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ENGINEERING EVALUATION/COST ANALYSIS SOUTH PLUME RESPONSIVENESS SUMMARY AUGUST 1990

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Engineering Evaluation/Cost Analysis
South Plume

RESPONSIVENESS SUMMARY

FEED MATERIALS PRODUCTION CENTER
Fernald, Ohio

August 1990

U. S. DEPARTMENT OF ENERGY
OAK RIDGE OPERATIONS OFFICE

Engineering Evaluation/Cost Analysis
South Plume

RESPONSIVENESS SUMMARY

FEED MATERIALS PRODUCTION CENTER
Fernald, Ohio

Prepared for

U.S. Department of Energy
Oak Ridge Operations Office

Prepared by

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TABLE OF CONTENTS

SECTION	PAGE
INTRODUCTION	1
SECTION 1: How the Plume Developed	4
SECTION 2: The Removal Action Process	7
SECTION 3: Basis for Recommended Alternative	10
SECTION 4: Treatment Issues	14
SECTION 5: Risk Issues	18
SECTION 6: Data Issues	22
SECTION 7: Detailed Revised Response to Comments U.S. Environmental Protection Agency	25

APPENDIX A: Comments Made During Public Comment Period Engineering Evaluation/Cost Analysis, South Plume

SOUTH PLUME EE/CA RESPONSIVENESS SUMMARY
INTRODUCTION

On April 16, 1990, the United States Department of Energy (U.S. DOE) published a report outlining its near-term plans for controlling uranium migration in groundwater just south of U.S. DOE's Feed Materials Production Center (FMPC) near Fernald, Ohio. The area has been referred to as the "south plume," and this and other environmental issues were identified during U.S. DOE's major environmental study, known as the Remedial Investigation and Feasibility Study (RI/FS).

The decision-making document published April 16, 1990 is the Engineering Evaluation and Cost Analysis (EE/CA), South Plume. It identifies U.S. DOE's near-term approach for controlling the south plume, and includes U.S. DOE's rationale for selecting this approach. Pursuant to comments received from the community and the U.S. Environmental Protection Agency (U.S. EPA) and the Ohio Environmental Protection Agency (OEPA), U.S. DOE revised the EE/CA on August 1, 1990.

This Responsiveness Summary was prepared pursuant to the terms of the 1990 Consent Agreement between U.S. DOE and U.S. EPA, as well as relevant federal laws, regulations, and guidelines, including:

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 United States Code, Section 9601, *et seq.*, as amended
- National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 Code of Federal Regulations, Sections 300.67 and 300.415
- Community Relations in Superfund: A Handbook, Interim Version, June 1988, EPA/540/6-88/002

The EE/CA analyzed five alternatives, which include:

Alternative 1	No Action
Alternative 2	Groundwater Monitoring and Institutional Controls

Alternative 3	Alternate Water Supply with Groundwater Monitoring and Institutional Controls (referred to hereafter as Alternate Water Supply)
Alternative 4	Groundwater Pumping, Alternate Water Supply, Groundwater Monitoring, and Institutional Controls (referred to hereafter as Pump and Discharge)
Alternative 5	Groundwater Pumping with Treatment, Alternate Water Supply, Groundwater Monitoring and Institutional Controls (referred to hereafter as Pump and Treat).

U.S. DOE's recommended alternative for the south plume is Alternative 4, which is detailed in the EE/CA. It calls for pumping water from a contaminated area in the aquifer in the south plume into FMPC's effluent line, where it would be discharged without treatment into the Great Miami River.

This alternative was a major topic during the RI/FS Community Meeting on May 22, 1990 and was discussed in detail during the South Plume EE/CA Workshop on May 30, 1990. The workshop included an opportunity for participants to make formal verbal comments. A 30-day public comment period began on April 16, 1990 and was extended until June 18, 1990 in response to requests from the community. In addition to comments from U.S. and Ohio EPAs, U.S. DOE received 87 comments from the Paddys Run Road Site Project and eight members of the community. U.S. DOE also considered significant comments from the RI/FS Community Meeting, as well as the June 19, 1990 Community Roundtable on radiation.

This Responsiveness Summary summarizes (by topic) and responds to significant comments received during the public comment period. This Responsiveness Summary is U.S. DOE's final response to all comments addressing the South Plume EE/CA; note that a preliminary response to comments made by U.S. EPA and Ohio EPA was prepared and delivered to the EPAs in July 1990; these detailed responses have been revised since the preliminary draft and are included in Section 7. Appendix A is the list of the public comments.

In general, the community voiced concern about the recommended alternative; specifically, commenters focused on the quantitative increase in uranium that would be discharged into the Great Miami River and the potential exposure to uranium by a larger population. Comments also questioned the need for cost-effectiveness to be included as a criterion for evaluating all removal action alternatives. U.S. EPA requires evaluation of cost-effectiveness in selection of any EE/CA response.

Many commenters said they wanted actual treatment of the south plume water to remove all above-background concentrations of uranium before discharge into the river. Commenters expressed concern about potential adverse impacts on health and the environment because of the additional release of uranium into the river. But in the absence of an accelerated final remedy that would treat the south plume, most members of the public said they preferred Alternative 5, known as Pump and Treat. This alternative called for mixing the groundwater pumped from the south plume with treated plant effluent before discharge into the Great Miami River. For reasons explained later in this document and in the revised EE/CA, U.S. DOE has deleted Alternative 5 from the revised EE/CA.

After considering comments from the public and U.S. and Ohio EPAs, U.S. DOE has revised the EE/CA. The major technical changes include the elimination of Alternative 5 from further consideration and the reduction of the allowable concentration of uranium in the groundwater from 33 parts per billion (ppb) initially proposed by U.S. DOE, to 30 ppb. The reasons for these changes are explained in this summary and the revised EE/CA.

This Responsiveness Summary, together with the revised EE/CA, explain U.S. DOE's rationale for the revisions and the selection of the recommended alternative. The revised EE/CA has been submitted to U.S. EPA for modification, approval, or disapproval under Section IX of the CERCLA Consent Agreement.

SECTION 1

How the Plume Developed

Comment:

The community wanted to know how the plume developed, focusing on past practices and probable sources of contaminant releases to the south plume. Commenters requested more specific information about the probable source(s) of the plume -- e.g., current as well as historical releases -- and clarification of U.S. DOE's rationale on uranium source (as discussed in Sections 2.41 and 3.2). They asked for specific information (such as plant records, site hydrology, details of the modeling, etc.) used to support conclusions about the probable sources of south plume contamination. One commenter attributed the presence of the south plume to past practices regarding a treatment facility.

Response:

A body of data exists that may be used to define historic and continuing releases, including the identification of probable sources of these releases across the southern boundary of the FMPC. The data, from these independent sources and analyses, were used to predict movement of the plume. In this case, the various informational sources include, but are not limited to: plant estimates of the mass of uranium flowing to the storm sewer outfall ditch on an annual basis; historic information on releases to Paddys Run; engineering estimates of the release rates from these surface water courses into the aquifer; direct monitoring data on the current location of the south plume and the distribution of uranium concentrations within the plume; the current knowledge of groundwater velocities and uranium migration rates, and a numerical model that successfully reproduces known or observed current conditions by superimposing estimated releases over the period of interest onto the simulated groundwater flow and solute transport systems.

These sources provided part of the data used to develop the south plume solute transport model. When evaluated, these data yield fairly consistent results without introducing unsubstantiated assumptions or unrealistic parameter values into the solute transport model. Therefore, information about past practices and releases, together with direct observations

(made through the collection of flow measurement, analyses of groundwater samples, and engineering estimates), provide a current understanding of the nature and development of the south plume.

In this case, both the direct observations of uranium distribution within the plume and the model results show that recent releases across the FMPC boundary may be approximately one order of magnitude less than the releases that occurred in the late 1950s and early 1960s. For this reason, the historic releases are considered the probable source of the highest concentrations observed in the plume today.

Source controls for the south plume are being fully evaluated in the feasibility study (FS) for Operable Units 1, 2, 3, and 4. The purpose of the EE/CA is narrower than that of the FS; thus, it is intended to prevent or minimize exposures to the public from contaminated groundwater until a final remedy can be implemented. Thus, source control is not addressed in this EE/CA.

Records of uranium discharges from the FMPC, field observations of uranium concentrations in groundwater, and model results consistently show that the plume outside the FMPC boundary, although still linked to continuing releases from the FMPC, is primarily the result of historic releases that were orders of magnitude greater than current releases. For example, the highest concentrations of uranium in the plume are already south of the FMPC boundary, with a decreasing trend in uranium concentrations proceeding back toward the FMPC boundary.

The data supporting this conclusion have been analyzed in support of the calibration of the solute transport model and will be presented in detail in the sitewide groundwater report that is currently being prepared in support of the Environmental Media (Operable Unit 5) remedial investigation (RI) report.

Regarding the clarification issue, DOE considers the information on page 3-1 of the April 1990 South Plume EE/CA is consistent with information previously presented in the EE/CA. Three distinct statements made in the third paragraph on page 3-1 are addressed here: first, the

reference to "a reduced, yet continuing source of uranium" from the FMPC is consistent with earlier statements that continuing releases exist but are not significant for purposes of the South Plume EE/CA. Second, the statement that the continuing releases are "not a focal point of the removal action" is consistent with the overall strategy that such releases will be addressed under Operable Unit 5 rather than the South Plume removal action. Finally, the statement that "the continuing source will be considered in the evaluation of removal action alternatives" is true. The current loadings were in fact used as the baseline condition in the evaluation of future conditions under the various removal action alternatives, including the no-action alternative.

Finally, one commenter questioned a 1951 decision not to build a waste water filtration system to trap uranium. The source of information and full details about the 1951 decision are not clear and require further research. Therefore, this comment (which is not a significant issue for purposes of the revised EE/CA) cannot be addressed completely until historical plant records are researched.

SECTION 2

The Removal Action Process

Comment:

Members of the community expressed interest in the removal action process -- determination of removal action objectives, establishment and application of evaluation criteria and how they are applied, and the removal action's applicability to the RI/FS. Comments also focused on source control, treatment, and disposal of the pumped groundwater -- i.e., the commenter asked how, without controlling the source of the uranium, and without treating the pumped groundwater, can this removal action comply with the NCP and Consent Agreement? They also questioned the rationale for using cost as an evaluation criteria in the alternatives analysis. Several comments were made about the adequacy of the EE/CA in addressing these issues.

Response:

Removal Action Objectives

The general intent and scope of this removal action, as stated in the Consent Agreement, are restated in the introduction of the South Plume EE/CA. The intent of any removal action, as defined in the National Oil and Hazardous Substances Contingency Plan (NCP) of March 1990 (40 Code of Federal Regulations [CFR] 300.415), is to abate, minimize, stabilize, mitigate, or eliminate a release or a threat of release prior to a final action if there is a threat to public health or the environment. Specific objectives have been established in Chapter 3.0 of the EE/CA pertaining to the south plume. The objectives include protecting public health and the environment. For the reasons shown below, these objectives would be met by Alternative 4, which calls for pumping groundwater from the south plume, and by Alternative 5, which (prior to being deleted) called for pumping and treatment of contaminated groundwater prior to discharge:

- Controlling plume migration, pending implementation of a final remedy
- Protecting public health by preventing public use of groundwater containing elevated uranium concentrations, by limiting public access to the groundwater

- Protecting public health and the environment because concentrations of uranium in the Great Miami River would remain within acceptable limits (refer to discussion of risk issues in Section 4 of this document for analysis)

Thus, discharging south plume water into the Great Miami River is fully consistent with the stated objectives of the South Plume removal action.

Removal Action Evaluation Criteria

The South Plume Removal Action meets all three U.S. EPA evaluation criteria that are required for removal actions. These criteria are listed below:

- Effectiveness
- Implementability
- Cost

Cost comparison, to which some commenters objected as an evaluation criteria, also is required by U.S. EPA in its interim EE/CA guidance and is addressed in the EE/CA. Cost estimates are provided in Chapter 5 and Appendix B of the EE/CA.

Source Control

None of the alternatives developed for the South Plume Removal Action included control of the source of the uranium flowing into the south plume, because of the scope and intent of the removal action and its relationship to the RI/FS underway at the FMPC. Source control is being more fully evaluated in the Remedial Investigation and Feasibility Study (RI/FS) process.

An inconsistency in the description of secondary objectives (in the Executive Summary and Section 3 of the EE/CA) is because of the redefinition of the objectives of the South Plume EE/CA at the time of negotiation of the Consent Agreement. Because Operable Unit 5 will consider the entire regional aquifer and the South Plume EE/CA focuses on controlling the existing plume at locations south of the FMPC, the objective of preventing future releases across the FMPC boundary has been shifted to the Operable Unit 5 RI/FS and should have been deleted from the Executive Summary of the April 1990 draft EE/CA. It is important to

note that the deletion of this objective from the South Plume EE/CA will not impact either the work performed to date or the recommendations made in the EE/CA. The reason is that none of the five alternatives would be effective in reducing or eliminating the continuing releases across the FMPC boundary.

Before determining what removal action alternatives would be appropriate for evaluation within the South Plume EE/CA, removal action objectives that are consistent with the Consent Agreement were identified. The identification of these objectives was a critical step in the development of the EE/CA, as the objectives determine what will be accomplished by the removal action. The objectives could range from total cleanup of a specific area to cleanup of a small surface hazard. Since the Fernald site is complex and poses multiple hazards, this removal action is intended to address only a portion of the site. Specifically, this action focuses on contamination in the groundwater south of the FMPC boundary, while other site conditions requiring more lengthy investigation and evaluation of solutions, including evaluation of potential sources of contamination to the groundwater, are currently being addressed under several of the operable units within the RI/FS. With this in mind, near-term alternatives were developed for the south plume, as described in the EE/CA. The intent of this evaluation was to identify alternatives that would reduce or mitigate the potential threat to the public and the environment from elevated uranium concentrations in groundwater, and specifically protect public health by limiting access to and use of groundwater with uranium concentrations exceeding acceptable limits. As discussed in the EE/CA, these objectives can be addressed without removal or control of the source and without treatment.

Alternatives

The alternatives in the original draft EE/CA represent a selection of options designed to protect public health and the environment by slowing migration of the south plume pending selection of a final remedy. A broadened scope, such as that identified under the more comprehensive feasibility study for Operable Unit 5 (which includes the south plume), would necessitate an expanded list of alternatives. This removal action is intended to provide an interim plan of action until the final action is selected and implemented.

SECTION 3

Basis for Recommended Alternative

Comment:

A number of commenters questioned U.S. DOE's rationale for recommending Alternative 4, known as Pump and Discharge. Others expressed the opinion that the EE/CA should explain how the alternatives would be implemented and how they would meet the removal action's objectives.

Some of the commenters' specific concerns include:

- What wells in the south plume area will be selected for continued additional monitoring and why?
- Is there an advantage to pumping from the center of the plume, and not just the leading edge?
- How does discharging south plume water into the Great Miami River not increase its mobility?
- How will local industrial users be affected by the south plume pumping? What are other potential impacts of this recommended alternative?
- Why doesn't U.S. DOE provide all industrial users with an alternate water supply?
- Does U.S. DOE have enough monitoring wells in place to adequately determine the best place to put the extraction wells and to define the plume?
- Will the proposed extraction wells be deep enough?
- Why doesn't U.S. DOE provide an alternative water supply for the community?
- Can the Feed Materials Production Center's facilities and pipeline handle the flow capacity that would be generated by the south plume pumping?
- Why doesn't U.S. DOE discharge the south plume water directly into the river?
- How many extraction wells will there be, and what are their anticipated pumping rates?
- How would the institutional controls work, as proposed by U.S. DOE?

Response:

U.S. DOE has numerous monitoring wells in the South Plume area, and is adding additional monitoring wells. This information that U.S. DOE collects from these wells, along with the groundwater model would provide ample information to identify appropriate locations for the extraction wells. As proposed by U.S. DOE, the recommended Alternative 4 proposes installing four wells, each capable of pumping 500 gallons per minute, at the southern, leading edge of the south plume. By evaluating the groundwater data, U.S. DOE has calculated how deep the wells need to be so that they would pull out the contamination, yet not cause the contamination to be drawn down deeper into the aquifer. The south plume water then would be pumped into the FMPC's existing effluent line, where it would be discharged without treatment into the Great Miami River. Alternative 4 also would provide an alternate water supply to two industrial users. This would eliminate the possibility that these wells would draw elevated uranium concentrations deeper into the aquifer. In addition, this alternative would include continued groundwater monitoring and institutional controls.

Institutional controls may include alerting potential new users within the south plume area about the contamination and monitoring any new wells installed in the area. These institutional controls would be developed with the cooperation of local officials and residents.

There is no need at this time, based on the data from the monitoring program, for an alternate water supply to be provided for the local communities because only three industrial users have been identified, and none of them use the water for anything other than industrial processes.

U.S. DOE considered placing the wells in the projected center of the plume and at the southern property line of the FMPC. As explained below, both locations were eliminated after evaluation because they would not fully meet the objectives of the removal action.

Locating the wells in the projected center of the plume would remove more uranium from the plume, but at the higher concentrations the remedy may require treatment. Treating water pumped from the projected center of the proposed plume is not a viable short-term option because there is no treatment system for removing uranium in place at this time.

Installing the wells at the leading edge of the south plume will slow the migration of the contamination without requiring so much pumping force as to affect industrial users. And the concentrations of uranium in the leading edge of the plume, according to the groundwater sampling data analyzed for the EE/CA, are not so high as to pose a potential risk.

The U.S. EPA has recognized the value of lowering concentrations. In two of its publications, A Citizen's Guide to Radon: What It Is and What To Do About It, (OPA-86-004), and Radon Reduction Methods: A Homeowner's Guide (Third Edition), the federal agency notes that risk increases with length of exposure and higher concentrations.

Thus, under the circumstances, discharging uranium-contaminated water into the Great Miami River currently represents the best response to the south plume issue. The recommended alternative fulfills its objectives of protecting the public health and the environment in the short-term, partly because it is a timely action. And although it may seem that the recommended alternative increases the mobility of the uranium, physical movement alone is not the sole criterion used in judging the effectiveness of a recommended action. Of equal importance in the case of the south plume the levels of uranium. If Alternative 4 is implemented, it will actually reduce the toxicity of water from the plume by reducing uranium concentrations.

U.S. DOE considered the possible effects to other users in arriving at its recommended alternative and, after evaluation, the recommended pump and discharge alternative will have the fewest negative impacts on other users.

There are several reasons for U.S. DOE's desire to use the existing effluent pipeline instead of discharging the south plume water directly into the Great Miami River. First, the effluent discharge system already is in place, cutting the amount of time it would take to implement the recommended alternative. The existing effluent discharge system has sufficient flow capacity to handle the increased volume of water that would result under the recommended alternatives. Second, using the existing system means that U.S. DOE would not have to negotiate for additional rights-of-way in order to build new pipeline, which is an important consideration for

implementing the removal action in a timely manner. Third, U.S. DOE believes it is prudent to use the existing system in order to have better operational control over the discharge system.

Discharging the south plume water directly into the Great Miami River also is not possible without building a new pipeline. As building a new pipeline would add cost and delay, this option was eliminated as not meeting the objective of implementing the removal action in a timely manner.

423

SECTION 4

Treatment Issues

Comment:

Several public commenters expressed concern that the recommended alternative would not include treatment. Generally, commenters asked for more detail on the treatment possibilities for water pumped from the south plume. Specifically, members of the public wanted to know why U.S. DOE was not considering treatment of either the water pumped from the south plume or treatment of the south plume itself.

There were some comments about the capabilities of the existing treatment systems at the Feed Materials Production Center, especially as applied to Alternative 5. One commenter was concerned because the treatment system proposed in the first version of the EE/CA would handle only about 700 gallons per minute (gpm) while the extraction wells for the south plume would be producing 1500 to 2500 gpm, which would mean that between one-half and three-fourths of the effluent in the system would be left untreated. Another commenter recommended that the Alternative 5 be designed to accomplish the objectives of the Consent Agreement, rather than just ensuring that the total mass of uranium released via the effluent pipeline does not exceed the existing FMPC release value.

Response:

Removal actions, as described in the National Oil and Hazardous Substances Contingency Plan (NCP) of March 1990 (40 Code of Federal Regulations 300.415), primarily are intended to eliminate, minimize or stabilize a release or a threat of release prior to a final remedy if there is a threat to public health or the environment. A second reason for implementing a removal action is to mitigate -- in the short term -- contamination migration pending final action. Also, to the extent practicable, removal actions also are to be consistent with the anticipated long-term remedy.

Moreover, although these NCP requirements may not ultimately apply to U.S. DOE, federal guidelines for removal actions call for the action to be taken within 12 months and at a cost of

17

no more than $2 million. CERCLA response actions requiring more time and money must be evaluated using the more comprehensive criteria of the remedial process.

