additional technical information in the early stage of each task as it becomes well-defined. Task Summary Letter Report will be prepared upon the completion of each task. These reports will be provided to US and Ohio EPAs. Frequent technical meetings will be held to discuss and address comments on each improvement task. The final results of the model improvements will be summarized in the "Groundwater Modeling Report - Summary of Model Improvements."

USEPA Comment No: 2

Section No:

Page No:

Comment: The decision to not incorporate the improved model in remedial investigation report for Operable Unit 4 where the risk assessment (using output from the current model) determines that an unacceptable risk to human health exists is relevant to DOE's modeling approach although it is not directly related to the plan. EPA concurs with this decision because further refinement of the current model would result in greater estimation of risk (which is already greater than the acceptable level) and would not add any additional information to the decision-making process.

Response: DOE agrees with EPA's position and will proceed with the Remedial Investigation Report for Operable Unit 4 using the current modeling results.

Action: DOE will proceed with the Remedial Investigation Report for Operable Unit 4 using the current modeling results.

SPECIFIC TECHNICAL COMMENTS

USEPA Comment No: 1

Section No: 4.2.1

Page No: 4-5

Comment: The plan states that the model design adequately represents the sources and sinks of the natural system reasonably well. However, the design does not adequately represent potential current sources of contamination in the south field area or the impact the water from the storm sewer outfall ditch has on flow patterns in the Great Miami Aquifer (GMA). The report should clearly identify specific areas of the model design that need additional refinement.

Response: The Operable Unit 5 RI fate and transport modeling will include all the source areas and contaminant migration pathways identified and characterized by Operable Unit 5 and other OUs at the FEMP. Additional sampling has been conducted by Operable Unit 2 to better assess the potential sources of contamination present on site and specifically in the south field area. Operable Unit 1 is collecting additional data for more detailed source characterizations. This information will be incorporated into the model improvement activities. The potential

impact to flow patterns in the Great Miami Aquifer caused by the water from the storm sewer outfall ditch is being investigated and will be summarized in the "Paddys Run Flow and Infiltration Model Report: Description and Results." Results of the Paddys Run flow and infiltration model will be used to improve the loading to the GMA model.

Action: Additional data on potential sources of contamination will be utilized during the model improvement. Results of the Paddys Run flow and infiltration model will be used to improve the loading to the GMA model. DOE will discuss the preliminary findings of this study with US and Ohio EPAs in the proposed technical meeting during the week of September 27, 1993. The Objectives and Technical Approach Summary for the tasks related to source loading (i.e., glacial overburden and upper GMA model and Paddys Run flow and infiltration model) will be provided to US and Ohio EPAs by the end of December, 1993. The Task Summary Letter Report will be submitted by January 24, 1994 and discussed in the proposed technical meeting during the week of January 31, 1994. The final results will be presented in "Groundwater Modeling Report - Summary of Model Improvements."

USEPA Comment No: 2

Section No: 4.2.4

Page No: 4-7

Comment: The plan states that site-specific data from the pump test performed as part of the South Plume Removal Action will help refine the model. Preliminary pump test results indicate that the hydraulic conductivity (K) in the GMA is not as homogeneous or isotropic as previously thought. DOE should evaluate the need for additional aquifer tests in other portions of the FEMP (either additional pump tests at one or two locations or slug testing at numerous locations) to help refine the heterogeneity of the K values used in the model.

Response: No additional pump tests are planned in the short term. The need for additional pump tests will be evaluated as part of each future remedial design activity once the groundwater model has been recalibrated using South Plume Pump Test Results. Preliminary pump test results, from Recovery Well 4, indicate that the hydraulic conductivity is slightly less than 400 feet/day. The model currently uses a value of 450 feet/day. This new hydraulic conductivity value is within the acceptable range of operation for the extraction system as it is currently designed "South Plume Removal Action Groundwater Modeling Report" (DOE, 1993). The four remaining recovery wells will be drilled to bedrock to determine if any clay layers are present or any drastic lithological changes are noted. A cost-effective correlation approach utilizing drilling data, lithologic samples, natural gamma ray logs and sieve analyses will be used to interpret area-specific hydrogeological conditions.

Action: The need for additional pump tests will be evaluated as part of each future remedial design activity once the groundwater model has been recalibrated using South Plume Pump Test Results. No additional action required at this time.

USEPA Comment No: 3

Section No: 5.1.2

Page No: 5-2

Comment: The plan proposes to add an additional layer above the topmost model layer to provide additional resolution on the vertical mixing. Although this approach appears reasonable, DOE should also provide specific information on which wells are screened in the topmost and additional layer to calibrate the model.