The analytical data indicate the presence of radionuclides and inorganic metals in the groundwater south of the Feed Materials Production Center. However, none of the metals exceed established drinking water standards and most of the radionuclides are found at natural background concentrations with the exception of uranium. Certain organic chemicals also have been observed in some samples, but these observations have not been persistent for the same monitoring wells and are far below allowable maximum concentration levels for all organics detected. For these reasons, uranium has been designated as the contaminant of concern for the South Plume Removal Action. All considered actions that account for public health and environmental protection against uranium also will provide protection against other radionuclides and chemicals because of the low levels present.

In the case of the south plume, exposure to the contaminants can occur only if the groundwater reaches the land surface or if a user draws groundwater from the plume. Therefore, one of the goals of the removal action is to prevent groundwater contaminated with higher concentrations of uranium from coming into contact with potential users and the environment.

As part of the South Plume EE/CA process, a wide range of short-term options were reviewed to determine if they met the primary goals of protecting the public health and environment in a timely, cost-effective manner. Some options were eliminated early in the process because they would not address the contamination adequately, could not be implemented, or would have had excessive costs compared to an alternative with the same degree of protection.

Treatment of the south plume water is not a viable short-term option because there is no advanced treatment system for removing uranium in place at this time. U.S. DOE estimates that the earliest time that any treatment system could be built is 1993. This does not meet the removal's objective of timeliness. Although one area industry is treating its water for uranium, the system is privately owned. Even if the system were available to U.S. DOE, it is not large enough to handle the volume of the south plume.

The use of an ion-exchange resin is considered to be the best technology for removing uranium that has dissolved in water. An ion-exchange resin could be described as a special filter to "pull" uranium from the water. Other technologies, such as in-situ vitrification, generally are not technically appropriate for the south plume. Vitrification, for instance, uses high doses of electricity to turn dry waste and semi-solids into glass. It does not work on liquids or sludges such as would be created when pumping water from the south plume. However, additional treatment options for the south plume are currently being evaluated more fully in the Operable Unit 5 FS.

But because the south plume requires more immediate attention, the EE/CA analyzes the best way to deal with the south plume in the short term, with the technology or facilities available now, while not interfering with any long-term remedial actions and ultimate site cleanup.

Based on the analysis in the EE/CA, discharging the south plume effluent into the Great Miami River is recommended as the best short-term solution for protecting the public health and the environment from higher concentrations of uranium.

After looking for wells in the south plume area and tracing their owners, U.S. DOE has found that there are only two, possibly three, known industrial users of groundwater with the higher levels of uranium. The wells presently used do not affect or control the southerly movement of the plume. The water drawn out of the plume by these two industries is used in their industrial processes and is not known to be used for human consumption. Should a similar situation develop with the third industrial user, U.S. DOE will respond appropriately.

The pumping by the industrial users, however, creates an additional pathway for human exposure, if the water were to be diverted from the industrial processes to other uses (for example, drinking water, sanitary uses, etc.). Therefore, in order to control or eliminate this potential pathway for human exposure (and the associated potential for human health risks), the U.S. DOE plans to provide these two industries with an alternate water supply. In addition to eliminating a potential pathway for human exposure to elevated uranium concentrations, the

action is consistent with another objective of the removal action: to stabilize the plume and slow any potential vertical migration into the deeper aquifer resulting from the use of the two industrial wells. This will control the spread of the plume pending a final remedial action.

With U.S. DOE's plan to implement institutional controls, potential new users within the south plume area would be alerted about the contamination. U.S. DOE also would monitor any new wells installed in the area.

Also, the force of the pumping from U.S. DOE's extraction wells is expected to prevent the contamination from moving farther south, where it could find its way to the public through wells and surface openings. Finally, discharging the south plume water into the Great Miami River will reduce the high concentrations of uranium because of the much larger volume of water in the river, where the uranium is well within background levels for the area. Background, or the naturally occurring uranium levels, is within 1 to 3 parts per billion for southwestern Ohio.

Thus, the recommended alternative of pump and discharge will protect the public health and the environment by mitigating the threat posed by the high concentrations of uranium in the south plume. The recommended alternative also will protect the public and the environment by halting the plume's migration to the south. Finally, the recommended alternative can be implemented with existing technology and facilities, as well as meet the federal guidelines for removal actions.

U.S. DOE has eliminated Alternative 5, known as Pump and Treat, from the revised South Plume EE/CA. However, U.S. DOE has planned and received Congressional authorization for an advanced waste water treatment plant for the FMPC. When completed, this treatment system will allow U.S. DOE to comply with its goals for discharge limits.

SECTION 5

Risk Issues

Comment:

Pathways and Related Issues

Several questions focused on pathways by which uranium can travel. Commenters wanted to know about more pathways than those identified in the EE/CA, about the potential for soil contamination along the river bed, and specific information about the cancer-causing potential of uranium. They also wanted more complete documentation of the removal action's pathway analysis and risk assessment. One commenter suggested that the exposure pathway analysis documented in the EE/CA did not meet U.S. EPA requirements.

Uranium Concentrations

The rationale supporting the pumping of water out of the south plume and into to the Great Miami River via the FMPC effluent discharge was questioned at both the May 22, 1990 RI/FS Community Meeting and the May 30, 1990 South Plume EE/CA Workshop, as well as in written comments. Many commenters did not accept the EE/CA premise that uranium concentrations in the overall FMPC effluent discharge to the river would decrease after mixing with the relatively lower concentrations of uranium from the south plume; rather, these commenters expressed strong concern about the increased uranium mass that would be discharged.

Contaminants of Concern

Several commenters expressed the opinion that U.S. DOE should consider other chemical and radiological contaminants in this analysis of the south plume. They said the EE/CA did not adequately address issues related to other contaminants and that the lack of this information affects the analysis provided by the groundwater model and may affect discharge permit compliance. One commenter said a broader list of contaminants of concern would more fully

meet removal action objectives identified in the Consent Agreement. One commenter asked why uranium is a contaminant of concern for the south plume but not for the river.

Applicable Standards

One commenter raised several questions regarding the standards, regulations, and guidelines that are applicable to the South Plume Removal Action. These highly technical concerns focused on the Applicable or Relevant and Appropriate Requirements, known as ARARs, and the absence of an industry-wide standard for radionuclides in groundwater. These commenters requested more discussion about final ARARs and how they will be met with the recommended alternative; asked that nonradioactive contaminants be added to the ARARs list and that maximum contamination levels (MCLs) be considered as potential ARARs; and suggested that reinjection of the pumped groundwater could be beneficial in meeting applicable ARARs.

Response:

A more complete discussion of the criteria that must be considered when calculating risk has been added to the revised EE/CA. The process used in the risk assessment for the south plume follows U.S. EPA guidelines for human health risk assessment. Generally, the first step is to identify the radionuclides and hazardous chemicals of concern. The next step is to do an exposure assessment that includes the characterization of an exposure setting and identifies possible exposure pathways.

For this EE/CA, the exposure pathways are identified by describing how humans may be exposed to contaminants originating from the south plume. Each pathway consists of:

- A source of contamination
- A mechanism for transporting the contamination through an environmental medium to a point of exposure
- A potential receptor at the location of exposure
- A route of exposure

In the case of the south plume, exposure to the contaminants can occur only if the groundwater reaches the ground surface, either through pumping or discharge to a surface water course. Because the model predicts that the south plume will not migrate to the Great Miami River or any other surface water course within the projected life of the removal action (5 years), natural groundwater discharge to surface waters is not considered as an exposure pathway for purposes of the EE/CA. The exposure pathways associated with pumping groundwater discharged to the Great Miami River are considered in evaluating the effectiveness of the removal action alternatives that involve pumping. Appendix G, Section 3.2 in the revised EE/CA includes an expanded discussion of risk issues. This discussion provides a more comprehensive list of the potential exposure pathways that may arise from pumping groundwater to the surface. Numerous ingestion, inhalation, and external radiation pathways are now identified.

The concentrations of contaminants are estimated at potential exposure points for the present and future. Where possible, direct measurements are used to determine current exposure point concentrations. In other cases, environmental transport models are used to predict current and future concentrations.

Elevated levels of uranium have been recorded as early as 1981 in groundwater south of the FMPC. As part of the ongoing RI/FS process, additional monitoring wells were installed and others were proposed for locations inside and outside the FMPC boundary to further evaluate the extent and magnitude of the uranium plume and to determine if other radionuclides or chemicals are present.

Groundwater data collected to date from the sand and gravel aquifer indicate the presence of radionuclides and inorganic metals in the south plume. Most of the radionuclides are found at natural background concentrations. None of the radionuclides or metals exceeded established or derived drinking water limits with the exception of uranium.

There is no evidence to indicate or suspect the presence of organic chemical contaminants in the area where the elevated uranium values occur, based on the sampling information and

historic data. There also is no evidence to suggest that there are any elevated levels of hazardous substances in the plume south of the FMPC. All the source locations where hazardous substances have been found or where they could be found are located far to the west and south of the location selected for the removal action wells. Therefore, the only chemical of potential concern in the south plume is uranium.

The separate discussion on risk assessment explains in detail the potential health hazards from exposure to uranium. U.S. EPA has recently established a reference dose for uranium of 30 ug/kg/day. The reference dose used in this assessment is 3.0 mg/kg/day. Because of the numerous uncertainties associated with the determination of an acceptable risk, a model and the suggested acceptable threshold dose for uranium levels in the kidney are used to calculate an acceptable uranium intake.

The risk assessment report attached to the revised EE/CA details all the applicable standards that must be considered. Since there is no standard for uranium in drinking water, U.S. DOE is using 30 parts per billion (ppb) as the allowable concentration of uranium in drinking water, based on discussions with U.S. EPA.

SECTION 6

Data Issues

Comment:

There were quite a few comments about the data used as the basis for decisions in the EE/CA. Many commenters were concerned about the groundwater model developed to define and track the south plume's flow. Commenters also said they wanted more recent data used in evaluating the alternatives.

Some of the commenters' specific questions and concerns include:

- Couldn't more recent RI/FS data be used?
- Did U.S. DOE try to ask every resident about his or her water supply? And will additional RI work be done to determine all users of the groundwater?
- Is there sufficient information to support the conclusion that pumping of the Southwest Ohio Water Company wells influences the groundwater flow patterns? Or could hydrogeologic features account for any easterly flow?
- Is the uranium found in a private well in the western portion of Paddys Run a western portion of the south plume?
- Why is U.S. DOE only addressing one plume in the proposed removal action?
- How do the existing industrial wells affect the south plume, and how will the alternatives affect the industrial wells?
- Is there enough information for the model to be accurate?
- Are the boundaries of the south plume accurately defined?

Response:

A full discussion of the groundwater model and the data used to create the model is contained in the revised EE/CA's Appendix A. The purpose of a model is to take the best information available and use that data to develop, as accurately as possible, a generalized, hypothetical description for analyzing or explaining. This definition of a model becomes more appropriate

when considering the south plume; it is an area of contamination within the huge Great Miami aquifer, which is buried beneath layers of soil, sand, clay, and rock. The model relies on data from other sources, such as the monitoring wells in the area, the U.S. Geological Survey maps, and field tests and observations.

Therefore, the model is necessary to supplement direct field observations so that the combined information base is sufficient to determine the nature and extent of the contamination and the potential risk to the public health and the environment. The model also is necessary for evaluating the removal action alternatives. In the most basic sense, groundwater monitoring data provide insight into the nature and extent of the contamination by establishing whether contamination is present at a specific location and to what level.

But in order to gather enough information to make the model worthwhile, there must be enough groundwater data to extrapolate averages. In the instance of the south plume model, there must be more than one season's worth of data. Several rounds of monitoring well samples must be considered, as well as any historic information about rainfall, flow rates, and other outside forces that may affect the character of the south plume and the determination of contamination sources. Also, each round of groundwater data involves a sequence of calibration checks, plume interpretation, and evaluation of alternatives for effectiveness.

Additional wells and monitoring locations are being determined as part of the continuing RI/FS study, and final design of the alternative will be based on all existing data. The additional monitoring locations also will help U.S. DOE determine if there are any other contaminants present in concentrations above allowable limits.

Placement of the monitoring wells and the criteria for their locations will be presented in the work plan prepared for the design and implementation of the selected alternative. Updates of results and progress are provided periodically through community meetings.

But in keeping with the objective of providing a timely action in the removal process, U.S. DOE used September 1989 data because it represented the most complete information for modeling

purposes. The date also established a "cut off point" so that the south plume process can continue on an accelerated schedule.

The U.S. DOE will include uranium data collected after September 1989 as the basis for action unless the more recent data indicate deviations from the earlier information. To date, however, the more recent data are consistent with both the September 1989 data and the conclusions drawn in terms of interpreting the shape and extent of the south plume and its future migration potential.

Therefore, as stated in Appendix A of the revised EE/CA, U.S. DOE believes that the available water level data from numerous monitoring wells is sufficient for a complete and successful calibration of the groundwater flow model.

In determining potential users and their locations, U.S. DOE researched permit and historical records, as well as scouted the area. U.S. DOE also has calculated whether other groundwater users will be affected by the recommended alternative, and estimates that any impacts will be negligible. Greater detail of the data used to support this conclusion is in the revised EE/CA and its Appendix A. However, the pumping rate does not produce enough of a cone of depression to significantly influence the south plume or aquifer users by drawing contamination into "clean" areas of the aquifer.

The Paddys Run Road Site RI/FS, a separate study, will evaluate the nature and extent of any contamination in plumes other than the south plume. To address other areas of contamination in conjunction with the south plume is beyond the scope of this removal action.

Based on the field observations and the models, the south plume appears not to be the source of the elevated uranium found in a private well in the western portion of Paddys Run. U.S. DOE is investigating further in this area.

SECTION 7

Detailed Revised Response to Comments
U.S. Environmental Protection Agency

COMMENT 1: Generally, the EE/CA does not provide adequate information regarding several major areas, including detailed cost information, the contaminant transport model, NPDES requirements and discharge limits, and exploration of treatment and alternate discharge locations.

RESPONSE TO COMMENT 1: Each major area of concern identified in this comment is specifically addressed in detail in other comments/responses. For this reason, no detailed response is provided here.

COMMENTS 2: The assumptions used in calculating risks to potential receptors were not presented. These risks need to be presented in terms of incremental risk.

COMMENT 113: Section 5.1.1, Page 5-2: The exposure pathway analysis, along with all data and sample calculations, is not included and should be presented in a separate appendix to the EE/CA to allow for a complete evaluation of this document. Section 5 evaluates the effectiveness of each alternative in protecting public health, using estimated doses to potentially exposed populations. It is unclear how uranium doses were calculated for: (1) drinking groundwater from the South Plume; (2) other exposures to groundwater from the South Plume; and (3) exposures to uranium via water from the Great Miami River. The EE/CA should clearly present the assumptions and procedures used to calculate these doses, so that the calculations can be independently verified.

COMMENT 114: Section 5.1.1, Page 5-2, Third paragraph: The environmental transport model discussed here and in the following paragraph should be presented in an appendix.

COMMENT 132: Section 5.2.1, Pages 5-6 and 7: The EE/CA must show how radiation doses were calculated for the all pathways, including drinking water. These calculations must include both the hypothetical maximally exposed receptor and the average exposed receptor. The individual data that was used to calculate average exposure conditions must also be provided. It is unclear what data was averaged and how it was averaged. Again, the term "site" is being misused.

COMMENT 135: Section 5.2.1, Page 5-8, Second Paragraph: The EE/CA must show how the Hazard Indices were calculated for the exposed individuals.

COMMENT 140: Section 5.3.1, Page 5-10: Calculations and assumptions used in the calculations for determining maximum and average exposures must be provided. FMPC exposures are also relevant.

RESPONSE TO COMMENTS 2, 113, 114, 132, 135, and 140: The text will be revised to indicate the assumptions used for calculating the radiation doses. Also, see responses to Comments 131, 138, 153, and 154.

An explanation of how the Hazard Indexes were calculated for each alternative will also be included in the text.

COMMENT 3: The two documents used in developing risk estimates, U.S. DOE documents 5400.XX and 5480.XX, were not submitted with the EE/CA. A copy of all reference materials should be provided to U.S. EPA and the information repositories. The request for these documents was put forth in the comments on the January draft of the EE/CA.

RESPONSE TO COMMENT 3: The U.S. DOE documentation used in developing the risk estimates in the South Plume EE/CA is 5400.5. Copies of this document will be provided to the U.S. EPA and the information repositories.

COMMENT 4: Several references are made to permits required for the alternatives discussed. Section 121(e) (1) of the Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA) provides that "No Federal, State, or local permit shall be required for that portion of any removal or remedial action conducted entirely on-site, where such remedial action is selected and carried out in compliance with this section." Section 300.5 of the March 1990 National Oil and Hazardous Substances Contingency Plan (NCP) defines on-site as "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action."

COMMENT 5: Several specific comments identify the misuse of the term "on-site". The term "site" should be used only in its meaning as defined under CERCLA and the NCP.

COMMENT 11: The discharge of the pumped groundwater to the Great Miami will require coordination with an approval from the Ohio Environmental Protection Agency (OEPA) through the National Pollution Discharge Elimination System (NPDES) permitting program. A modification to the FMPC's existing discharge permit may be required. If the discharge is considered to be "on-site", the discharge would not be subject to the procedural permit requirements at the point of discharge. Only substantive requirements must be met.

COMMENT 17: Section ES, Page ES-1, Third paragraph: "Releases from the FMPC" should be changed to read "releases on and from the site", or some equivalent language. The site is a larger area than the FMPC boundary. This comment also applies to the third sentence.

COMMENT 27: Section ES, Page ES-5, Second paragraph: The use of the term "off-site" is incorrect. Again, this should be corrected throughout the document.

COMMENT 159: Section 5.5.3, Page 5-19, Fifth paragraph: The lengthy and uncertain NPDES permit process for Alternative 4 should be sufficient reason to reject this alternative. It seems unlikely that additional discharges to the Great Miami River would be permitted, given that FMPC is not meeting current discharge limits (see Page 5-17).

RESPONSE TO COMMENTS 4, 5, 11, 17, 27, AND 159: The U.S. DOE acknowledges that the use of the term "site" in the South Plume EE/CA is confusing in relation to its CERCLA/NCP definition. U.S. DOE interperts the term "site" consistently with CERCLA and the NCP.

COMMENT 6: To provide support for a statement by citing "U.S. DOE 1988" is insufficient. Moreover, throughout the document factual statements are made with no reference provided for the public to determine the validity of those statements. The reference list and tables are provided in the document and they should be used throughout the text.

COMMENT 7: When providing the requirements of an analysis, please cite the reference setting forth those requirements.

RESPONSE TO COMMENTS 6 AND 7: These comments do not provide sufficient information to allow a specific response. The document will be checked to ascertain if additional citations can be made to support factual information. Many of the subsequent specific comments address similar issues; the responses to later comments will augment U.S. DOE's response to this concern.

COMMENT 8: The historic effectiveness of institutional controls presented in several of the alternatives needs to be presented.

COMMENT 137: Section 5.3.1, Page 5-9: What historically has been the effectiveness of institutional controls? If no regulatory or statutory authority exists for such "controls," this should be made clear in the evaluation of the alternatives. Ohio has been reluctant to respond to U.S. EPA inquiries in the past because of its concerns that institutional controls will be relied on in lieu of adequate engineering solutions.

RESPONSE TO COMMENTS 8 AND 137: U.S. DOE is not aware of an informational base on the historic effectiveness of institutional controls, and would welcome any information from the U.S. EPA and the OEPA. At the same time, U.S. DOE shares the OEPA's concerns regarding a

reliance on institutional controls in lieu of adequate engineering solutions when addressing final remedial actions at a site. This is particularly true when the institutional controls are limited to monitoring and various types of communications rather than regulatory or statutory authorities, as would be the case for the South Plume action. The latter condition was explicitly stated in the EE/CA (page 4-15): "U.S. DOE cannot exercise direct access control over the off site areas."

Realizing this limitation on institutional controls, the corresponding alternative was still considered appropriate as a potential minimum action under the South Plume EE/CA for two reasons: (1) the action is an interim response and a final action would still be forthcoming; and (2) if properly executed, the principal objective of public health protection could be achieved until the final action was implemented. This alternative was, however, eventually eliminated from consideration due to its general nonresponsiveness to the removal action objectives (page 6-2).

COMMENT 9: State Applicable and Relevant and Appropriate Requirements (ARARs) should have been identified in consultation with the appropriate State representative. Was this done and if so, was it documented?

RESPONSE TO COMMENT 9: A master list of potential ARARs was received in letter form from the OEPA and was used as a reference in preparing the ARARs for the south plume removal action. The listing of ARARs in the EE/CA also provided an opportunity for comment by appropriate State representatives.

COMMENT 10: Cost estimates should be explained in detail, possibly in an appendix.

RESPONSE TO COMMENT 10: Appropriate detailed cost back-up information will be appended to the EE/CA.

COMMENT 12: Alternatives that include treatment and other discharge locations were not fully addressed in the EE/CA. As agreed during the negotiations for the 1990 Consent Agreement, Operable Unit 6 would be dropped if a removal action would address the south plume contamination. The intent was to install a system that could ultimately be the final remedial action for the plume. The south plume is currently considered a part of Operable Unit 5.

RESPONSE TO COMMENT 12: The question of whether or not the EE/CA fully addressed the evaluation of treatment and discharge alternatives is the subject of subsequent comments/responses and is not addressed here. The U.S. DOE agrees with the remainder of this comment with the exception of the reference to "... a system that could ultimately be the final remedial action for the plume." While the proposed removal action could be the final action based on the Feasibility Study for Operable Unit 5, there is no requirement to delete an alternative because it does not represent a final solution. A more acceptable statement would be "... a system that could ultimately be integrated into the final remedial action for the plume," which would be consistent with the

CERCLA requirements for a removal action. There is no reference in Section IX (Removal Actions) of the Federal Facility Agreement that would supersede the CERCLA intent and lead to an interpretation that the removal action and final action for the south plume must be functionally synonymous. In fact, the "white paper" prepared by U.S. DOE in support of deleting Operable Unit 6 in favor of a revised removal action strategy specifies that the need for treatment would require further evaluation within the EE/CA process and that the allowance for pumping from the center of the plume would still be available under the remedial action program for Operable Unit 5 (and not a requirement of the south plume removal action).

COMMENT 13: The risk associated with uranium can not be isolated from risk presented by other hazardous substances in the plume.

COMMENT 26: Section ES, Page ES-4, First paragraph: All hazardous substances in the south plume are "contaminant(s) of concern" for this removal.

COMMENT 33: Section ES, Page ES-6, Fourth paragraph: The scope of the removal action is to remediate the south groundwater contaminant plume. The scope is not limited to radionuclides, but is to include all hazardous substances. Alternatives that address the other contaminants need to be further analyzed under this EE/CA.

COMMENT 52: Section 2.4.3.1, Page 2-42: The EE/CA does not present data to support the statement that uranium is the only contaminant of concern in the south plume.

COMMENT 53: Section 2.4.3.1, Page 2-42: The statement that organic chemicals in the groundwater are not persistent and are far below MCLs is not sufficiently supported. The data submitted to U.S. EPA indicates that only six out of 29 2000-series wells were sampled for organic analytes and only one was sampled for organic compounds more than once. In addition, none of the 3000-series wells or 4000-series wells were sampled for organics.

COMMENT 54: Section 2.4.3.1, Page 2-42: The EE/CA does not present any data to support the statement that uranium is the only contaminant of concern in the south plume.

COMMENT 109: Section 5.1.1, Page 5-2: The statement that "uranium is the only constituent...that could present a public health risk from chemical or radiological exposures" is not substantiated by data in the EE/CA.

COMMENT 111: Section 5.1.1, Page 5-2: The EE/CA does not provide sufficient data to support the focus on uranium alone.

COMMENT 160: Section 5.5.3, Page 5-19, Fifth paragraph: Groundwater should be tested for any problematic chemicals.

RESPONSE TO COMMENTS 13, 26, 33, 52, 53, 54, 109, 111, AND 160: Hazardous substances are not considered in the removal action because there is no evidence to indicate or suspect their presence in the area where the elevated uranium values occur.

Historic Data

During the six rounds of RCRA sampling at the FMPC that preceded the RI/FS sampling program, samples from two wells appeared to indicate the presence of some hazardous material. Analyses from Well 3014 showed 1.1 ppb tetrachloroethane in RCRA sampling Round 2 and 2.4 ppb bromoform along with 1.0 ppb trichloroethene in RCRA sampling Round 4. HSL organics were not detected in this Well in Rounds 1, 3, 5, or 6. Such spurious low readings are far more indicative of a problem with contaminated sampling equipment, improperly followed field procedures, cross contamination during shipping, or cross contamination in the laboratory or a combination of all of these. No volatiles were detected in any round from samples taken from Well 2014.

An 87 ppb reading of 1,1,1, trichloroethane was in one half of a duplicated sample collected from Well 2061 (OS-2) in RCRA Round 5. The other half of the duplicate sample did not contain any 1,1,1, trichloroethane. Both halves of the sample contained cyclohexane. One half had 42 and the other 12.5 ppb. The half that had no 1,1,1, trichloroethane did have 40.5 ppb of acetone while the other half did not contain any acetone. Such results, especially from duplicate samples, indicate that there were problems with field procedures, decontamination activities, or laboratory procedures. The laboratory used for these analyses was not CLP certified. A further complication for Well 2061 is that this well contains a pump of unknown design that could be contributing these materials to the sample. Previous rounds and the subsequent round of sampling have not shown these materials to be present.

RI/FS Data

In the first round of sampling under the RI/FS thirty six wells were sampled for the full Hazardous Substance List (HSL) of parameters. Only trace amounts of a few organics were detected in any of these samples. All of these samples were from wells in the Waste Storage Area. All the 2000-series wells in the production area have been sampled for full HSL analyses. Only one sample indicated 14 ppb of phenol. If material were present in the aquifer in this area it would not become part of the South Plume because the groundwater gradient is to the east under both the Waste Storage Area and the Production Area.

Samples have been collected from Paddys Run for full HSL analysis and the results have shown that there were no hazardous materials in the stream. Paddys Run is the pathway between the Waste Storage Area and the South Plume. If there is no hazardous material in the pathway, it is unlikely that there will be any in the receptor.

HSL analyses have been done on water and soil samples in the Paddys Run Study Area when field data indicated that hazardous materials were apparently present. All three of these instances were located outside the area of the elevated uranium plume addressed by the South Plume EE/CA.

Well 3094 encountered organic material that caused elevated HNu readings when it was drilled. As a result a soil sample was collected during the drilling of adjacent Well 2094. Analysis of the soil sample indicated xylene. Analysis of a water sample, which clearly contained a second phase of oily material on the surface, collected from Well 2094 indicated xylene was present in the sample. The industries involved in the Paddys Run Road Site RI/FS are directly upgradient from Wells 2094 and 3094.

Well 3126 located on the east bank of Paddys Run and south of the area of elevated uranium was sampled during installation for full HSLs. A sample was collected in December 1989 to determine the source of a very foul smell from the well which was noticed shortly after the water table was penetrated. There were no hazardous substances in the water.

During the installation of Well 2129, located on the property line between the two industries involved in the Paddys Run Road Site RI/FS, it was noted that the soil smelled faintly of an aroma similar to the aroma found in Well 2094. The vapors did not register on the HNu meter however. A water sample was collected from Well 2129 on February 1, 1990 and analyzed for the full HSL analysis. Arsenic is the only hazardous substance present at elevated levels. No hazardous organic materials were detected.

In April of 1990 samples were collected from wells 2015, 2060, 2095 and 2106 for full HSL analysis. These wells are located along Willey Road and lie along a line perpendicular to the flow of the South Plume. These samples are still being analyzed.

Summary

There is no evidence to suggest that there are any hazardous substances in the plume of elevated uranium south of the FMPC. All the source locations, where hazardous substances have been found or where they could be found within the South Plume Study Area, are located far to the west and south of the location selected for the removal action wells. The model predicts that while the flow path may be distorted, water particles from locations within the Paddys Run Road Site source area will not be drawn into the removal action wells. Therefore the only material which is of concern in the area is uranium.

COMMENT 14: There appears to be an over reliance on U.S. DOE guidance instead of U.S. EPA guidance documents. U.S. DOE guidance is considered "To Be Considered" (TBCs) in this response action. The methodology used to estimate dose equivalents to the general public due to the transport of uranium from groundwater and surface water is the Nuclear Regulatory Agency (NRC) Regulatory Guide 1.109. This methodology is not presented in this report. Because this methodology differs from the methodology used by U.S. EPA (EPA-PRESTO) to estimate

exposures to populations following releases of radionuclides from low-level waste disposal facilities, this methodology and justification for its use should be included in the EE/CA. Tabulated summaries for the calculated exposure concentrations derived using this methodology, summaries of the risk factors considered in the risk evaluation, and a summary of the calculated risks.

RESPONSE TO COMMENT 14: After a careful comparison of the calculation model equations and transport parameters used in both NRC Regulatory Guide 1.109 and PRESTO-II (ORNL-5970), there are only a few insignificant differences between these methods for the four exposure pathways of this assessment. The exposure parameters used in PRESTO-II correspond to the "average" exposure parameters of this assessment.

Excess risks of fatal cancers were not calculated in this assessment since selection of risk coefficients would introduce unnecessary discussion of the selected risk coefficients. Since excess risks are proportioned to the above-background radiation doses, calculation of above-background radiation doses for each alternative allows for the necessary comparison of potential human health impacts. Also see response to Comments 2, 113, 114, 132, 135, and 140.

COMMENT 15: Estimates of when the plume will contact the Great Miami River, with and without pumping, should be presented.

COMMENT 28: Section ES, Page ES-5: The EE/CA states that "because the south plume is not predicted by the model to migrate to the Great Miami River or any other surface water course within the project life of the removal action (i.e., within five years)...". Data is not presented to support this conclusion.

RESPONSE TO COMMENTS 15 AND 28: The statement that the south plume will not migrate to the Great Miami River within the five-year project life is based on the results of the calibrated groundwater flow and solute transport models. According to the model results, the leading edge of the plume will reach the Great Miami River in approximately 20 years under the no-pumping (i.e., no action) condition. Under pumping conditions (i.e., Alternatives 4 and 5), the plume will be fully intercepted by the pumping wells and will not continue to migrate southward toward the river. Of course, if the decision is made to discharge the treated or untreated groundwater that is pumped out of the south plume to the river, the water will enter the river immediately upon pumping.

COMMENT 16: Section ES, Page ES-1: The language regarding the July 1986 Federal Facility Compliance Agreement (FFCA) should be updated with information regarding the 1990 Consent Agreement.

COMMENT 37: Section 1.0: Background information should be updated to reflect the requirements of the 1990 Consent Agreement.

RESPONSE TO COMMENTS 16 AND 37: The background information in the Executive Summary and Section 1, Introduction will be revised to include the amendment of the Federal Facilities Compliance Agreement by the Consent Agreement signed by U.S. DOE and EPA on April 9, 1990. The revision will also indicate that the Consent Agreement established the "operable unit" approach to the RI/FS and contains a commitment by U.S. DOE to perform specific removal actions.

COMMENT 18: Section ES, Page ES-1, Last sentence: This sentence is incorrect. The removal action is required by the 1990 Consent Agreement and the decision for performing the removal action is not "pending the outcome of the Remedial Investigation/Feasibility Study (RI/FS) and the implementation of a final remedial action".

COMMENT 19: Section ES, Page ES-2, First paragraph: It is not U.S. EPA's position that an EE/CA was required for this removal action. The six-month period was not required for planning of the removal, but rather for characterization of the plume.

COMMENT 35: Section ES, Page ES-6, Fourth paragraph: The fundamental objective of the removal action is to begin remediation of the south groundwater contaminant plume. This is the reason that the sixth operable unit was eliminated.

RESPONSE TO COMMENTS 18, 19, AND 35: The wording of the last sentence on page ES-1 has apparently been misinterpreted by the U.S. EPA. U.S. DOE did not intend that the removal action will be committed to or performed only after the RI/FS is completed and the final action is implemented; rather, the sentence was simply intended to convey that the removal action will be consistent with and integrated into the final remedial action for the regional aquifer under Operable Unit 5. The wording of this sentence will be corrected.

The statement made on page ES-2 does not reference the need for an EE/CA as the "U.S. EPA's position." The need for additional site characterization (which appears to be supported by many of the U.S. EPA's comments) has been a true factor in the planning of the removal action; however, this has not been a sole factor in exceeding a six-month period for project planning. The U.S. DOE stands behind the cited statement since the magnitude and technical complexity of the anticipated action do, in and of themselves, require more than a six-month planning period.

Although it may be the U.S. EPA's interpretation that the fundamental objective of the removal action is to begin remediation of the south plume, such an interpretation is not consistent with either the NCP or the Federal Facility Agreement. Each of the latter documents state that the objective of removal actions is to abate, minimize, stabilize, mitigate, or eliminate the release or threat of release of hazardous substances, pollutants, contaminants, or hazardous constituents, while the NCP further specifies eight factors to be considered in determining the appropriateness of a removal action. The two factors applicable to the south plume are the potential contamination of

drinking water supplies and the associated potential for exposure. The primary objective for the south plume removal action identified on page ES-6 is responsive and fully consistent with these two NCP factors.

COMMENT 20: Section ES, Page ES-2, First paragraph: The last sentence is misleading. The NCP was finalized in March 1990.

COMMENT 38: Section 1.0, Page 1-2: NCP references should be updated to reflect March 1990 finalization of the revised NCP.

RESPONSE TO COMMENTS 20 AND 38: The U.S. DOE acknowledges that the references to the proposed NCP are incorrect. The reason for this oversight is that the early drafts of the EE/CA were prepared prior to the issuance of the NCP in March 1990. All references to the NCP will be appropriately updated.

COMMENT 21: Section ES, Page ES-2, First paragraph: Reference to the National Environmental Policy Act (NEPA) are not relevant to this document and causes confusion regarding what is the controlling authority. This document should be prepared in accordance with requirements of the NCP and not the NEPA.

RESPONSE TO COMMENT 21: The National Environmental Policy Act (NEPA) provides a statutory procedure for consideration of environmental concerns consistent with national policies and goals. NEPA applies to all major governmental actions which may have a potential effect on the environment. Because the South Plume removal action is being undertaken by U.S. DOE (a governmental agency) and it could result in an environmental impact, U.S. DOE must comply with the documentation requirements of NEPA. The EE/CA contains the information necessary for compliance with NEPA and is recognized as satisfying NEPA requirements by the U.S. EPA ("Draft Engineering Evaluation/Cost Analysis Guidance for Non-Time-Critical Removal Actions, June 2, 1987".)

COMMENT 22: Section ES, Page ES-3, Last sentence: The RI/FS is not past tense. It is not complete.

RESPONSE TO COMMENT 22: The referenced sentence makes it clear that additional monitoring wells are still to be installed, thereby implying the RI/FS is not yet complete. Nevertheless, the sentence will be reworded to eliminate a possible misinterpretation.

COMMENT 24: Section ES, Page ES-4, First paragraph: RI/FS data that has been collected beyond September 15, 1989 has to be used for evaluation of this removal action. The most recent data is required to be used.

COMMENT 32: Section ES, Page ES-6, First paragraph: The discussion needs to be updated with more recent groundwater RI information.

COMMENT 43: Section 2.3, Table 2-2: Analytical data on uranium from sampling rounds 7 and 8 should be included in EE/CA.

COMMENT 44: Section 2.3, Tables 2-3, and 2-4, and 2-5: Sampling from rounds 5 and 6 was conducted 9 to 12 months ago and data must be included in the EE/CA.

RESPONSE TO COMMENTS 24, 32, 43, AND 44: So that the EE/CA process can continue in the most expeditious manner, a "cut off point" must be established in relation to the data base to be used for purposes of the South Plume EE/CA. This is particularly important due to the central role of the modeling study in analyzing the south plume and the removal action alternatives, since each round of groundwater data causes a sequence of calibration checks, plume interpretation, alternative effectiveness evaluations, graphic presentations, etc. The U.S. DOE is willing to include the available uranium data from Rounds 7 and 8 of groundwater sampling in the EE/CA, but intends to continue to use the September 1989 data as the basis of the action unless the more recent data indicates consequential deviations from the September (and earlier) data.

To date, the more recent data is generally consistent with both the September 1989 data and the conclusions drawn therefrom in terms of interpreting the shape and extent of the south plume and its future migration potential. The consistency/inconsistency of the new data with the September data will be explained further in the report, as will the importance of any inconsistencies.

COMMENT 25: Section ES, Page ES-4, First paragraph: There is no drinking water standard for uranium.

RESPONSE TO COMMENT 25: U.S. DOE agrees that there is no drinking water standard for uranium, but questions where on page ES-4 a statement to the contrary is made. One would have to read such an interpretation into what is written. However, due to the possible confusion, the wording within the first paragraph will be modified.

COMMENT 29: Section ES, Page ES-6: The EE/CA states that "mitigation of the source of groundwater contamination, which in this case is represented by the prevention of future releases across the FMPC site boundary". This secondary objective is not stated consistently, e.g., in Section 3.2, it is omitted.

RESPONSE TO COMMENT 29: The inconsistency in the secondary objectives is due to the redefinition of the objectives of the South Plume EE/CA at the time of negotiations of the Federal

Facility Agreement. Since Operable Unit 5 is to consider the entire regional aquifer and the South Plume EE/CA is to focus on controlling the existing plume at off-site locations south of the FMPC, the objective of preventing future releases across the FMPC boundary has been shifted to the Operable Unit 5 RI/FS and should have been deleted from the Executive Summary of the EE/CA (see Comment/Response 49). It is important to note that the deletion of this objective from the South Plume EE/CA will not impact either the work performed to date or the recommendations made in the EE/CA. The reason is that none of the five alternatives would be effective in reducing or eliminating the continuing releases across the FMPC boundary. Reference is made to Page ES-11 for confirmation of this statement.

COMMENT 30: Section ES, Page ES-5, Second paragraph: The 33 ppb calculated value is incorrect. The 15 pCi/l Maximum Concentration Level (MCL) for gross alpha should be used, since there is not a specific standard for uranium. This number may actually need to be lower because of additional contaminants that are also in the south plume. The effective dose should be calculated over seventy years, not fifty. All of U.S. U.S. DOE's guidance documents are "to be considered" (TBCs) and are not necessarily "applicable" requirements.

COMMENT 34: Section ES, Page ES-6, Fourth paragraph: Again, the use of the 33 ug/l figure is inappropriate and should be removed from the entire document.

COMMENT 119: Section 5.1.1, Page 5-3: As previously stated, it is not appropriate to use this 4 mrem effective dose equivalent for uranium. Use of this number is inconsistent with current regulations under the Safe Drinking Water Act. A limit of 15 pCi/l (22.5 ug/l) for gross alpha is more consistent with the intent of the regulations.

RESPONSE TO COMMENTS 30, 34, and 119: There is currently no MCL for uranium in community water systems. The MCL for gross alpha particle activity (15 pCi/l) presented in 40CFR141.15(b) specifically excludes uranium and radon. In the absence of an MCL for uranium, an acceptable concentration for uranium in groundwater must be determined in order that the interim remedial action for the South Plume can proceed.

In the process of selecting an acceptable concentration for uranium in groundwater which may be used as a drinking water source, various approaches were considered. A concentration limit of 100 ug/l (67 pCi/l) was recommended by M. E. Wrenn, et. al, in Health Physics, Vol. 48, pp. 601-633 (1985). This limit was recommended to limit toxic effects to the kidney. A concentration limit of 105 ug/l for adults is derived from the reference dose of 3 ug/kg/day for uranium (EPA IRIS computer data base).

An acceptable concentration for uranium in groundwater can be derived from radiation risk considerations. In the proposed standards for the control of residual radioactive materials from inactive uranium processing sites, EPA has proposed a concentration limit of 30 pCi/l (45 ug/l) for combined uranium-234 and uranium-238 to present the same level of risk as for radium at its MCL of 5 pCi/l (52 FR 36001 and EPA 520/1-87-014).

Based on discussions between U.S. EPA and U.S. DOE, U.S. DOE has agreed to use 30 pCi/l as the allowable limit of uranium in drinking water. A more complete discussion of this limit and how it applies to the risk assessment is included in the revised EE/CA.

Concentration limits based on radiation dose considerations are directly related to concentration limits based on radiation risks. For example, although the concentration limit (MCL) for radium-226 (5 pCi/l) is based on a risk determination, the annual radiation dose is 4 mrem from ingestion of water having a radium-226 concentration of 5 pCi/l at a rate of two liters per day for year. The annual dose equivalent limit of 4 mrem is also the limit from which MCLs for beta particle and photon radioactivity from which MCLs for beta particle and photon radioactivity from manmade radionuclides are determined [40CFR141.16(a)]. In accordance with U.S. DOE Order 5400.5 (February 8, 1990), acceptable concentrations of radioactive materials in drinking water are derived from the radiation dose limit of 4 mrem per year. There is no exception made in U.S. DOE Order 5400.5 for uranium isotopes in drinking water. The concentration guide for uranium in drinking water is calculated to be 22 pCi/l (33 ug/l) (U.S. DOE Order 5400.5, Chapter III).