Response: In order to increase vertical resolution, the plan proposes to divide the current top model layer into two layers. The 2000-series well data will be used to calibrate the new layer 1 and 3000-series well data will be used to calibrate the new layer 3 (i.e., the original model layer 2). Also, available hydropunch data collected from elevations between the 2000 and 3000-series wells will be evaluated for model calibrations. If area-specific hydropunch data is not available for calibrating the new layer 2, data collected from 2000 and 3000-series wells can be interpolated to calibrate this layer. Currently, DOE is utilizing GIS techniques to develop the new model grid structure. All the available information of monitoring well screen elevations in the model area will be considered in the new model layer definition.

Action: A listing of wells which are screened in the topmost and additional layer will be prepared and submitted to the US and Ohio EPAs as part of the calibration criteria. The 2000 and 3000-series and appropriate hydropunch data will be used to calibrate the top three layers. The Task Objectives and Technical Approach Summary for the model grid design task will be provided to US and Ohio EPAs by the end of September, 1993. The Task Summary Letter Report will be submitted by October 14 and discussed in the proposed technical meeting during the week of October 18, 1993. The final results will be presented in "Groundwater Modeling Report - Summary of Model Improvements."

USEPA Comment No: 4

Section No: 5.1.4

Page No: 5-2

Comment: According to the plan an independent Paddy's Run model will be developed to improve the definition of the source term. DOE should provide specific field activities that need to be conducted to determine seepage rates and the extent of the glacial till.

Response: Additional infiltration data may be useful to improve the model's accuracy; however, obtaining representative infiltration rates in the field is very difficult and not cost-effective. There are several reasons for the difficulty in measuring infiltration to calibrate the Paddys Run Flow and Infiltration Model. They include: (1) infiltration rates are highly dependent on the soil conditions which are present at the onset of a storm event (e.g., moisture content, soil type, ground cover, etc.); (2) infiltration is a transient process and therefore changes during a storm event; (3) unlike pump tests, scale of a field test for infiltration rate is usually too small to obtain a representative value for a large area.

No additional field activity is planned for the Paddys Run modeling for the RI. Instead, conservative assumptions for model parameters will be used during model development. For example, the stream bed of Paddys Run is assumed to consist of the same material as the Great Miami Aquifer where it cuts through the glacial overburden and have the same permeability and porosity characteristics. This approach will result in conservatively higher estimations of infiltration rates.

Action: No action required.

USEPA Comment No: 5**Section No: 5.2.1****Page No: 5-3**

Comment: The plan states that an updated set of calibration criteria will be used for future calibration efforts. DOE should provide specific criteria so that the EPA can evaluate their applicability to the improved model.

Response: DOE agrees. A specific set of calibration criteria will be developed as a guideline for model improvement. The criteria will be separated into three distinct types; for steady-state flow, transient flow, and solute transport. The quantitative criteria for the flow model will include measures of mean residual, maximum residual, variance of residual, and spatial correlation of residuals. Also, criteria for water balances will be defined. The solute transport calibration criteria will consist of a target range for the contaminant concentrations and statistical analysis. Geostatistical analysis of groundwater elevations and uranium concentration data are underway. These results will be used to finalize the new criteria. The criteria will be developed prior to model recalibration and discussed with US and Ohio EPAs. The final criteria will be summarized in "Groundwater Modeling Report - Summary of Model Improvements."

Action: A specific set of calibration criteria will be developed and discussed with US and Ohio EPAs prior to model recalibration. The Task Objectives and Technical Approach Summary Report for the task will be provided to US and Ohio EPAs by the end of September, 1993. The Task Summary Letter will be submitted by October 14 and discussed in the proposed technical meeting during the week of October 18, 1993. The final criteria will be summarized in "Groundwater Modeling Report - Summary of Model Improvements."

USEPA Comment No: 6**Section No: 5.2.3****Page No: 5-4**

Comment: The plan states that multiple zones may be created for the distribution factor (K_d). DOE should provide the rationale for using multiple zones and criteria that will be used to divide the model domain into zones.

Response: The previous solute transport model (completed in 1990) only focused on the South Plume area and did not consider geochemical data from other portions of the FEMP. A new range of realistic K_d values and their distributions will be determined based on a review of appropriate data from previous and planned site-specific experimental studies (i.e., Operable Unit 2 and Operable Unit 5 batch tests). DOE will limit the necessary zonation of K_d so as not to over-complicate the modeling process. The use of multiple zones of K_d values is, however, a typical modeling practice since K_d values can vary with contaminant forms, soil type, and groundwater conditions.

Available data relating to K_d will be compiled and reviewed. These data will be statistically analyzed to determine common statistical parameters and, if appropriate, geostatistical parameters. Results of previous solute transport calibration runs will be re-evaluated by using the updated calibration criteria first. If the site-specific data substantiates the use of multiple zones for K_d , then these K_d values will be used for modeling.

Action: DOE will provide and discuss the rationale for using multiple zones and values of K_d to the US and Ohio EPAs when evaluations of the site-specific K_d values are completed. The Task Objectives and Technical Approach Summary for the task will be provided to US and Ohio EPAs by the end of November, 1993. The Task Summary Letter Report will be submitted by December 15 and discussed in the proposed technical meeting during the week of December 27, 1993. Final zonation and values of K_d will be provided in the "Groundwater Modeling Report - Summary of Model Improvements."