Although the concentration guides for uranium isotopes presented in U.S. DOE Order 5400.5 (from which the drinking water limit for uranium is calculated) are rounded to one significant figure, calculation of the acceptable concentration of uranium to more significant figures can be performed by use of the source documents referenced in the Order (e.g., U.S. DOE/EH-0071, Internal Dose Conversion Factors for Calculation of Dose to the Public). These calculations give an acceptable uranium concentration of 22.4 pCi/l (33.5 pCi/l). This is rounded to 22 pCi/l (33 ug/l).

Use of radiation dose conversion factors other than those presented in U.S. DOE/EH-0071 can give a derived concentration limit which differs somewhat from 22 pCi/l (33 ug/l). For example, use of the dose conversion factors from Federal Guidance Report No. 11, EPA-520/1-88-020 (September 1988) gives a derived concentration limit of 20.4 pCi/l (30.6 ug/l). This concentration differs from the selected value by less than ten percent and is well within the range of uncertainties of the factors from which the concentrations are calculated.

COMMENT 31: Section ES, Page ES-5, Third paragraph: Groundwater discharges to surface water has to be considered as an exposure pathway in the EE/CA.

RESPONSE TO COMMENT 31: The sentence in question should have been more specific in stating that groundwater discharges to surface water will not be considered as an exposure pathway only under the no action and nonpumping alternatives since the plume will not reach the river within the five year period of the removal action (see Comment/Response 15). A correction will be made in the EE/CA. The groundwater/surface water exposure pathway is, in fact, considered under the pumping alternatives since the treated or untreated groundwater will enter the river upon the initiation of pumping. It is also important to note that this same pathway will be considered under all alternatives for Operable Unit 5 since the plume would reach the Great Miami River within the time period of interest of the final remedial action.

COMMENT 36: Section ES, Page ES-10: Table ES-1 should address compliance with ARARs and list TBCs.

RESPONSE TO COMMENT 36: The specific ARARs and TBCs of central importance to the south plume removal action are included in Table ES-1 under the appropriate effectiveness criteria. To introduce ARAR/TBC compliance as a separate entry in the table would be repetitive, if not misleading since strict compliance with ARARs is not a requirement of removal actions (as long as the final action achieves compliance).

COMMENT 39: Section 2: The southern/downgradient extent of the uranium plume is not defined. The text should be modified to include the most recent information.

COMMENT 47: Figure 2-11, Page 2-31: Data from wells 2094 and 3137 indicate that the uranium plume extends far beyond what is indicated by this figure. The isocontour maps should be extended south to the area of wells 2094 and 3137 and other recently installed wells.

COMMENT 59: Section 2.4.3.3, Page 2-44, Fifth paragraph: A justification for the first sentence needs to be presented. The conclusion is questionable. Figure 2-17 and Table 2.3 show that uranium was found in well 2127 at a concentration of 37 ug/l, above the "derived" concentration of 33 ug/l. This well lies outside the south plume as defined by the EE/CA, suggesting that: (1) there may be other areas outside the plume with groundwater concentrations of uranium above 33 ug/l; and (2) this groundwater may be used for drinking water, feed-stock watering, or crop irrigation.

COMMENT 74: Section 4.2.4.1: There does not appear to be a good correlation between the location of the five-year plume boundary presented in Figure 4-2 and the current location of the plume. This is particularly true in the vicinity of well 2127 and the southeast tip of the modelled plume.

COMMENT 98: Section 4.2.4.5, Page 4-10, Second paragraph: Given the data in Table 2.3 and the well locations in Figures 2-11 and 2-17, the definition of the southern plume boundary and the location of proposed extraction wells are questionable. Figure 2-11 shows a gap of approximately 4000 feet in the monitoring well network between Wells 2061 and 2094, making it difficult to identify the southern plume boundary. In addition, Well 2127, with a maximum uranium concentration of 37 ug/l, is approximately 2000 feet south of the proposed extraction wells. Finally, Figure 2-17 shows that several residential and commercial wells are located adjacent to and immediately upgradient of the proposed extraction wells.

COMMENT 186: Figure A-2: This diagram indicates that the model does not provide a good simulation of the plume southwest of FMPC.

COMMENT 187: Figure A-2: There is inadequate groundwater monitoring well coverage throughout the area where the model predicted there should be contamination.

RESPONSE TO COMMENTS 39, 47, 59, 74, 98, 186, AND 187: Based on an excellent degree of consistency among records of discharge from the FMPC, groundwater monitoring results, direct observations of field conditions, and ground water flow and solute transport model results, the U.S. DOE is confident that the south plume under consideration in the EE/CA is separate and apart from other areas of elevated uranium observed further to the south and west along Paddys Run. For this reason, many of the questions and concerns raised by the U.S. EPA in these comments are considered to be inaccurate representations of actual field conditions.

The South Plume, as presented in Figure A-2, is the result of leakage from both the storm sewer outfall ditch and that portion of Paddys Run that remains dry over a good portion of the year. This reach extends from near the K-65 silos on the FMPC property to a point on the order of 1000 feet off site. The shape of the plume and the concentration distribution shown in Figure A-2 was generated by imputing uranium release values for the years of plant operation -- as developed by National Lead of Ohio (NLO) and Westinghouse Materials Company of Ohio (WMCO) -- into the solute transport model and predicting the resultant concentration profile that would be observed today. The monitoring data from the available wells to the south of the FMPC confirm the overall reliability of these model predictions (see the response to Comment 48).

Based on these predictions, the leading edge of the plume (as defined by the 30 ppb contour) is predicted to be located just north of New Haven Road and west of Route 128. Reasons for placing the interceptor wells south of New Haven Road and the protection that would be provided are discussed in the response to Comment 95 and the related Comment 157. These predictions supported the development of an additional groundwater monitoring program in the vicinity of New Haven Road that is currently being implemented. The observed concentration in a recently installed well north of New Haven Road near the predicted limit of the plume was 14 ppb, which is close to the expected value and indicates that the plume may in fact be a small distance north of the current predictions. Whether the proposed interceptor wells will be shifted to the north side of New Haven Road is still to be determined as additional data becomes available and the model is further refined. The incorporation of the most recent data into the EE/CA is the subject of the response to Comment 24 and related comments.

The elevated uranium concentrations at Wells 3094 and 2127 are not related to the plume identified in Figure A-2 and should not be incorporated into the isocontour map shown on the figure; rather, these observed levels are the result of a lesser amount of uranium leakage from Paddys Run over its lowermost 1.25-mile reach. The loadings from this discharge and the resultant plume would be much smaller than the previously described South Plume because the bottom of Paddys Run is not as conductive in this reach and only the residual uranium that had not leaked into the aquifer in the upper reaches would be available for release. Concentrations on the order of 5 to 10 ppb are expected throughout much of the area east and south of Paddys Run along this lower reach. Additional wells are planned in this area to determine the nature and extent of contamination and to confirm that additional areas exceeding the 33 ppb target level do not exist.

The reading of 37 ppb in Well 2127 was a one-time occurrence in this well (out of several samples over time) and represents the only well outside of the south plume with a reading exceeding the 33 ppb target level. This well is a monitoring well that is not used for drinking water, feed-stock watering, or crop irrigation. The U.S. DOE maintains a program of monitoring groundwater from a series of monitoring wells and private domestic wells to provide an early warning system capable of detecting changes in the groundwater situation in this area. As mentioned earlier, additional wells will soon be incorporated into the monitoring network by U.S. DOE to provide additional coverage.

COMMENT 40: Section 2: The south field area and fly ash piles should be shown in a figure.

RESPONSE TO COMMENT 40: The Southfield Area and the fly ash piles will be added to Figure 2-1.

COMMENT 41: Section 2.1, Page 2-4: The existing effluent line was installed in 1952, is 4,200 feet long, and is made of 16-inch diameter cast iron pipe with a minimum and maximum sloe of 0.1% and 12.7%, respectively. The second paragraph states that the same pipeline has a capacity of 6.5 mgd, or 10 cfs. This capacity calculation is not consistent with a minimum slope of 0.1 percent. The minimum slope required to handle 10 cfs is approximately 2 percent.

RESPONSE TO COMMENT 41: FMPC has reviewed the USEPA comment concerning the capacity of the effluent line. The minimum slope, 0.1%, occurs in a section of the effluent line between Manhole (MH) 180 and the Great Miami River (GMR). However, the average slope from MH 177 to the GMR is 1.55%. This slope provides for a flow

capability of 4400 gpm. In conclusion, the head from MH 177 is adequate to ensure this flow capability through the flat section of effluent line prior to releases to the GMR.

COMMENT 42: Section 2.1, Page 2-4: Leachate from the "fly-ash piles" and other disposal in the south field area may have caused contamination from hazardous substances other than uranium. Analysis of groundwater samples from around the waste piles should include Radium-226 and Radium-228 because these substances are typical contaminants of fly-ash.

RESPONSE TO COMMENT 42: All groundwater samples collected under the RI/FS are analyzed for a full suite of radiological parameters, including Radium-226 and Radium-228. The reason that this may not be apparent in the South Plume EE/CA is that these parameters were not found at levels that would introduce them as contaminants of concern into the south plume removal action (see previous comments/responses on contaminants of concern). In addition, the regional aquifer in the vicinity of the Southfield Area and fly ash piles, as well as the issue of continuing releases from these areas across the southern boundary of the FMPC, will be included in Operable Unit 5 rather than the South Plume EE/CA. This is addressed in detail in Comment 49 and the associated response.

COMMENT 45: Figure 2-9, Page 2-20: The location of the Southwest Ohio Water Company (SOWC) wells should be shown on this figure. A potentiometric surface distribution should also be added to this map.

RESPONSE TO COMMENT 45: U.S. DOE agrees that neither Figure 2-9 nor any other figure in the EE/CA report illustrates all the key points on groundwater hydrology referenced in the text. Figure 2-9 will be replaced by a figure that shows both the Southwest Ohio Water Company wells and the regional potentiometric surface.

COMMENT 46: Section 2.3, Page 2-27: The uranium concentration presented in Table 2.3 is not consistent with concentrations listed in the analytical database. Uranium concentrations in the database for monitoring well 2015 (round 2) is 175 ug/l, for monitoring well 2068 is 2 ug/l (round 2), and 2 ug/l (round 3).

RESPONSE TO COMMENT 46: U.S. DOE has checked the laboratory data sheets and the analytical database for the numbers in question. Both of these data sources agree with the information presented in Table 2.3 of the EE/CA.

The following table lists the data in the data base and the laboratory reports for Rounds 2 and 3 of the RI/FS sampling program for Wells 2015 and 2068:

TOTAL URANIUM

	ROUND 2		ROUND 3	
WELL	LABORATORY	DATA BASE	LABORATORY	DATA BASE
2015	169	169	185	185
	178	178	179	179
2068	2	2	<1	<1

Perhaps the reviewer had a version of the data base that was not current or the made an error in calling up information from the data base.

COMMENT 48: Section 2.3, Page 2-31: The concentration contours for observed uranium concentrations shown on Figure 2-11 no not closely match the simulated present-time uranium concentration predicted by the groundwater contaminant transport model shown in Figure A-2. Since the predictive model does not match, the conclusions of the contaminant transport model are suspect.

RESPONSE TO COMMENT 48: The match between the present-time concentrations calculated by the solute transport model and the observed uranium concentrations shown on Figure 2-11 is adequate for the purposes of the removal action. The solute transport model was used to support the following conclusions:

- All water in the plume would be intercepted by the proposed interceptor well system
- Figure A-2 is an estimate of the distribution pattern of uranium in the south plume today
- Figure A-3 is an estimate of the distribution pattern of uranium in the south plume five years from present

- Interceptor wells near the center of the plume would affect a relatively small area over the five-year project period (Figure 4.2)

- The plume is narrower along its leading edge than along its center (Figure 4.2)

- Flow from the interceptor wells in alternative 4 will reduce the concentration in the FMPC discharge to the Great Miami River

- The maximum uranium concentration in the groundwater north of the interceptor wells will experience a minimal decrease over a five-year period

With regard to the first item, note that contaminant migration will be mitigated if the proposed interception wells are effective. The effectiveness of the proposed interceptor wells is only dependent upon intercepting all groundwater flowing within the plume. The particle tracking presented on Figure A-5 shows that all water within the plume defined by the 30 ug/l contour is intercepted regardless of whether one uses the concentration values for sampling Round 4 given on Figure 2-11 or the 30 ug/l contour derived from the modeling and shown on Figure A-5. Thus, not only does the solute transport model support this conclusion, Round 4 data also supports the conclusion.

With regard to the remaining items, the comment that the conclusions of the contaminant transport model are suspect because concentration contours in Figure 2-11 do not closely match concentrations shown in Figure A-2 is addressed as follows:

- The statistical procedure for evaluating the fit between observed and calculated concentrations is described on page A-8. As stated, none of the differences between the means of observed data at a well and the calculated concentration at that well are so great as to be improbable. In other words, the calculated concentrations are consistent with the means of the observed concentrations.

- The uranium concentration data mapped in Figure 2-11 is from only one sampling round (Round 4), and should not be used as a basis for evaluating the degree of calibration of the model. Concentrations in some wells in the FMPC area vary greatly from round to round in a pattern that appears to be random. Either the concentrations at a given well do not follow a discernable time trend, or the increases and decreases do not coincide with increases and decreases at a nearby well. Since developing a transient flow model and a transient solute transport model that simulates such random fluctuations precisely would be extremely time consuming

and costly and would far exceed the standards of current modeling practice, we have used a steady-state flow model and changed simulated uranium source rates in the transient solute transport model infrequently. The last simulated change in source rates corresponds to the year 1976. All of the uranium concentrations in the Fernald data base used for model calibration were measured after 1976. Consequently, data from only one sampling round represents very short-term transient conditions and are not the best representations of the current plume. Since the concentrations measured at any given well appear to be normally distributed and temporal variations in concentrations at the wells do not follow those of nearby wells, the most representative value for uranium concentration at a well is the true mean for samples from the well. Therefore, the concentrations calculated by the model should not match Round 4 concentrations too closely because some of the those concentrations may deviate considerably from the true mean.

- The hand drawn contours between data points in Figure 2-11, are not constrained by the requirement to conserve mass in the groundwater system, while the model conserves mass and is highly constrained by the principals of groundwater flow and solute transport theory. Consequently, concentrations calculated by the model should not follow the hand drawn contours on Figure 2-11 too closely.

- The major differences between the maps in Figures 2-11 and A-2 are related to round 4 concentrations in wells 2045 and 2046. The calculated concentrations at these wells were considerably lower than the observed concentrations. Each of these wells is nearly surrounded by wells with very low concentrations. This condition indicates that these wells represent very localized anomalies which contain a very small proportion of the uranium mass in the plume. Consequently, even if such anomalies are truly present, they would not affect the conclusions presented in the EE/CA report. Inspection of Figures 2-11 and A-2 shows that even in the worst case (shown by the contours) the anomalies represent a very small proportion of the uranium mass in the plume. The 100 ug/l contour on Figure 2-11 is conservative and does not help the reader to immediately recognize that observed concentrations in wells 2045 and 2046 are anomalous and are nearly surrounded by low concentrations.

- The model should not be expected to match the Round 4 concentration at Well 2046 closely. When the EE/CA modeling was done only three concentrations were available from this well (309, 851, and 232 ug/l). This variation of concentrations was so great and the number of analyses was so small that the observed concentrations provided little information on a truly representative value for the well. In fact, the 95 percent confidence interval for the true mean of these values is 0 to 1302 ug/l. Recently, a concentration of 907 ug/l has been measured at this well and the 95 percent confidence interval for the true mean becomes 12 to 1137 ug/l. There is no known source for uranium contamination in the immediate vicinity of the well, and the well is nearly surrounded by observation wells yielding low uranium concentrations. Consequently, we hesitate to introduce radical source loadings that would be necessary to match the sample mean (575 ug/l) closely.

With regard to the predictive capacity of the model, we note that a new well drilled where the extended axis of the simulated plume shown in Figure A-2 crosses New Haven Road (close to the location of the proposed interceptor well 3) produced an observed concentration of 14.54 ug/l. The concentration calculated by the model at this location was 5.45 ug/l. This is an excellent prediction at an important location that is far from monitoring wells used in the calibration. The prediction confirms that the model provides a useful estimate of the general configuration and concentration of the plume and is adequate for the purposes of the EE/CA.

COMMENT 49: Section 2.4.1, Page 2-41, Third paragraph: It is not clear how the "apparent historical nature of the plume area" and the "anticipated accelerated movement of the existing plume" support the conclusion to treat only the off-site portion of the south plume. Furthermore, the assumption that there is no continuing source for the south plume contaminants is not supported in the report by any specific data.

RESPONSE TO COMMENT 49: The strategy document prepared by U.S. DOE to support the deletion of Operable Unit 6 proposed that the "big picture" of the regional aquifer be considered under the Operable Unit 5 RI/FS while the off site plume of elevated uranium be singled out as that portion of the regional aquifer that must be addressed on an accelerated basis. While the EE/CA deals only with the off-site portion of the south plume, other issues related to the off-site plume (including continuing releases) will be addressed under Operable Unit 5.

Records of discharge from the FMPC, field observations of uranium concentrations in groundwater, and model results are consistent in showing that the off-site plume, although still linked to continuing releases from the FMPC, is primarily the result of historical releases that were orders of magnitude greater than current releases. For example, the center of the plume is already off site, with a decreasing trend in uranium concentrations as one proceeds back to the FMPC boundary. Consequently, for purposes of the removal action, the off-site plume can be considered as a distinct area of concern without compromising the underlying objectives of the removal action.

Nowhere is it stated that the U.S. DOE is assuming that there is no continuing source for south plume contaminants; rather, it was stated that any continuing sources are not significant contributors to the south plume (as defined for purposes of the EE/CA). The data supporting this contention have been analyzed in support of the calibration of the solute transport model, and will be documented in detail in the sitewide groundwater report that is currently being prepared in support of the Operable Unit 5 RI.

The anticipated accelerated movement of the plume is an important consideration within the context of the removal action objectives. The historic and current positions of the plume have been north of the most restricted branches of the buried channel aquifer. As the plume enters this constricted channel, the velocity of the leading edge of the plume will increase significantly. For this reason, migration control of the off-site plume and its leading edge is an important objective in relation to the protection of groundwater users currently downgradient from the south plume.

COMMENT 50: Section 2.4.1, Page 2-41: The EE/CA's definition of an operable unit is not consistent with the NCP, which defines an operable unit as a discrete part of an entire response action that decreases a release, threat of release, or pathway of exposure. The EE/CA defines the operable units as a geographic area.

RESPONSE TO COMMENT 50: The NCP further states that: "Operable units may address geographical portions of a site, specific site problems, or initial phases of an action, or may consist of any set of actions performed over time or any actions that are concurrent but located in different parts of a site."

The U.S. EPA's contention that the EE/CA defines an operable unit as a geographic area is incorrect. The reference to an operable unit cited in the EE/CA indicates that Operable Unit 5 will consider the entire Great Miami Aquifer. Under Operable Unit 5, no distinction will be made as to whether the aquifer underlies the FMPC or areas outside of the FMPC boundary. This was intended to clarify that the study area for the south plume removal action is a distinct subset of the regional aquifer being addressed under Operable Unit 5. The south plume study area, though distinguishable as a geographic

area, has its basis in the distribution of uranium concentration in groundwater rather than in a preassigned geographic area.

COMMENT 51: Section 2.4.2, Page 2-41: This section should address the long-term characteristics of heavy metal contamination. For example, the persistence and half-lives of the radionuclides in question should be included.

RESPONSE TO COMMENT 51: The short-term nature of the removal action (i.e., an assumed five-year project period) negates the need to address the long-term persistence of radionuclides in detail. The solute transport model, which provides the basis for evaluating future contaminant behavior under the various removal action alternatives, does account for radionuclide decay and retardation within the aquifer. The text in the EE/CA report will be expanded to explicitly mention the long-term characteristics of uranium and their application to the removal action.

COMMENT 55: Section 2.4.3.1, Page 2-43, Second paragraph: The EE/CA states that chemical toxicity is the principal concern for soluble uranium compounds in the South Plume groundwater. However, the derived concentration limit is based on intake of radiological materials. The EE/CA should support the use of a radiologically based standard for a chemically-toxic compound.

COMMENT 134: Section 5.2.1, Page 5-8: It is not clear how the risk of exceeding the limit of 4 mrem relates to the Hazard Index.

RESPONSE TO COMMENTS 55 AND 134: It is generally believed that intake of uranium in water should be limited by considerations of chemical toxicity (for an example see, Health Physics, Vol. 48, pp. 601-633). As stated in the response to Comment 30, the concentration limit derived from chemical toxicity considerations (nonstochastic effect of kidney toxicity) is of the order of 100 ug/l. The use of the concentration limit derived from radiation dose considerations (33 ug/l) is more health protective and corresponds to an acceptable health risk for stochastic effects (e.g., fatal cancer).

Selection of a 4 mrem radiation dose limit provides a level of health protection for an acceptable lifetime risk of fatal cancers, for which the assumption of no threshold for induction from radiation exposure exists. The Hazard Index presents the ratio of the calculated intake to the intake which is at the hypothetical threshold for an effect (kidney damage) to occur.

COMMENT 56: Section 2.4.3.1, Page 2-44, Second paragraph: The text states "...approximately 100 acres of off-site property is underlain by groundwater exceeding the derived concentration...". An estimate of total volume of contaminated groundwater should also be made in order to estimate a total acreage above background for each hazardous substance should also be presented.

RESPONSE TO COMMENT 56: The two pieces of additional information requested by the U.S. EPA are essentially meaningless in terms of the potential scope of the action. Their inclusion in the EE/CA report may, in fact, lead to an erroneous interpretation of the objectives and scope of the removal action.

The total volume of contaminated groundwater is generally unrelated to an action targeted to plume migration control. The necessary pumping rate to effect plume control and the period of time for the plume to reach the collection wells are the principal parameters of interest. To include the volume of contaminated groundwater as a parameter of interest could lead to the interpretation that only this volume of water would require removal under any proposed pumping action.

The total acreage underlain by groundwater with above background concentrations of each hazardous substance is inconsistent with the objectives and the ARARs/TBCs established for the south plume removal action. The inclusion of this information would be superfluous and could result in confusion in relation to the development and evaluation of the south plume removal action alternatives.

COMMENT 57: Section 2.4.3.1, Page 2-44, Second Paragraph: The derived concentration of 33 ug/l should also be expressed in terms of excess cancer risk in order that risks posed by this site can be compared with other CERCLA actions.

RESPONSE TO COMMENT 57: The derived concentration for uranium in drinking water (33 ug/l) corresponds to an excess cancer risk range of 0.5 to 2 cancers per year per one million people drinking this water at a rate of two liters per day [derived from Ground Water Protection Standards for Inactive Uranium Tailings Sites (40CFR192) - Background Information for Proposed Rule, EPA 520/1-87-014 (July 1987)].

The text (second paragraph, second sentence) will be change to read:

"This value . . . drinking water and corresponds to an excess cancer risk of 0.5 to 2 cancer per year per one million people who drink this water of a rate of 730 liters per year."

COMMENT 58: Section 2.4.3.2, Page 2-44: Information on the location and estimated time that contaminated groundwaters will discharge to the Great Miami River under a no-action alternative is necessary to evaluate the passive response actions (Alternatives 1, 2, and 3), as well as active response actions (Alternatives 4 and 5), if project delays become a factor.

RESPONSE TO COMMENT 58: The plume defined by the 30 ug/l contour will not reach the Great Miami River during the five-year period of the removal action. Figure A-3 shows the extent of the plume at the end of the period. However, we will provide a particle tracking map showing the potential location of uranium discharge to the Great Miami River at later times under no-action conditions. We will also provide a graph showing the discharge of uranium from the plume to the Great Miami River. This graph will show pounds of uranium per day versus time. It will be based on particle tracking from the south boundary of the model to the Great Miami River and will assume plug flow of the contaminant in that area.

COMMENT 60: Section 2.4.3.3, Page 2-45: The sentence "untreated water is not used for drinking water supplies" is not accurate. Information on recent discoveries and industrial users should be included.

RESPONSE TO COMMENT 60: The statement that untreated water is not used for drinking water supplies applies only to the two industries being discussed in the previous sentences. The EE/CA report will be modified to clarify this statement, which U.S. DOE still believes to be accurate. The U.S. EPA's reference in Comment 60 to "... recent discoveries..." likely refers to the uranium detected in Well 2127 and a nearby private well. Only the monitoring well showed intermittent uranium levels exceeding the derived concentration for uranium in drinking water. Consequently, the statement that "... (the) only known users of groundwater with uranium levels exceeding the derived concentration for uranium in drinking water are the industries ..." remains valid.

COMMENT 61: Section 2.4.3.3, Page 2-45, Last paragraph: A third potential future receptor of uranium in groundwater south of FMPC would include any individual who

may install a well for potable use, crop irrigation, or livestock from an area located within the plume.

COMMENT 62: Section 2.4.3.3, page 2-45, Last paragraph: Under the no action alternative future unrestricted potable use of private and industrial wells that have been forced to be contaminated must be considered. Wells falling into this category include 2060, 2061, 3062.

RESPONSE TO COMMENTS 61 AND 62: The future unrestricted potable use of groundwater from the area located within the south plume had in fact been considered in the public health risk assessment for the no-action alternative. In evaluating the no-action alternative, the maximum probable receptor was considered to be located at the point of maximum uranium concentration in groundwater (i.e., approximately 600 ppb, as defined by the model results). This condition is even more restrictive than using concentration values from Wells 2060, 2061, and 3062. The U.S. DOE will add this third potential future receptor of uranium in groundwater to the other two potential receptors given on page 2-45 of the EE/CA report.

COMMENT 63: Section 2.4.3.3, Page 2-45, First paragraph: The statement that potential receptors along "Paddys Run Road to the west reportedly use cisterns with imported water..." seems inaccurate considering the level of contamination and public concern. Documentation on a door-to-door survey should be presented. The survey should include wells not documented as a drinking water source, but may be used for irrigation or animals.

RESPONSE TO COMMENT 63: U.S. DOE has solicited information from all residents on the presence and use of wells in the south plume area and beyond. Groundwater samples were collected from all wells to which U.S. DOE was given access. A report on this survey, including the monitoring results, has been prepared by and is available from from U.S. DOE. In addition, the Ohio Department of Health (ODH) conducted a monitoring program of private wells south of the FMPC. A report on the ODH survey is also available. The South Plume EE/CA was prepared with full knowledge of these reports and their contents.

COMMENT 64: Section 2.4.3.3, Page 2-45, First paragraph: The EE/CA should provide supporting groundwater monitoring data from the residential and commercial wells discussed.

COMMENT 67: Section 4.2.2, Alternative 2: The results from all water supply wells within the plume should be included in alternative screening and in Section 2.

RESPONSE TO COMMENTS 64 AND 67: Groundwater quality data from several years of monitoring residential and commercial wells are compiled in several documents. Principal among these documents are the aforementioned reports on U.S. DOE's residential survey and the ODH study, as well as the annual Environmental Monitoring Reports released by the U.S. DOE. Other documents, such as the RCRA monitoring reports and documents prepared by U.S. DOE in support of its defense of the class-action lawsuit, also contain data from a subset of the private and commercial wells.

The U.S. DOE does not feel that it is necessary to include all the previously collected data in the EE/CA report, as long as: (1) the statements made in the EE/CA report are supported by the data contained in other documents; (2) the other documents are appropriately referenced in the EE/CA report; and (3) these same documents are made available in the Administrative Record. In any case, the EE/CA report will be reviewed and additional data will be included if deemed necessary to better support the assumptions, evaluation, and conclusions of the EE/CA process.

COMMENT 65: Section 3.2, Page 3-1, Third paragraph: The identification of a source of uranium from FMPC areas north of the south plume is not consistent with the information provided in Section 2.4.1.

RESPONSE TO COMMENT 65: U.S. DOE considers that the information contained on page 3-1 is consistent with the previous information contained in the EE/CA. Three distinct statements made in the cited paragraph will be addressed in this response. First, the reference to "... a reduced, yet continuing source of uranium..." from the FMPC is consistent with earlier statements that continuing releases exist but are not significant for purposes of the South Plume EE/CA. Second, the statement that the continuing releases are "... not a focal point of the removal action..." is consistent with the overall strategy that such releases will be addressed under Operable Unit 5 rather than the south plume removal action. (Each of these first two issues are addressed in more detail in the Response to Comment 49.) Finally, the statement that the "... continuing source will be considered in the evaluation of removal action alternatives..." is true. The current loadings were in fact used as the baseline condition in the evaluation of future conditions under the various removal action alternatives, including the no-action alternative.

COMMENT 66: Section 4: The issue of contaminated sediments continuing contribution to groundwater contamination needs to be addressed in the EE/CA. If sediments are still

contributing to groundwater contamination, removal alternatives need to include sediment and stream remediation. If RI information indicates that sediments are not currently contributing to groundwater contamination, this information should be included.

RESPONSE TO COMMENT 66: This comment includes two issues requiring response. First, sediments in Paddys Run and the storm sewer outfall ditch do not represent a significant source of contamination to the south plume. With the exception of a few sporadic and localized "hits", observed concentrations of all radionuclides and hazardous chemicals in the sediments are below established clean-up levels and do not pose a public health risk or a significant release potential to the underlying aquifer. This conclusion is being addressed in detail in the Operable Unit 5 RI and supporting risk assessment.

Of more significance is the vertical leakage of contaminated surface water through the sediments of these drainageways and into the underlying aquifer. The preceding response (to Comment 65) has indicated that such releases are being accounted for in the evaluation of the removal action alternatives; however, control of the releases is not being addressed as part of the south plume removal action. The surface water medium itself is a subject of Operable Unit 5. A companion removal action for the control of surface water runoff from the Waste Storage Area will greatly reduce the amount of contaminants still entering Paddy's Run and the underlying aquifer. The storm water retention basins have achieved a similar reduction in loadings to the storm sewer outfall ditch, and ultimately the regional aquifer.

COMMENT 68: Section 4.2.3, Page 4-2, Alternative 3: There is no substantiation to support the claim that a well discharging from the base of the aquifer at 50 gpm will not draw contaminated groundwater down into the lower aquifer.

RESPONSE TO COMMENT 68: We will perform additional particle tracking to substantiate that a well with an estimated capacity of 50 gpm discharging from the base of the aquifer will not draw contaminated groundwater down into the lower aquifer. We note here that the average discharge of the actual well will be much less than 50 gpm because it will be replacing a light commercial water supply.

COMMENT 69: Section 4.2.3, Page 4-2, Alternative 3: Alternate water supplies are proposed for two affected industries. Plans/criteria for providing alternate water to other users/residents should be presented.

RESPONSE TO COMMENT 69: The U.S. DOE is committed to protecting the public health and the environment. The Department would take an appropriate action if

concentrations of radionuclides or hazardous chemicals attributable to the FMPC exceed established standards in groundwater for a specific private or commercial use. The U.S. DOE would not, however, support a removal action strategy/decision process that included an "open ended" action to provide an alternate water supply to other users/residents if the pre-established criterion is exceeded at some point in the future. Such a scenario would be inconsistent with the removal action process since the integration of unknown future conditions could lead to a nonoptimal solution for the known problems and conditions being addressed by the removal action. For example, the preferred remedy for an alternate water supply to private residences may be different than the remedy currently being proposed by the U.S. DOE for the two affected industries. Any future actions would be best addressed at the time of problem identification, either as an additional removal action or as part of the overall RI/FS for Operable Unit 5.

COMMENT 70: Section 4.2.3, Page 4-3, Second paragraph: Siting a replacement well within the same aquifer, even if it is screened below the expected depth of contamination, is questionable. If this is permitted, extreme care must be taken to ensure well integrity, so that deeper portions of the aquifer are not affected. This option assumes that hydrogeologic conditions are extremely well understood and are static, a situation that is not completely supported by current data.

RESPONSE TO COMMENT 70: The U.S. DOE agrees that extreme care must and will be taken in installing the replacement well to ensure well integrity and to prevent cross-contamination. The 2000- and 3000-Series monitoring wells were successfully installed under the same constraints during the RI/FS program.

The U.S. DOE does not share the U.S. EPA's opinion that the situation is not completely supported by current data. The hydrogeologic conditions in the vicinity of the replacement well, as simulated by the groundwater flow and solute transport models, are sufficiently understood and supported by field observations to proceed with the alternate water supply well. Conditions in the lower aquifer zone are very stable and will not be perceptibly perturbated by the proposed pumping scheme due to the thickness of the aquifer and the relatively high groundwater velocities and flow rates.

COMMENT 71: Section 4.2.3, Page 4-3, Second paragraph: It is not clear why <u>both</u> industrial users cannot be served from the same well along Willey Road. This proposal appears feasible since, according to Figure 4-1, both receptors are located adjacent to the proposed water line.

RESPONSE TO COMMENT 71: The initial concept developed for the alternate water supply had both industries being served by the same well to be located west of the

facilities. However, further development of the engineering features led to a decision to serve only one industry from the proposed well. Of particular note was the identified need for additional components such as an elevated water tank and associated controls to accommodate fluctuating demands and to maintain water pressure to both industries. It was also perceived that a dual service from a single supply well did not represent a true duplication of the existing independent supplies since both industries would be vulnerable to problems with the system. The recognition that a deeper well would suffice for one of the industries due to the lower pumping rates provided an acceptable option that avoided the aforementioned shortcomings of the dual service.

COMMENT 72: Section 4.2.4.1, Well location: Much of the text of this section does not strictly relate to well location. To avoid confusion, model predictions of the impact of pumping may be more appropriate in Section 4.2.4.2.

RESPONSE TO COMMENT 72: The U.S. DOE disagrees with this comment and the related suggestion. The purpose of Section 4.2.4.1 is to provide the basis for an intermediate decision point on the general location of the proposed pumping wells. Without the information presented in this section, the decision to locate the wells at the southern, leading edge of the plume rather than at the FMPC boundary or in the middle of the plume could not be fully supported. On the other hand, Section 4.2.4.2 addresses only the details of the pumping scheme once the general location near the leading edge of the plume had been established. A discussion of the advantages and disadvantages of the three candidate locations would not, therefore, be appropriate in this section.

COMMENT 73: Section 4.2.4.1: This section does present information regarding the assumptions that were made when the model simulations were run. The additional information that is required to be presented includes pumping rates, the number of extraction wells, extraction well locations, compliance monitoring, and values used for hydraulic gradient and transmissivity. This information is required to determine if the results of the model are valid. The data presented in the EE/CA is insufficient to provide for an independent verification of the model results. If the results of the model cannot be verified, the conclusions of the authors that are based on the results of the modeling cannot be evaluated.

RESPONSE TO COMMENT 73: Pumping rates, number of extraction wells, and extraction well locations for the option involving locating pumping wells near the southern, leading edge of the plume are given in Figure A-5. We will repeat or reference this information in Section 4.2.4.1. A description of compliance monitoring will also be presented.

We will add details for modeling related to the option involving locating pumping wells near the middle of the plume.
The hydraulic gradient is shown in Figure A-4 and A-5. We will submit information on hydraulic conductivities in the 5 layers of the flow model. Transmissivity, of course, varies throughout the "South Plume" area due to variation in aquifer thickness and was not an input item in the three-dimensional flow model. We will supply information on aquifer thickness.

COMMENT 75: Section 4.2.4.1: Clarification should be provided on what exactly the five-year plume denotes.

RESPONSE TO COMMENT 75: The dashed line in Figure 4-2 represents the predicted size and shape of the south plume (as defined by the area with uranium concentrations exceeding 30 ppb in the uppermost layer of the aquifer) in five years if no action is taken. The solid line provides the size and shape of the plume if interceptor wells are installed along an east-west transect through the point of highest uranium concentration and are pumped for a five-year period. The predicted plume behavior in both cases is based on the results of the solute transport model. A principal reason for including Figure 4-2 in this section was to illustrate the lack of impact of such interceptor wells on the future behavior of the southern portion of the plume. The text in Section 4.2.4.1 will be augmented to clarify the information contained in the figure.

COMMENT 76: Section 4.2.4.1: This section provides discussion on the inadequacy of the proposed pumping schemes. In order to construct a pumping system, the objectives and parameters need to be defined, including the number of wells, pumping rates, location, and cleanup goals. Until a system is designed, or these parameters are defined, a complete analysis can not be completed. This discussion may be best moved to another section of the EE/CA.

RESPONSE TO COMMENT 76: The U.S. EPA's apparent misinterpretation of the intent of Section 4.2.4.1 is again reflected in this comment. The development of a well-defined pumping alternative requires the following two levels of analysis: (1) where the wells should be generally located under the assumption that plume control can be effected at each location; and (2) the number and pumping rates of the wells necessary to control plume migration once a location is selected. Section 4.2.4.1 is intended only to address the former issue, while the latter analysis is discussed in Section 4.2.4.2 and remains subject to refinement and modification as new data is made available through the RI/FS.

The degree to which the pumping wells will achieve the removal action objectives is dependent on well location and forms a major criterion in selecting a preferred location. This is discussed in Section 4.2.4.1 within the context of both the advantages and disadvantages of each location for the interceptor wells. The complete analysis of the pumping alternatives in terms of the removal action objectives and the clean-up goals is presented in Chapter 5.0. The inclusion of the less detailed information in Chapter 4.0 of the EE/CA report allows for an intermediate decision point on the definition of Alternatives 4 and 5 prior to the comparative evaluation of these alternatives with the non-pumping alternatives in Chapter 5.0.

COMMENT 77: Section 4.2.4.1: A pumping system that collects water from both the center and the southern boundary of the plume should be evaluated for this removal. This scenario may provide the most effective long-term solution to control the contaminant plume.

COMMENT 79: Section 4.2.4.1, Page 4-6, Second and third paragraphs: Two sets of extraction wells should be considered, one near the center of the plume to extract highly contaminated groundwater, and another near the southern edge of the plume to prevent further contaminant migration.

COMMENT 192: Section 6.4: The option of both mitigating the migration of the plume at the low-concentration front edge and treatment of the more concentrated portion of the plume should be considered as an alternative in this EE/CA. The generation of highly concentrated uranium sludge (second bullet) is not a sufficient reason to reject Alternative 5.

RESPONSE TO COMMENTS 77, 79, AND 182: The U.S. DOE agrees that the most effective long-term solution for control of the contaminant plume may be a pumping system that collects water from both the center and the southern boundary of the plume. The issue is whether such a dual pumping scheme is consistent with the objectives and intent of the removal action. U.S. DOE's position is that it is not, as reflected in the following statement from U.S. DOE's strategy document prepared to support the deletion of Operable Unit 6 in favor of a revised removal action and a redefinition of Operable Unit 5: "Allowance for pumping from the center of the plume is still available under Operable Unit 5, although such an additional action would have to be independently justified against the option of waiting for the plume to reach the southern pumping wells." U.S. DOE's position on this matter is based primarily in the resultant conflict with the preference for schedule minimization. As the scope of the action increases, any opportunities to accelerate the necessary approvals and funding requests are realistically

reduced. More importantly, the likely need to treat groundwater pumped from the middle of the plume introduces a significant increase in the required design and implementation times due to the additional technical issues and engineering components. An approximate doubling of the total pumping rate would also cause an exceedence of the capacity of the main effluent line, thereby requiring a second discharge point. This would introduce the need for a new NPDES permit and other conditions that could further delay implementation (see the response to Comment 84 and associated comments).

Also at issue is the compatibility of such a strategy with the NCP, for it can be construed that pumping from the middle of the plume is being requested more to accelerate a final action than to meet the principal objectives of the removal action. It was the U.S. EPA that once expressed concern to U.S. DOE about pursuing removal actions that extend beyond the Superfund-based schedule and cost limits due to the perception that the removal action was being used as a means of circumventing the complete CERCLA review and decision process.

COMMENT 78: Section 4.2.4.1, Page 4-5, Third paragraph: Quantitative data should be incorporated into the report to support the conclusion that "...the continuing release across the site boundary via groundwater transport are not considered significant when compared to the historical releases that represent the hypothesized underlying course of the off-site (off-FMPC) plume."

RESPONSE TO COMMENT 78: A resolution of the issue of historical versus continuing releases across the southern boundary of the FMPC must rely on consistent results from a number of independent data sources and analyses. In this case, the various informational sources include, but are not limited to: estimates of the mass of uranium lost to the storm sewer outfall ditch on an annual basis; historic information on releases to Paddys Run; engineering estimates of the leakage rates from these surface water courses into the underlying aquifer; direct monitoring data on the current location of the south plume and the distribution of uranium concentrations within the plume; the current understanding of groundwater velocities and uranium retardation (i.e., migration rates); and a numerical model that successfully reproduces current conditions by superimposing estimated releases over the period of interest onto the simulated groundwater flow and solute transport systems. When all the aforementioned informational sources yield consistent results without introducing unsubstantiated assumptions or unrealistic parameter values into the model, one gains confidence in the current understanding of what happened in the past and how that relates to what is happening today.

In the case of the south plume, both the direct observations of uranium distribution within the plume and the model results point to recent releases across the FMPC boundary that are approximately one order of magnitude less than the releases in the late 1950's and

early 1960's. It was these historic releases that are considered to be the source of the highest concentrations observed in the plume today. When consideration is given to the effectiveness of the two stormwater retention basins and the forthcoming removal action to eliminate the release of contaminated runoff from the Waste Storage Area to Paddys Run, the validity of the statement made on page 4-6 is substantiated.
Details of the analysis cited above are beyond direct inclusion in the EE/CA report or this response. They will be presented in the sitewide groundwater report that is in preparation. Citations to this report will be added to the EE/CA report. U.S. DOE also welcomes U.S. EPA to review this information.