USEPA Comment No: 7

Section No: 5.2.4

Page No: 5-5

Comment: The plan proposes that geostatistical analysis will be used to further determine calibration criteria. Calibration criteria are usually determined before the modeling effort. DOE should explain how the geostatistical analysis will be used.

Response: The purpose of the geostatistical analysis in the model improvement plan is to help identify trends with respect to groundwater levels, Uranium concentrations, and other important parameters to support hydrogeological interpretations. The results of the analysis will be used to develop the calibration criteria. Both the geostatistical analysis and development of the calibration criteria tasks will be completed prior to model recalibration.

The following on-going geostatistical tasks are parts of the model improvement activities:

- (1) Develop estimates for piezometric head. The monthly piezometric head data for each season (from 1990 through 1992) will be averaged at each well. A three-dimensional (x,y,z) spatial grid of the estimated piezometric head will be prepared for each season for the 2000, 3000, and 4000-series wells. For 2000-series wells, a three-dimensional (x,y,t) temporal spatial grid of estimated head changes over time at each two-dimensional (x,y) location will also be produced.
- (2) Determine a long-term steady-state estimate for piezometric head. The monthly head data will be averaged across the entire 3-year period from 1990 through 1992. A three-dimensional (x,y,z) spatial grid of the estimated piezometric head will be prepared.
- (3) Calculate yearly estimates for Uranium concentrations. The Uranium concentration data from 1000, 2000, 3000, and 4000-series wells will be averaged for each year from 1990 through 1992 at each well. A three-dimensional (x,y,z) spatial grid of the averaged Uranium concentrations will be produced for each of the 3 years. Because not all the wells were sampled in every year, the areal extent of this annual analysis will be limited by the available data in each year.

- (4) A joint temporal-spatial analysis for Uranium concentrations will be performed. For the 2000-series wells, a three-dimensional (x,y,t) temporal-spatial grid of estimated Uranium concentration changes over time at each two-dimensional (x,y) location will be produced.
- (5) The spatial distribution of K_d data will be estimated. A three-dimensional (x,y,z) spatial grid of K_d values will be generated.
- (6) The spatial distribution of the overburden thickness will be determined. Glacial overburden data will be analyzed to generate a two-dimensional (x,y) spatial grid of the estimated glacial overburden thickness.
- (7) Simple statistics, including mean, median, maximum, minimum, variance, number of samples, and tolerance interval will be performed for time-varying data points and on each total data set.

Action: The Task Objectives and Technical Approach Summary for the task will be provided to US and Ohio EPAs by the end of September, 1993. The Task Summary Letter Report will be submitted by October 14 and discussed in the proposed technical meeting during the week of October 21, 1993. Results of the above listed geostatistical tasks will be presented in a task summary report and "Groundwater Modeling Report - Summary of Model Improvements."

USEPA Comment No: 8

Section No: 5.4.3

Page No: 5-7

Comment: The plan states that the first post-audit will be conducted a minimum of 5 years after model calibration. The timing of the post-audit does not present a definitive approach. DOE should propose exact time frames for post-audits; for example at 3 years after calibration and every 5 years thereafter.

Response: DOE agrees that a definitive approach to timing of the post-audit should be presented. The timing for post-audit suggested by US EPA (i.e., 3 years after recalibration and every 5 years thereafter) is reasonable.

Action: This timing of the post-audit (i.e., 3 years after recalibration and every 5 years thereafter) will be specified in "Groundwater Modeling Report - Summary of Model Improvements."

USEPA Comment No: 9

Section No: 5.5

Page No: 5-7

Comment: The plan states that letter reports will be prepared at the end of each short-term model improvement task. According to the schedule presented in the plan, several tasks are complete and DOE has not submitted letter reports. DOE should submit the letter reports as soon as possible.

Response: The schedule provided in the plan requires revisions. To date, there have been no model improvement tasks completed and subsequently no letter reports submitted. The tasks which are currently ongoing include: (1) model grid expansion and GIS presentation of model structure; (2) additional geochemical data collection; (3) geostatistical analysis on water level data; (4) Paddys Run flow and Infiltration Model development; (5) pump test and slug test analyses; and (6) steady and transient state calibration criteria development. DOE still intends to prepare task summaries for each short-term improvement task and provide these summaries to the US and Ohio EPAs.

Action: An updated schedule for the GMA model improvement process will be developed and provided to US and Ohio EPAs. DOE will prepare Task Objectives and Technical Approach Summary and Task Summary Letter Report for each improvement task and submit these reports to US and Ohio EPAs. Frequent technical meetings will be held to discuss and address comments on each improvement task. A complete summary of model improvements will be presented in "Groundwater Modeling Report - Summary of Model Improvements."