COMMENT 80: Section 4.2.4.1, Page 4-6, Third paragraph: The third sentence requires further explanation. It is unclear why "...future reliance on ... additional remedial action under the RI/FS would no longer be required."

RESPONSE TO COMMENT 80: The reference to the need for no further action applies only to those groundwater users at downgradient locations cited in the previous sentence. The basis for this statement is that the successful implementation of the proposed action would eliminate further migration of the plume so that the downgradient users would never be affected by unacceptable levels of uranium in groundwater. The sentence will be modified to clarify its applicability to only the downgradient users.

COMMENT 81: Section 4.2.4.2, Removal options: Orienting the wells north to south instead of east to west would remove the largest amount of contaminant from the largest section of the aquifer if the capture zone for a well or pair of wells can encompass the width of the plume.

RESPONSE TO COMMENT 81: The orientation of wells along a north-south transect was evaluated as part of the early alternative screening effort. The principal advantage of such an orientation is that it minimizes the distance that the plume would have to travel to reach an interceptor well, thereby minimizing the required duration of pumping. However, this alternative was not retained for further consideration due to its ineffectiveness in capturing the plume.

The modeling analysis completed in support of the EE/CA process indicates that the capture zone for a single well or pair of wells would not encompass the width of the plume. Even as the plume narrows to the south through the constricted bedrock channel, it has been determined that at least three wells in an east-west orientation would be required to effect plume control with little or no factor of safety. The proposed siting of

four wells under Alternatives 4 and 5 introduce the necessary margin of safety to secure the capture of the entire plume in the lateral direction.

COMMENT 82: Section 4.2.4.2: The impact of pumping four wells at 500 gpm on the contaminant distribution needs to be presented. This section indicates that the impact will be sufficient to make pumping an effective choice, while earlier in the document the effect is presented as being minimal. A clarification is required.

RESPONSE TO COMMENT 82: The reference in this comment to "... earlier in the document the effect is presented as being minimal" is difficult to address without a more specific citation. It is likely that the reference is being confused with a statement made in Section 4.2.4.1 that, if the wells are located in the middle of the plume, "... the area directly affected by the pumping wells ... is relatively small and a major portion of the plume south of the pumping wells will continue to migrate as if no action had been taken." The key is the reference to that portion of the plume south of the interceptor wells, for in fact the portion of the plume already past the pumping wells would not be captured. A principal reason for proposing wells at the southern edge of the plume is to avoid this shortcoming.

The capture efficiency of the four wells pumping at 500 gpm each is best illustrated by Figure A-5. The purpose of this figure is to demonstrate that particles released into the regional aquifer along Paddys Run north of the industries and along a major portion of the storm sewer outfall ditch would eventually be captured by the pumping wells. Similarly, any contaminated groundwater within the current south plume would also be captured. This figure was prepared by an analysis of the steady-state velocity vectors predicted by the groundwater flow model. A particle is introduced at a certain location, and then tracked over time as it moves at the speed and in the direction indicated by the sequential velocity vectors.

COMMENT 84: Section 4.2.4.3, Page 4-8, Discharge options: The elimination of the alternative of discharging water far south in Paddy's Run needs to be described more fully.

COMMENT 85: Section 4.2.4.3, Page 4-8, Discharge options: The elimination of the alternative of discharging water far south in Paddy's Run needs to be described more fully.

COMMENT 96: Section 4.2.4.5, Page 4-10: The EE/CA should present the rationale for pumping groundwater uphill to Manhole 175. The sampling point could be relocated to one of the manholes further down the line, such as Manhole 180. Also, creating a new discharge point should be further developed.

COMMENT 101: Section 4.2.4.5, Page 4-10, Fourth paragraph: The EE/CA should discuss the rationale for pumping groundwater uphill to Manhole 175. The sampling point could be relocated to one of the manholes downstream, such as Manhole 180, and the groundwater could be discharged into the same manhole, with considerable savings in power consumption costs.

RESPONSE TO COMMENTS 84, 85, 96, AND 101: There are six primary reasons why the proposed alternative is to pump the groundwater back to Manhole 175 for discharge through the main effluent line. These include:

- There are several reasons for U.S. DOE's desire to use the existing effluent pipeline instead of discharging the south plume water directly into the Great Miami River. First, the effluent discharge system already is in place, cutting the amount of time it would take to implement the recommended alternative. The existing effluent discharge system has sufficient flow capacity to handle the increased volume of water that would result under the recommended alternatives. Second, using the existing system means that U.S. DOE would not have to negotiate for additional right-of-ways in order to build new pipeline, which is an importance consideration for implementing the removal action in a timely manner. Third, U.S. DOE believes it is prudent to use the existing system in order to have better operational control over the discharge system.

- The likelihood that pipeline easements back to the FMPC will be easier to secure due to the presence of highway and railroad right-of-ways throughout the proposed route of the pipeline.

- A preference to discharge the flow into the Great Miami River rather than Paddys Run, which contains a much lower flow rate and often runs dry. Discharges to intermittent streams should, in general, be avoided.

- There is a technical preference for discharging the flow into the main effluent line at an elevated location that would not be flowing under pressure. Discharge of pressurized groundwater flow into Manhole 180 or another downgradient manhole flowing under pressure would introduce poor entrance conditions and could result in unacceptable pressure conditions in the pipelines (e.g., flow reversal if the main effluent line is surcharged at a time when the pressure is not maintained in the groundwater discharge line).

- The conveyance of the groundwater back to the vicinity of Manhole 175 will allow a future tie-in to the Advanced Wastewater Treatment Plant so that a portion of the groundwater can undergo treatment during periods of low flow into the treatment plant from other sources (e.g., during periods of little or no stormwater runoff).

COMMENT 83: Section 4.2.4.3, Page 4-8, Discharge options: What is the closest municipal wastewater treatment facility is in the area?

RESPONSE TO COMMENT 83: Discharge of the pumped groundwater to a municipal wastewater treatment plant is not a viable alternative for several reasons. The projected flow rate of over 2,000,000 gallons per day is equivalent to the wastewater flow from a community of approximately 20,000 people, indicating that no treatment plant within several miles of the site would have the capacity to accept the flow. In addition, the presence of even detectable levels of radionuclides that would require secondary and even tertiary treatment units for effective removal would likely not be accepted by any municipal authority. The resultant generation of radioactively contaminated sludges or resins and the special considerations and requirements for handling such materials would also eliminate this option from acceptance by a municipal authority.

COMMENT 86: Section 4.2.4.4, Page 4-9, Treatment options: This section is inadequate. There is no detailed description of appropriate treatment technologies that can be used to remove all the hazardous substances from the pumped groundwater. There is no data to support the contention that any remedial technology/treatment option is not cost effective, particularly when a description of applicable treatment options are not presented. A complete list of technologies, a discussion of how each works, and benefits and costs needs to be provided.

RESPONSE TO COMMENT 86: In support of the initial screening of alternatives for Operable Unit 6 (prior to its deletion), U.S. DOE screened and reviewed available

treatment technologies, both in general and as part of the design process for the advanced wastewater treatment plant. Both studies concluded that ion exchange is the only proven technology with widespread application for the removal of soluble uranium from water to levels below the derived drinking water standard of 33 ppb. The effectiveness of this technology was demonstrated by IT through a treatability study using water from the south plume, with concentrations being reduced from close to 300 ppb to approximately 10 ppb for the most effective resin tested. Coagulation and precipitation were also capable of removing the uranium, but this process was judged not to be as reliable and introduced several additional problems (e.g., larger sludge volumes) without a commensurate reduction in cost.

The inclusion of all the supporting information on technology screening in the EE/CA report was not considered necessary due to the straightforward conclusion that ion exchange has both a proven record of performance in similar applications and is cost-effective when compared to other less reliable technologies. In response to the comment, however, additional information will be provided in the EE/CA report to support this technology selection. Reference will also be given to other reports that contain more detailed information.

COMMENT 87: Section 4.2.4.4, Page 4-9, Treatment options: The removal of an equivalent mass of uranium from the current FMPC effluent to offset proposed actions is an unacceptable approach. If a quantity of uranium can be removed from the current effluent, it should be done immediately. The radionuclides currently being discharged are not regulated under the facility's NPDES permit. The current effluent concentrations (660 pCi/l in 1987) exceed U.S. DOE Derived Concentration Guides limits of 550 pCi/l. This effluent is subject to treatment requirements of U.S. DOE Order 5500.5 that requires the use of best available technology (BAT) or treatment. The dilution of the current effluent with less contaminated groundwater should not be a means of achieving an internal U.S. U.S. DOE requirement.

COMMENT 91: Section 4.2.4.4, Page 4-9, Fifth paragraph: Any treatment scheme should minimally achieve a net reduction in uranium discharged by FMPC to the Great Miami River. As indicated on page 5-17, current release rates for uranium exceed discharge limits.

COMMENT 103: Section 4.2.4.6, Page 4-12: The design of a treatment system to ensure that total uranium released as effluent would not exceed FMPC release values is discussed in this section. The rationale for not exceeding this release value should be given since the current release concentration exceeds U.S. DOE guidance.

COMMENT 149: Section 5.5.1, Page 5-16: Compliance with U.S. DOE Orders would likely result in a discharge number lower than 1500 lbs/yr (approximately 1300 lbs/yr).

COMMENT 162: Section 5.6.2, Page 5-21, Fifth paragraph: The second sentence of the fifth paragraph should be changed to indicate that the total mass of uranium will not exceed FMPC's discharge limit, rather than the "existing FMPC release value". Existing releases already exceed the discharge limit.

RESPONSE TO COMMENTS 87, 91, 103, 149, AND 162: Numerous comments received from the U.S. EPA involve treatment issues. This response will be limited to the treatment goals in relation to U.S. DOE guidance and the anticipated net reduction in uranium loadings under the concept of removing an equivalent mass. Other related issues, as for example the cost-effectiveness of the treatment alternative and the validity of the equivalent mass concept, are addressed separately in subsequent responses.

U.S. DOE recognizes that the current release concentration exceeds U.S. DOE guidance; this recognition is, in fact, the driving force behind the planned advanced wastewater treatment plant that has already received Congressional authorization and has been progressing as a U.S. DOE line-item project since its inception in 1986. This project will comply with U.S. DOE's Order 5400.5 that requires the use of best available technology. The statements in the EE/CA report regarding the treatment objective were developed from the perspective of not increasing the mass of uranium to the river as a result of pumping rather than the overall compliance with U.S. DOE Orders. The U.S. DOE agrees that the treatment goal should be extended to achieve compliance with the discharge limit rather than to simply prevent exceedence of the existing FMPC release value. Appropriate changes will be made in the EE/CA report.

COMMENT 88: Section 4.2.4.4, Page 4-9: The statement that a new treatment facility "...is not cost effective due to the high flow, low concentration nature of the extracted groundwater..." is not supported. This statement is later used to support a "no treatment" alternative for removed groundwater.

RESPONSE TO COMMENT 88: The U.S. DOE contends that the statement is supported. A cost-effectiveness analysis requires consideration of both the incremental cost of an alternative and the incremental benefits that would be gained. The cost of treatment of a wastewater stream is highly dependent on the flow rate through the system. As mentioned earlier, the flow that is projected from the wells (2000 gpm) can be equated to the wastewater flow from a community of about 20,000 people, thereby giving some

perspective to the magnitude of the treatment plant requirements for the "high flow" portion of the equation. The incremental present worth cost of providing treatment for the south plume water, assuming a five-year operation and maintenance period, is approximately $50 million if the water being pumped is treated and $15 million if the current discharge from the FMPC is treated under the "removal of an equivalent mass" concept. These incremental costs can be compared to a total present worth cost of approximately $10.6 million for Alternative 4 (pumping without treatment).

The "low concentration" portion of the equation is most important in terms of the benefits gained by treatment. It has been established in the risk assessment supporting the EE/CA that the direct discharge of the pumped groundwater will not exceed established or derived standards/guidelines, and will not pose an unacceptable public health risk to even the hypothetical maximum exposed receptor under any exposure scenario. Therefore, treatment would not be required to satisfy public health protection standards.

A second view of the lack of benefits is provided by comparing the incremental loading of uranium to the Great Miami River that would result from pumping without treatment to the background condition in the river. The annual uranium loading to the river as a result of pumping without treatment is estimated to range from approximately 90 pounds of uranium per year during the first year of pumping to 250 pounds per year during the fifth year of pumping. This can be compared to the approximate 12,000 pounds of uranium that pass under the Ross Bridge (upstream from the FMPC discharge) on an annual basis assuming average flow conditions in the river (3460 CFS) and the observed background concentration of uranium of 1.2 pCi/l (1.8 ppb). Therefore, the total contribution from the south plume would represent an approximate 1 percent increase in uranium loadings above background. To introduce a 150 percent to 500 percent increase in cost to avoid this 1 percent increase in loading cannot be justified from a cost-effectiveness standpoint, particularly when the incremental loading does not represent an unacceptable public health risk.

COMMENT 89: Section 4.2.4.4, Page 4-9: This section proposes the construction of a new treatment plant as an alternative, but does not propose to use it for groundwater remediation. Because the purpose of this EE/CA is to evaluate the means for south plume remediation, it is not clear how this alternative can be considered a treatment option.

COMMENT 117: Section 6.3, Page 6-3, Second paragraph: The "unassociated releases form FMPC operations:" are not subject to regulation under CERCLA, and hence are not required by SARA to employ treatment technologies that permanently and significantly reduce toxicity, mobility, and volume. Thus, although this risk comparison may be valid, it does not take into account the specific intent of the SARA amendments. The EE/CA

should be modified to include removal and treatment of the south plume alone as a separate alternative.

COMMENT 178: Section 6.3, Page 6-3, Second paragraph: The discharge needs to be treated. The current discharge already exceeds limits and it is a regulatory requirement to meet ARARs. The NCP states that there should be a preference for permanent solutions using treatment technologies.

COMMENT 181: Section 6.4, Page 6-4, Second bullet: This statement could be true for any cleanup where groundwater is treated. However, the preference for treatment implicitly allows production of sludge where toxicity and volume of waste are reduced, especially where it may be necessary to implement the same treatment system for protection of public health and the environment in the future. The implementation of the treatment system now would appear to be consistent with final remediation.

RESPONSE TO COMMENTS 89, 177, 178, AND 181: U.S. DOE recognizes the SARA mandate to utilize permanent solutions and treatment technologies to the maximum extent practicable. However, under the NCP, a removal action does not require strict compliance with ARARs or the preference for treatment, as long as the selected removal action does not prohibit the future selection of permanent solutions in the RI/FS and the preference for permanent solutions is satisfied in the selection of the final action. On the other hand, two requirements that do strictly apply to removal actions under CERCLA -- cost-effectiveness and consistency with the final action -- must be satisfied.

The alternative of pumping and treatment of the south plume alone was considered in the initial stages of the EE/CA process. However, the preliminary present worth cost estimate of $60 million for the complete alternative could not be justified. The anticipated implementation of an alternate treatment capacity to satisfy the applicable U.S. DOE Order, as well as the results of the risk assessment that public health objectives would be satisfied even without treatment, provided the principal justification for deleting this alternative based on cost-effectiveness (see also the response to Comment 176). The lack of cost-effectiveness of treating the south plume water can be put into perspective by considering that implementation of a separate treatment plant for a five-year project life at a present worth incremental cost of about $50 million would reduce uranium loadings to the Great Miami River by approximately 100 to 250 pounds per year. On the other hand, the incremental cost of the advanced wastewater treatment plant of $15 million will result in an estimated reduction of uranium loading of close to 1500 pounds annually.

It must be recalled that the shifting of the interceptor wells to the south end of the plume was partially based on the lower concentration of the extracted water during the early

years of pumping. This scenario accommodates the elimination of treatment under the removal action pending the completion of the advanced wastewater treatment plant. Alternative 4 would satisfy all ARARs and other factors to be considered for the south plume removal action; the provision of treatment of the south plume water would not reduce the current out-of-compliance discharges until the same endpoint is reached (i.e., the advanced wastewater treatment plant is installed). As long as the advanced wastewater treatment plant proceeds along the established implementation schedule, the current noncompliance with U.S. DOE discharge limits will be satisfactorily corrected independent of whether or not CERCLA or NPDES authorities apply to the current uranium discharge.

Acceleration of the advanced wastewater treatment plant to better accommodate the removal action is not practical. Although preference will be given to the construction of the ion exchange unit to effect uranium removal at the earliest possible time, U.S. DOE estimates that the earliest the plant could be operational is 1993. It is also important to note that the advanced wastewater treatment plant has already been approved by Congress as a U.S. DOE line-item project and is proceeding within the established design process. To "reprioritize" the project by requiring treatment under the removal action will likely require an independent approval process due to the concomitant shift in program and funding source. In the end, the date for the advanced wastewater treatment plant to come on line would likely be delayed in relation to the schedule currently being pursued under the approved line-item project scenario.

COMMENT 90: Section 4.2.4.4, Page 4-9, Third paragraph: The meaning of the last sentence in this paragraph is not clear. To what level does the industry presently treat the groundwater?

COMMENT 92: Section 4.2.4.4, Page 4-9: The meaning of the last sentence is not clear. To what level does the present industry treat the groundwater?

RESPONSE TO COMMENTS 90 AND 92: The requirement for continued treatment by the affected industry does not pertain to uranium or its anticipated background concentration in groundwater pumped from the alternate water supply well. Based on information provided to U.S. DOE by the industry, constituents in groundwater other than those introduced by releases from the FMPC must also be removed in order to meet the process requirements. It is expected that these same constituents will be present in the groundwater pumped from the regional aquifer upgradient from (i.e., to the west of) the south plume and will, therefore, require removal using the industry's existing treatment plant. The text will be corrected to clarify this issue.

COMMENT 9: Section 4.2.4.4, Page 4-9: The industry's treatment unit could be supplemented with additional units and should be considered for treatment for this removal.

COMMENT 93: Section 4.2.4.4, Page 4-9: The industry's treatment unit could be supplemented with additional units and should be considered for treatment for this removal.

RESONSE TO COMMENT 93: All information provided to U.S. DOE by the affected industry does not support the U.S. EPA's contention that the existing treatment plant represents a viable treatment alternative. As indicated in the previous comment/response, it is expected that continued operation of the plant will be necessary for the industry to meet its process requirements. Therefore, conversion of the plant to serve the needs of the remedial action program under any degree of control by the U.S. DOE cannot be expected. In addition, the existing treatment units already cover a major portion of the treatment building that is surrounded by other process facilities. Consequently, an expansion of the treatment plant's capacity to accommodate an order of magnitude increase in flow rate is not practical.

COMMENT 94: Section 4.2.4.4, Page 4-9: The fact that Alternative 5 would generate uranium-containing sludges is not a significant negative factor. The new wastewater treatment plant planned for FMPC will generate similar sludges for which treatment and disposal provisions will also have to be made.

COMMENT 163: Section 5.6.2, Page 5-22, Third paragraph: The mass of uranium in the sludge will be less than the mass of uranium in the untreated water pumped to the river under Alternative 4. Proposed techniques for handling the sludge should be presented.

COMMENT 164: Section 5.6.2, Page 5-22: The amount of uranium sludge generated by Alternative 5 should be relatively small. If handled properly, the sludge should not pose a significant public health or environmental threat.

RESPONSE TO COMMENTS 94, 163, and 164: FMPC agrees with the EPA comments. The amount of sludge to be generated should not be a significant negative. While the uranium in the sludge could pose a health hazard, using existing standards as a basis, the proper procedures will be developed for handling uranium containing sludges. The exact procedures will be developed as part of a standard operating procedure for the Advanced

Wastewater Treatment Facility. The procedure will be based on existing manufacturing specifications such as:

08-BN-410-07 Filtration of Raffinate
08-BN-490-02 Disposal of Waste Filtrate and Effluent

In addition, the presence of the uranium in drums, rather than in the groundwater, will provide a significant reduction in the threat to the environment and public health.

COMMENT 95: Section 4.2.4.5, Pump and discharge: It is not possible to evaluate the proposed locations of interceptor wells because of the lack of information on the model. The proposed locations are not supported by the data in the EE/CA. The wells are not located in a position that will prevent the water supply wells on New Haven Road and Paddys Run south of New Haven Road from receiving contamination. Data needs to be used to support the location of the wells proposed through use of the model.

COMMENT 157: Section 5.5.2, Page 5-18, Fourth paragraph: The decision to locate proposed extraction wells so close to residential and commercial properties should be reconsidered. The EE/CA states that existing wells within the principal zone of drawdown for the extraction system are believed to be screened in a deeper aquifer. The screen intervals should be confirmed before finalizing extraction well locations.

RESPONSE TO COMMENTS 95 AND 157: Based on the information available and the results of the model at the time of EE/CA preparation, the leading, southern edge of the south plume is close to and approaching New Haven Road just to the west of Route 128. The residential and commercial properties along New Haven would be just to the west of the projected limit of the plume, while private water supply wells along Paddys Run south of New Haven Road would remain far to the west of the predicted future path of the plume under the no-action alternative. The response to Comment 39 and related comments provide more details on plume location and its relationship to groundwater users.

The preliminary location of the interceptor wells just south of New Haven Road near Route 128 was selected based on the projected path of the plume and the availability of open space in this area for the wells and ancillary facilities. A position south of the road provided a margin of safety to both the lack of confirmatory data on the actual location of the plume front and the anticipated movement of the plume prior to the wells actually being installed and operational. To locate the pumping wells farther to the north could

"miss" the leading edge of the plume and the water supply of the downgradient users may eventually be impacted.

It was recognized that the private residences and commercial establishments along New Haven Road would remain north of the interceptor wells. However, the projected movement of the plume indicates that the plume would remain to the east of these groundwater users. In addition, the wells will create a localized east-west gradient that will tend to draw the plume away from these users and provide additional protection. The zone in which the wells are screened would have little effect on the level of protection since the plume would not be expected to be present in any layer of the aquifer beneath the area of concern.

The location of the interceptor wells given in the EE/CA is considered to be preliminary, as recognized in the Federal Facility Agreement: "... a groundwater collection system, the location of which will be established after additional data is collected regarding the magnitude and extent of groundwater contamination." The most recent data from the RI/FS indicates that the leading edge of the plume may be farther north than originally projected. If this is confirmed, the proposed well location may be redefined to the north of New Haven Road to provide more positive protection to the residences and commercial establishments along the road.

COMMENT 97: Section 4.2.4.5, Page 4-10: If the pumped groundwater is brought back to FMPC, the water has to be tested prior to mixing with the existing effluent discharge.

COMMENT 104: Section 4.2.4.6, Page 4-12, Fourth paragraph: Provisions should be made to sample the FMPC effluent prior to treatment. Central valves and bypasses should be installed so that when the uranium concentrations are below the discharge limit, the flow can bypass the treatment system and increased pumping of recovery wells may occur. Conversely, when sampling shows that uranium concentrations exceed the effluent limit, groundwater could be diverted to the treatment system. This comment is only relevant if the treatment is effective at removing low concentrations of contaminants.

COMMENT 107: Section 4.2.4.6, Page 4-14: Provisions should be made to sample FMPC prior to treatment. Central valves and bypasses should be installed so that when contaminant concentrations are below the discharge limits, the flow can bypass the treatment system and increased pumping of recovery wells may occur.

RESPONSE TO COMMENTS 97, 104, AND 107: Provisions will be made for sampling the pumped groundwater prior to mixing with the existing FMPC discharge. However, the

requirement for testing the water as a decision criterion for treatment is neither practical nor warranted. The capacity to treat the pumped groundwater will be dependent on the flow rate of other FMPC discharges (which will be highly dependent on uncontrollable rainfall conditions) rather than on the quality of the groundwater being pumped.

Short-term fluctuations in groundwater quality that would give credence to the U.S. EPA's proposal for a quality-based decision point are not expected. The current shape of the plume indicates that it was formed by a gradual increase and decrease in uranium releases over the last several decades. The dispersion of the released uranium as it migrated through the aquifer over the intervening years would yield a "smoothed out" concentration profile, as is currently observed by the monitoring well network. Even the effects of "one time" discharges back in the 1950's and 1960's would have dispersed and been diluted such that a concentration spike would not be expected out of the pumping wells. The proposed surge tank would also smooth out any concentration fluctuations since water from all four wells will be mixed prior to release back to the FMPC.

In the unlikely event that a significantly elevated zone of contamination is intercepted, the proposed monitoring wells upgradient from the pumping wells will provide an early warning system so that an appropriate response can be taken prior to the actual pumping of the water. This further reduces the need for an "end of the pipe" testing and control system.

COMMENT 99: Section 4.2.4.5, Page 4-10, Third paragraph: It is unclear why recovery wells were designed with 40-foot well screens at the top of the aquifer, when data from 3000-Series wells indicate groundwater contamination at depths to at least 75 to 100 feet. The recovery well system should be designed with well screens installed from the top of the aquifer to the bottom of the existing plume in order to increase efficiency in the recovery of contaminants.

RESPONSE TO COMMENT 99: We will supply information on particle tracking which showed that water at the bottom of the plume is drawn up to the screens. Deeper wells would increase cost without benefiting contaminant recovery.

COMMENT 100: Section 4.2.4.5, Page 4-10, Fourth paragraph: The existing effluent line constructed in 1952 may not be large enough to accommodate the additional flow. Testing of the effluent line for exfiltration to identify bad joints, etc., which could reintroduce the contaminated groundwater back into the ground at a different location, needs to be completed.

RESPONSE TO COMMENT 100: With regard to the potential for exfiltration from the effluent line, the condition of the effluent line is being determined by testing. The most recent testing was June 16, 1990. The preliminary results indicate some repairs are required between Manholes 179 and 180. In addition, no testing has been conducted between Manhole 180 and the river because high flow rates in the river have prevented divers from finding the exit to the river and install a plug. Additional attempts will be made to complete the integrity of testing of this section of the effluent line during the summer of 1990 when the Great Miami River is at a low flow condition. Necessary repairs to the effluent line will be completed prior to the South Plume pumping.

COMMENT 102: Section 4.2.4.5, Page 4-12, First paragraph: The last line of this paragraph indicates that six monitoring well clusters will be installed. Figure 4-3, however, shows 11 well clusters.

RESPONSE TO COMMENT 102: There will be a total of 11 monitoring well clusters that would be used for performance monitoring. However, only the six well clusters surrounding the interceptor wells will be installed as part of the removal action. The other five clusters already exist as part of the RI/FS monitoring well program.

COMMENT 105: Section 4.2.4.6, Page 4-14, First paragraph: If the treatment system is to operate at 700 gpm when the extraction wells produce 1,500 to 2,000 gpm, not all the contaminated groundwater will be treated before discharge. This is not consistent with the intent of the treatment alternative, and will not "...ensure that the uranium discharge to the Great Miami River is not increased over current levels."

COMMENT 106: Section 4.2.4.6, Page 4-14: Again, a reference is made to design goals of no increasing total uranium discharges over current levels. U.S. DOE Order 5400.5 has an effective date of May 8, 1990 and requires current levels be reduced.

COMMENT 155: Section 5.5.1, Page 5-17, First paragraph: Current U.S. DOE (TBCs) release concentrations limit is 550 pCI/l with future concentration values of 100 pCI/l. The current value is 660 pCI/l. Any alternative providing for this process compromises U.S. DOE Order 5400.5 requiring Best Available Technology (BAT) to be applied to concentrations currently being discharged at FMPC.

COMMENT 166: Section 5.7.1, Page 5-24: The chemical-specific TBC of 33 ug/l is derived from the U.S. DOE Order 5400.5. Comments regarding this derivation have

423

previously been presented. This U.S. DOE Order also requires treatment. This fact needs to be addressed as a TBC.

RESPONSE TO COMMENTS 106, 155, AND 166: As stated in U.S. DOE Order 5400.5; "Standards for liquid effluent discharges are driven by U.S. DOE's 'as low as reasonably achievable' (ALARA) policy. The order adopts 'best available technology' (BAT) as the required level of treatment for liquid wastes containing radioactive materials and require that the BAT be phased at the earliest practical time. Technical and economic considerations are included in determining BAT. Based on cost and benefit considerations, radioactive waste streams that contain radionuclide concentrations of not more than the DCG reference values at the point of discharge to a surface waterway normally will not require treatment to further reduce the concentration." The planning of the Advanced Wastewater Treatment facility is in response to these requirements.

COMMENT 108: Section 4.2.4.6, Page 4-14: If the treatment system is to be operated at 700 gpm when the extraction wells will be producing 1,500 to 2,000 gpm, not all of the contaminated groundwater will be treated. This is not consistent with the intent of the treatment alternative.

RESPONSE TO COMMENTS 105 AND 108: It must be recalled that the proposed treatment scenario is to utilize the concept of "removal of an equivalent mass," in which case the water being treated is the current discharges from the FMPC rather than the groundwater being pumped from the south plume. The 700 gpm design flow rate is based on the FMPC effluent rather than on the rate of pumping of the south plume.

COMMENT 110: Section 5.1.1, Page 5-2: Direct contact and inhalation through showering is not considered in the exposure pathways risk analysis.

COMMENT 112: Section 5.1.1, Page 5-2: An additional pathway that is required to be considered is direct exposure to groundwater resulting from the water of lawns and gardens. This activity could cause surface deposition at close proximity to residents. Inhalation of resuspended dusts, particularly those associated with lawn mowing or gardening, should be considered.

COMMENT 130: Section 5.2.1, Page 5-6: Calculated doses of 36, 18, 88, and 47 mrem are presented. No time interval is specified. Additionally, none of these calculations include exposure components due to vegetation watering, mowing, and gardening.

n5

RESPONSE TO COMMENT 110, 112, and 130: Numerous other potential exposure pathways were considered in addition to the four pathways presented in the report. These pathways include:

- External dose from submersion in air near resuspended materials following irrigation
- Inhalation of resuspended materials following irrigation
- External dose from materials deposited onto soil following irrigation
- External dose from materials deposited in river sediment
- External dose from immersion in river water
- External dose at the water surface from materials in river water
- Inhalation of materials released from water during showering
- Internal dose from ingestion of fish
- Internal dose from ingestion of fowl
- Internal dose from ingestion of eggs, cheese, etc.

These potential pathways were eliminated from inclusion in the quantitative exposure assessment since one or more of the transport and dose assessment parameters caused the dose contribution to be so small as to be insignificant with respect to the four pathways for which the quantitative exposure assessment was performed.

As stated in Section 5.1.1, the calculated radiation doses are the committed effective dose equivalents (50-year) as a consequence of intake for one year.

COMMENT 115: Section 5.1.1, Page 5-3: "A value of 2.7 ug/l/kg/day . . . used as the acceptable intake rate for uranium was derived in an earlier report (IT 1989). What report is this? Has it been reviewed and validated?

COMMENT 120: Section 5.1, Page 5-3, Second Paragraph: The EE/CA must show how the acceptable daily intake of 2.7 ug/kg/day was derived and not just reference another

report. The EE/CA is an independent document and all exposure assumptions, including estimated daily intake and acceptable daily intake and calculations must be provided. The risk assessment evaluation must be consistent with U.S. EPA's Risk Assessment for Superfund, Volume I - Human Health Evaluation Manual (Part A).

RESPONSE TO COMMENTS 115 AND 120: The acceptable daily intake value of 2.7 ug/kg/day was derived from animal exposure data according to standard methods and is explained in detail in the cited report (IT 1989). Since the early drafts of this report were written, the U.S. EPA has established a reference dose for uranium of 3 ug/kg/day (U.S. EPA, [1989] Integrated Risk Information System [IRIS] computer data base). Use of the 2.7 ug/kg/day intake value gives a margin of health protection of 10 percent over use of the 3 ug/kg/day. Since there is now an established reference dose, the text (second paragraph, third sentence) will be changed to read:

The uranium chemical toxicity reference dose of 3 ug/kg/day is used as the acceptable intake rate (U.S. EPA 1989). Calculated Hazard Indices (HIs) will therefore be reduced by 10 percent throughout the text to be consistent with this change.

COMMENT 116: Section 5.1.1, Page 5-3: "Uranium isotopes...which exceed background concentrations in the off-site south plume." Explain why background concentrations are a basis for making a decision.

RESPONSE TO COMMENT 116: Background concentrations are not being used as a basis for making a decision, as indicated by the use of a uranium concentration of 33 ppb as the derived limit that forms the basis of the removal action. On the other hand, the statement that no other radioactive constituents exceed background levels in the south plume is important in establishing uranium as the only radiological contaminant of concern (see the response to Comment 13 and related comments). Constituents that are below background levels can be eliminated from consideration under the removal action without establishing derived, risk-based target levels as was done for uranium.

COMMENT 117: Section 5.1.1, Page 5-3: Data needs to be presented that supports the statement that "this condition has been generally satisfied...in support of the RI/FS."

RESPONSE TO COMMENT 117: Data will be presented in the EE/CA to support this statement.

COMMENT 118: Section 5.1.1, Page 5-3: Using a 730 l/yr water intake, a 50%/50% activity mix of uranium-238 and uranium-238, and conversion factors from Federal Guidance Document 11, a 19 pCi/l (29 ug/l) figure is calculated.

RESPONSE TO COMMENT 118: The radiation dose conversion factors for uranium-234, uranium-235, and uranium-238 presented in Federal Guidance Report No. 11 are 8.8 percent, 6.4 percent, and 10.9 percent higher, respectively, than the radiation dose conversion factors used from U.S. DOE/EH-0071 Internal Dose Conversion Factors for Calculation of Dose to the Public (July 1988). Hence, concentration limits for uranium in drinking water are approximately 10 percent lower when derived by use of the higher dose conversion factors. Differences in radiation dose conversion factors presented in these two reports are a consequence of round-off errors and minor differences in calculation models. See response to Comments 30, 34, 119.

COMMENT 121: Section 5.1.1, Page 5-3, Fourth paragraph: An explanation of the assumptions used to convert the U.S. DOE guideline of 4 mrem/yr into a groundwater concentration of 33 ug/l should be presented. Provide a regulatory citation for the 100 mrem limit in this paragraph.

RESPONSE TO COMMENT 121: See response to Comments 30, 34, and 119.

COMMENT 122: Section 5.1.1, Page 5-4, First paragraph: State the source of the derived concentration threshold (chemical toxicity) of 95 ug/l for uranium.

RESPONSE TO COMMENT 122: The text (1st paragraph, 1st sentence) will be changed to read:

A concentration of uranium in drinking water at the limit of 33 ug/l is less than the concentration threshold derived from the acceptable daily intake based on chemical toxicity.

For an adult (70 kg) assumed to ingest two liters of water per day, the acceptable daily intake of 3 ug/kg/day based on chemical toxicity (EPA 1989) corresponds to a drinking water concentration of 105 ug/l. This is also addressed in the response to Comments 30, 34, and 119.

COMMENT 123: Section 5.1.1, Page 5-4: A reference is required for the statement that "a concentration of...at the limit of 33 ug/l is below the derived concentration threshold of 95 ug/l for chemical toxicity in humans."

RESPONSE TO COMMENT 123: Two risk-based values for uranium were derived to establish a target level for the south plume removal action. The level based on radiological risk was 33 ppb, while that based on chemical toxicological risk was 95 ppb. As explained in the sentence following that cited in the comment, because the radiological-based limit is lower and represents the more health-protective case, it was selected as the chemical-specific TBC. The method by which the 33 ppb and 95 ppb values were derived is the subject of the responses to Comment 30 (and related comments) and Comment 122, respectively.

COMMENT 124: Section 5.1.1, Page 5-5: "The objective of plume control will be evaluated by an alternative, as well as the portion of the south plume that will be controlled. A precise quantification of this factor is limited by the remaining uncertainties as to the nature and extent of the leading, southern edge of the plume." How precise does this quantification need to be in order to initiate installation of the system? Why has this information not been obtained? U.S. EPA guidance calls for the EE/CA to provide a framework for evaluating and selecting alternative technologies (March 30, 1988).

COMMENT 126: Section 5.1.2, Page 5-5, Second paragraph: The meaning of "this factor" and "remaining uncertainties" in the last sentence should be specified.

RESPONSE TO COMMENTS 124 AND 126: "This factor" refers to the "degree of hydraulic control of plume migration being effected by an alternative", as identified in the preceding sentence that was misquoted in the comment. The "remaining uncertainties" refer to the fact that the leading edge of the plume is currently based on results of the calibrated solute transport model, as supported by limited confirmatory field data from both private wells along New Haven Road and a small number of monitoring wells that provide approximate bounds on the extent of the plume. It was recognized by both the U.S. DOE and the U.S. EPA that the preferred strategy would be to proceed with the EE/CA process in parallel with the installation and sampling of additional monitoring wells to confirm the southern limit of the south plume. The sequential use of field data and model results to help focus confirmatory sampling is a commonly practiced strategy, but in this case the timeliness of the removal action is forcing parallel efforts.

The impacts of this issue on the final selection of well locations were discussed in the response to Comments 95 and 157. The U.S. DOE agrees that the final selection of well locations and the installation of the wells must await the data from an approved monitoring well program in the south plume area and possibly additional wells if the involved agencies agree that more confirmatory information is still needed. Field confirmation will also be available as the interceptor wells and the upgradient monitoring wells are installed, and field adjustment of well location may be found to be necessary.

On the other hand, the U.S. DOE contends that the current understanding of the south plume is sufficient to support the selection of the alternative of pumping from the southern edge of the plume pending the final decision on well locations.

COMMENT 125: Section 5.1.2, Page 5-5: "There remains a lack of direct observations on both the chemical plume to the south of the FMPC and the degree to which the plumes have already mixed. Model results indicate, however, ..". Direct observations should be going on right now.

RESPONSE TO COMMENT 125: The Paddys Run Road Site RI/FS is underway and has completed installing wells. These wells were sampled in early May and data from the samples should become available in July 1990. In mid-May the FMPC RI/FS sampled piezometers installed by the Paddys Run RI/FS to determine the lateral extent of the area of elevated uranium as predicted by the modeling. In April all the FMPC RI/FS wells in the South Plume Area were sampled for full radiological and the general groundwater parameters. In addition four wells along Willey Road were sampled for full HSL parameters to verify that these materials are not leaving the FMPC property. All of these analyses should become available in late June or early July.

COMMENT 127: Section 5.1.2, Page 5-5, Fourth paragraph: The first and second sentences are contradictory. If the plumes have already mixed (first sentence), it is not clear how the model results can show otherwise (second sentence).

COMMENT 136: Section 5.2.2, Page 5-9: The statement that "plume mixing would also continue or would occur..." is confusing. An earlier reference to plume mixing indicates that there is none. Which is correct?

RESPONSE TO COMMENTS 127 AND 136: None of these statements are in fact contradictory, although refinement of the text will be introduced to eliminate the confusion. On page 5-5, the first sentence indicates that field data that would confirm

whether or not plume mixing has occurred is not yet available but is forthcoming. In the second sentence, the condition being assumed for purposes of the EE/CA (i.e., that no mixing has occurred or will occur) is stated along with the basis for the assumption (i.e., the model results). The statement cited in the comment from page 5-9 is taken out of context. It is qualified in the text by the conditional phrase "... if hydraulic conditions result in the crossing of the two migration paths." A statement that such hydraulic conditions are not expected will be added to page 5-9.

COMMENT 128: Section 5.1.4, Page 5-6, Second paragraph: The discount rate used throughout the EE/CA is 5 percent. The EPA EE/CA guidance specifies that a 10 percent discount rate is to be used.

RESPONSE TO COMMENT 128: The U.S. EPA Emergency Response Division (ERD) began preparing a second draft of the EE/CA guidance in 1988. The completion of this document was delayed pending the revisions to the National Contingency Plan. However, an expanded outline was prepared by ERD in the interim to assist Regions in preparing EE/CAs until the new draft was available. This outline recommends the use of a discount rate of 5 percent before taxes and after inflation. Reference: U.S. EPA Memorandum: From: Timothy Fields, Director, Emergency Response Division; To: Superfund Branch Chiefs, Region I-X and OHM Coordinators, Regions I-X, Subject: Outline of EE/CA Guidance, March 30, 1988; U.S. EPA Washington D.C.

The Draft 1987 EE/CA Guidance for Non-Time Critical Removal Actions does however, recommend a 10 percent discount factor. This rate can be changed from 5 percent to 10 percent in the document as requested, but should not affect the relative costs of alternatives.

COMMENT 129: Section 5.1.4, Page 5-6, Second paragraph: The text states that "...cost estimates are intended to provide an accuracy of $\pm$25 percent." While this level of accuracy is acceptable for preliminary RI/FS activities, the intent of an EE/CA is to provide a higher level of accuracy in cost estimation. Given that the objective an EE/CA is cost analysis, accuracy of $\pm$10-15 percent should be attainable.

RESPONSE TO COMMENT 129: The EE/CA is used to support the selection of a preferred removal action alternative the same as an RI/FS is used to support the selection of a preferred remedial action alternative. The U.S. DOE is not aware of any requirement for more accurate cost estimates in an EE/CA than in an RI/FS. Nevertheless, in the case of the south plume EE/CA, much of the cost information was derived from detailed cost estimates prepared for U.S. DOE and its contractors based on

conceptual designs for the conveyance and treatment units. The estimates are, therefore, more accurate than the goals established. In addition, the relative magnitude of the cost differential among the removal action alternative allows justification of the cost-effectiveness analysis whether or not the accuracy is within 25 percent or 10-15 percent of the actual costs.

COMMENT 131: Section 5.2.1, Page 5-6: The uranium concentrations and assumptions used throughout this section (and for all subsequent alternatives) to calculate radiation and uranium intake doses should be specified. Calculations should be presented either in the text or in an appendix for verification.

COMMENT 138: Section 5.3.1, Page 5-9, Fourth paragraph: Indicate the groundwater concentrations used to calculate doses for the drinking water pathway. It appears that the concentration is approximately 2.5 ug/l for maximum exposure. Since Alternative 2 is designed only to prevent exposure to concentrations above 33 ug/l, there is no justification for using this concentration as a maximum level.

COMMENT 151: Section 5.5.1, Page 5-17, First paragraph: The information on actual current releases should have been presented in an earlier subsection of Section 5. Exposure estimates should be based on these actual releases, rather than on discharge limits that may or may not be attained in the future.

RESPONSE TO COMMENTS 131, 138, and 151: The maximum exposed individual is assumed to drink 730 liters of water per year (i.e., two liter per day). The radiation dose conversion factor (50-year committed effective dose equivalent per unit intake) is 2.5×10^{-4} mrem/pCi (U.S. DOE. 1988). With a maximum measured concentration of 195 pCi/l, the calculated radiation dose is 36 mrem per year of intake.

For the average exposed individual, the daily intake is assumed to be one liter. The calculated radiation dose is 18 mrem per year of intake.

The assumed ingestion rate of water by the maximum exposed individual is two liters per day (730 liters per year). The concentration of uranium in the river water is calculated by assuming mixing at low flow conditions (as stated in the text). There is assumed to be a decrease in uranium concentration in drinking water when taken from the river for processing to a potable water condition. This assumption overestimates the radiation dose. In this case the above-background concentration of uranium in the river water is 1.7 pCi/l and is used for all four exposure pathways.

423

Calculations of liquid effluent releases and subsequent hypothetical radiation doses are based on the premise that concentration limits specified in U.S. DOE Order 5400.5 will be met. The text will be changed to include the assumption used in the calculations.

COMMENT 133: Section 5.2.1, Page 5-7, Third paragraph: List the mass of the uranium discharged by each user of contaminated groundwater. Specify how the figure of 1500 pounds of discharged uranium was calculated.

COMMENT 143: Section 5.4.1, Page 5-12, Fourth paragraph: The assumptions concerning the relative amounts of uranium discharged by FMPC and the industries along Paddy's Run Road are <u>not</u> described earlier in the EE/CA.

RESPONSE TO COMMENTS 133 AND 143: The mass of uranium discharged annually through the FMPC main effluent line has been estimated to be 1500 pounds. This value is based on an average flow rate of 0.576 mgd (page 2-5 of the EE/CA) at an average uranium concentration of 550 ppb (page 5-7 of the EE/CA). These values are representative of the conditions observed over the last several years at the FMPC. For the industry, a uranium loading of 30 pounds per year was estimated based on observed concentrations of about 40 ppb in the pumping well and a typical pumping rate of less than 200 gpm. (Note that the 30 pounds per year was used in the risk assessment as a potential discharge even though the treatment currently provided by the industry would eliminate such a discharge.) The 2 percent reduction cited on page 5-12 is based on eliminating the 30-pound contribution from the assumed 1530-pound total discharge.

COMMENT 139: Section 5.3.1, Page 5-10: The statement that the generation of uranium-bearing sludges would represent an additional public health or environmental concerns is not accurate, unless the site mismanages the sludges. This statement here, and elsewhere in the document (page 6-4) needs to be eliminated or clarified.

RESPONSE TO COMMENT 139: The statement that the uranium-bearing sludges would represent a public health and environmental concern will be eliminated based on the U.S. EPA's argument that this would only be true if the sludges were mismanaged. A statement that the sludges would represent an additional, continuous source of uranium-bearing wastes that will have to be addressed by U.S. DOE's long-term waste management plan for the FMPC will be added to the EE/CA. The anticipated volume of the sludge and the associated uranium concentration will also be added to the EE/CA report (see the response to Comment 94 and related comments).

83

423

COMMENT 141: Section 5.3.4, Page 5-12, Second paragraph: Section 5.3.3 implies that additional monitoring wells would be installed as a component of Alternative 2. Costs for these wells are not included in the cost estimate.

RESPONSE TO COMMENT 141: Alternative 2 does not include the installation of additional monitoring wells. Additional locations, outside the current monitoring network, may however, be sampled and analyzed. The text will be reworded to clarify the scope of Alternative 2.

COMMENT 142: Section 5.4, Page 5-12: Alternatives that evaluate an alternate water supply should include provisions for the proper abandonment of existing contaminated wells to assure that its used curtailed.

RESPONSE TO COMMENT 142: Provision of an alternate water supply is an action taken by U.S. DOE to prevent use of contaminated groundwater. Notification of the fact that the wells are contaminated and supply of an alternate water source would seem to be sufficient reasons for affected users to stop using contaminated water. It is, however, no guarantee and U.S. DOE is not aware of any statutory or legal authority it may have to force affected users to abandon existing wells.

COMMENT 144: Section 5.4.1, Pages 5-13, Second paragraph: Alternative 3 includes an alternate water supply and is more protective than Alternative 2. Thus, it is not clear why maximum and average doses for the drinking water pathway are the same for both alternatives.

RESPONSE TO COMMENT 144: The addition of an alternate water supply in Alternative 3 does provide for more effective public health protection than the monitoring and institutional controls proposed in Alternative 2, but only in terms of a higher probability that the necessary restrictions and controls can be implemented and maintained. That is, an alternate water supply provides a more proactive and secure method for eliminating the future use of contaminated groundwater. Within the context of the risk assessment, however, since no receptors are currently using the groundwater in the south plume as a drinking water source and it is assumed that each alternative will be effective in eliminating the future use of the affected groundwater, the calculated risk would be the same for both alternatives.

84

423

COMMENT 145: Section 5.4.2, Page 5-15: In the "Effectiveness: Other Factors" section, no mention is made of the potential need for U.S. Army Corps of Engineers permits for the stream crossing.

COMMENT 172: Section 5.7.2, Page 5-31: "In addition, a Corps of Engineers (COE) wetlands permit may be required for the stream crossings necessary for the alternate water supply in Alternatives 3, 4, and 5." Will these activities be considered off-site?

RESPONSE TO COMMENTS 145 AND 172: The potential need for a Corps of Engineers permit for the stream crossing is in fact cited on the bottom of page 5-14 and the top of page 5-15. The U.S. DOE's interpretation of the "site" in terms of permitting requirements under CERCLA did not consider the stream crossing as an on-site activity, but one could argue that the known releases of uranium into Paddys Run and the subsequent releases from Paddys Run into the underlying aquifer could qualify the stream as part of the site. This issue requires resolution among the involved agencies.

The reference to a wetlands permit on page 5-31 would be similarly affected by the definition of the site. It is important to note, however, that the wetland area identification effort recently completed concluded that the Paddys Run corridor did not contain jurisdictional wetlands. Consequently, the EE/CA will be corrected by eliminating any references to wetland permits. Paddys Run is still classified as a "water of the United States," however, and the potential need for a Section 404 permit for dredge and fill activities associated with the stream crossing remains a consideration.

COMMENT 146: Section 5.4.4, Page 5-16, First paragraph: Capital costs should include the cost of additional monitoring wells mentioned in the previous paragraph.

RESPONSE TO COMMENT 146: The cost estimate does include the cost of installing 12 new monitoring wells under Alternative 3. This will be clarified in the text.

COMMENT 147: Section 5.5.1, Page 5-16, Fourth paragraph: The estimated uranium discharge for the first year is too low. Figure A-8 indicates that the average uranium concentration in water withdrawn from the aquifer will be approximately 10 ug/l, assuming equal pumping of all four wells. Assuming continuous operation, and using the relationship between ug/l and pCi/l on page 5-3, the annual loading discharged into the river will increase approximately 27 mCi rather than 6 mCi.

85

RESPONSE TO COMMENT 147: The value in question was erroneously typed as 446 mCi rather than 466 mCi. This error will be corrected.

COMMENT 148: Section 5.5.1, Page 5-16, Fourth paragraph: Figure A-9 shows the annual uranium loading to the Great Miami River during the fifth year will be 2,150 pounds, not 1,750 pounds.

RESPONSE TO COMMENT 148: Figure A-9 shows that the total uranium loading from all four wells during the fifth year of pumping will be 250 pounds (830 pounds - 580 pounds). When added to the 1500 pounds of uranium contributed by the existing discharges from the FMPC, the total uranium loading during the fifth year will be 1750 pounds as stated on page 5-16.

COMMENT 150: Section 5.5.1, Page 5-16, Fourth paragraph: Current release estimates for uranium in paragraph 1 (440 mCi/1500 pounds) differ from estimates on page 5-8 (448 mCi/1500 pounds).

RESPONSE TO COMMENT 150: For the purpose of this assessment, it is assumed that the concentration of uranium in the liquid effluent is 550 pCi/l in accordance with U.S. DOE Order 5400.5. The liquid effluent average flow rate is approximately 0.89 cfs (25 l/s) (WMCO 1988). The annual release of uranium calculated from these parameters is approximately 434 mCi. Because of the overall uncertainties in these parameters, an approximate value for the annual quantity or uranium released via the liquid effluent is 430 mCi. This is converted to a mass by use of the specific activity (activity per mass) for uranium. Since the specific activity depends on the ratios of uranium isotopes, the ratio for uranium isotopes is assumed to be the same as for natural uranium. The specific activity of natural uranium is approximately 1 mCi per 1.5 kg. This is equal to approximately 1 mCi per 3.30 pounds. Therefore, a uranium release of 430 mCi is equal to 1,420 pounds.

Released quantities, in units of activity (mCi) or weight (pounds), of liquid effluents presented in this report reflect the overall uncertainty in these values and hence are rounded values. Use of more significant figures implies an accuracy not attainable for these reported quantities.

The text will be made to be internally consistent, but will indicate approximate values wherever necessary.

423

COMMENT 152: Section 5.5.1, Page 5-17, First paragraph: Diluting the current FMPC discharge with contaminated water extracted from the aquifer will lower the release concentration, but it will increase the total mass of uranium discharged.

RESPONSE TO COMMENT 152: The statement made in this comment is true and consistent with the information presented in the EE/CA report (e.g., see the bottom of page 5-16 and the top of page 5-17).

COMMENT 153: Section 5.5.1, Page 5-17, Second paragraph: Under Alternative 4, the amount of uranium entering the Great Miami River will increase, compared to Alternative 1 (no action). It is, therefore, not clear how doses from exposure to river water can decrease from 0.8/0.4 mrem to 0.7/0.3 mrem.

COMMENT 154: Section 5.5.1, Page 5-17, Third paragraph: Alternative 4 involves extracting contaminated water from the aquifer. If the amount of contaminated water decreases, it is not clear why maximum doses for the drinking water pathway should increase compared to Alternative 2 and 3.

RESPONSE TO COMMENTS 153 AND 154: The above-background concentration of uranium in the river following dilution at low flow condition is slightly higher for each of the five years for Alternative 4 then for Alternative 1. The text will be changed to reflect these corrections, as well as to include calculated above-background concentrations of uranium. Table ES-1 will be revised to included these concentrations:

87

ALTERNATIVE	NET URANIUM CONCENTRATION ABOVE-BACKGROUND (pCi/l)	RADIATION DOSE (mrem) DRINKING WATER MAXIMUM	DRINKING WATER AVERAGE	ALL PATHWAYS MAXIMUM	ALL PATHWAYS AVERAGE
1	1.7	0.31	0.16	0.67	0.34
2	1.7	0.31	0.16	0.67	0.34
3	1.7	0.31	0.16	0.67	0.34
4 year 1	1.8	0.33	0.16	0.71	0.35
4 year 2	1.9	0.35	0.17	0.75	0.37
4 year 3	1.9	0.35	0.17	0.75	0.37
4 year 4	2.0	0.37	0.18	0.79	0.40
4 year 5	3.0	0.37	0.18	0.79	0.40
5	1.7	0.31	0.16	0.67	0.34

These calculated doses are listed to two significant figures and should be rounded to one significant figure. Rounding off values are essentially the same as those currently in the text, but the text will be revised with these new values. Also see response to Comments 131 and 138.

COMMENT 156: Section 5.5.2, Page 5-18, Second paragraph: The basis for the conclusion that there will be an "improve(d) environmental condition for aquatic biota" is not clear. Under Alternative 4, the amount of uranium discharged to the Great Miami River will increase, even if the concentration of the discharge will be lower. Any hypothetical concentration effect will be negligible given the flow rate of the discharge (4.5 cfs) compared to the river flow (3,460 cfs).

RESPONSE TO COMMENT 156: Data collected to date from the Great Miami River indicates that essentially all the uranium is in a soluble (non-filterable) form. The same condition is expected for any uranium in groundwater pumped from the south plume. Under such conditions, the impacts on aquatic biota would be more dependent on the concentration of uranium in the water column than on the total mass flow of uranium. Although U.S. DOE agrees that any benefits that would result from a 550 percent decrease in concentration in the effluent would be minimal and likely not discernible due to the high flow rate in the river, the statement that an improved condition may result is valid. Credit for this environmental improvement was not significant in the decision to select Alternative 4 as the preferred alternative. Of more importance is that the future conditions under Alternative 4 will not result in an incremental adverse effect on the aquatic biota.

COMMENT 158: Section 5.5.2, Page 5-19, Second paragraph: The construction period time frame has not been changed from 6 months to 12 months. No change in the costs of Alternative 4 has been noted as a result of this change.

RESPONSE TO COMMENT 158: During earlier drafts of the EE/CA, the location of the supply wells was the center of the plume. The draft issued in December 1989, which was provided as a courtesy to EPA, was based on the wells being located at the "leading edge of the plume." The capital cost, $7.4 million, was based on this well location. However, the draft did not reflect anticipated increases in the schedule. This was corrected in the EE/CA, which was forwarded to U.S EPA in April 1990. Both the cost and schedule estimates are based on the conceptual design. As the design progresses through Title I and II, these estimates will be updated.

COMMENT 161: Section 5.6.1, Page 5-21, Second paragraph: It is not clear why hazard indices for Alternative 5 (which includes treatment and reduced uranium loadings to the Great Miami River) exceed the hazard indices for Alternative 4 (Page 5-20).

RESPONSE TO COMMENT 161: Based on the values reported on pages 5-17 and 5-21 for Alternatives 4 and 5, respectively, the hazard indices for Alternative 5 do not exceed those for Alternative 4. The two sets of values are reported to be the same for the two alternatives. Even though a reduction in uranium loadings to the Great Miami River would result under Alternative 5, the effect of this reduction on the concentration of uranium in the river would be small and the risk values based on the resultant concentrations would show very little change from those associated with Alternative 4. It is indicated on page 5-17 that the risk values may be indistinguishable among alternatives due to the rounding off of the numbers to the third decimal point.

COMMENT 165: Section 5.6, Page 23: On page 19, the following statement is made: "Minimal access to and easement across other properties will be required." Is this also true of Alternative 5?

RESPONSE TO COMMENT 165: The statement is also applicable to Alternative 5 and will added to Section 5.6.3.

COMMENT 167: Table 5.1: This table contains no air emissions standards. Would no ARARs exist for the process of operation.

RESPONSE TO COMMENT 167: The only ARARs pertaining to air emissions for the proposed alternatives in the EE/CA would be the control of fugitive dust. These requirements are covered by OAC-3745-17-08 which is listed in Table 5-1. The state of Ohio has been delegated by U.S. EPA authority under the Clean Air Act to regulate air quality in Ohio with the exception of air standards for radionuclides. No emissions will result from the use of ion exchange in Alternative 5.

COMMENT 168: Table 5.1, Page 5-26: Are any wetlands located within the South Plume area?

RESPONSE TO COMMENT 168: Wetlands do exist within the boundary of the FMPC, which is the limit of a wetlands delineation study conducted by U.S. DOE. Based on this information, it cannot be concluded that wetlands exist in areas potentially impacted by the South Plume removal action. Therefore, an ARAR for the protection of wetlands would be relevant and appropriate to insure that wetlands are properly identified and protected.

COMMENT 169: Table 5.1, Page 5-28: The EE/CA did not consider any alternatives that includes the re-injection of groundwater. Where is such an alternative considered? If so, it is not on-site such that only substantive requirements need be met? The second ARAR should be deleted.

RESPONSE TO COMMENT 169: The U.S. EPA's statement that the EE/CA did not consider any alternatives that include reinjection of groundwater is correct. The requirement for underground injection control will be eliminated from Table 5-1. Plume control via the use of injection wells is considered in the RI/FS under Operable Unit 5.

COMMENT 170: Table 5.1, Page 5-28: Operable Unit 6 is listed under the sixth ARAR. This requires revision.

RESPONSE TO COMMENT 170: The reference to Operable Unit 6 has been eliminated from Table 5-1.

COMMENT 171: Table 5.1, Page 5-30: "Established cleanup standards for inactive uranium mill tailing sites; some standards may be applicable to the FMPC remedial response". What are they? Some others be relevant and appropriate.

RESPONSE TO COMMENT 171: 40 CFR 192 applies standards of protection for human health and the environment to uranium processing site management and to remedial actions at inactive uranium processing sites. The standards are designed to limit releases of Radon-222 from residual radioactive material to the atmosphere but not necessarily to groundwater and are applicable to remedial actions (long term) as opposed to removal actions. However, among the purposes of the regulation is to "...inhibit the misuse and

spreading of radioactive materials...and to protect water" (40 CFR 190.20(a)(1)). 40 CFR 190.20(a)(3) addresses steps that should be taken to assess and remediate groundwater contaminated by releases of contaminants from a tailings pile. This regulation may be relevant and appropriate though not legally applicable to some of the proposed alternatives for the South Plume removal action.

COMMENT 173: Section 5.7.3, page 5-31: A reference is made to supervision by the U.S. Nuclear Regulatory Commission (NRC) of actions taken as a result of releases from FMPC. The NRC authority and requirements should be clearly delineated.

RESPONSE TO COMMENT 173: The text has been revised to eliminate the reference to supervision by NRC.

COMMENT 174: Section 5.7.3, Action-Specific ARARs and TBCs: "...are also subject to U.S. EPA pursuant to 40 CFR 264 and 40 CFR 300." The process and operation are also subject to 40 CFR 262.

RESPONSE TO COMMENT 174: 40 CFR 262 is applicable to the extent that U.S. DOE becomes a generator of hazardous wastes as a result of the treatment process under Alternative 5.

COMMENT 175: Section 5.7.3, Page 5-32: "Management of residuals from the treatment and disposal actions will be regulated under the NRC land disposal rules (10 CFR 62) and U.S. DOE Order 5820.2." If these residuals contain hazardous wastes, the hazardous waste portion of those residuals are subject to the 40 CFR 268 Land Disposal Restrictions.

RESPONSE TO COMMENT 175: U.S. DOE agrees that 40 CFR 268 is applicable only if a listed or characteristic waste is generated as a result of treatment under Alternative 5.

COMMENT 176: Section 6.3, Page 6-2: As stated, the pump and treat alternative has been given slightly higher preference due to reduction in discharge concentrations. The preference of CERCLA for treatment and U.S. DOE's Guide 5400.5 requirement for treatment is not addressed in the EE/CA.

RESPONSE TO COMMENT 176: According to the U.S. EPA's CERCLA decision process, the preference for treatment applies only after the statutory requirement for cost-effectiveness has been satisfied. That is, the alternatives are first evaluated for relative cost-effectiveness and those for which the costs greatly exceed the costs of other alternatives that provide a similar level of protection are deleted from further consideration. Only from among those alternatives that remain would the alternative that maximizes the use of permanent solutions (i.e., treatment) be selected as the preferred

alternative. It is also important to note that a removal action is not required to satisfy the preference for permanent solutions under CERCLA/SARA, as long as the selected removal action does not prevent the future selection of permanent solutions in the RI/FS and the preference for permanent solutions is satisfied in the selection of the final action.

The cost-effectiveness evaluation for the south plume removal action alternatives is summarized on the attached figure. As indicated, Alternative 3 could in fact be supported as the only cost-effective alternative. However, because U.S. DOE's own exposure guidelines are being violated by the presence of uranium exceeding 33 ppb at off-site locations, a decision was made to implement groundwater pumping as a minimum removal action. On the other hand, the inclusion of treatment in Alternative 5 cannot be supported in terms of the benefits gained for the more than doubling of the costs. It must be recalled that Alternative 5 is based on the use of the advanced wastewater treatment plant for treating an equivalent mass of uranium. To proceed with a separate treatment system for the groundwater pumped from the south plume would result in a present worth cost of approximately $60 million, far exceeding the benefit gained by the removal of uranium that would not pose an unacceptable risk without treatment.

The requirement for treatment of liquid waste streams in U.S. DOE Order 5400.5 is based on the ALARA principle, which also requires consideration of economic factors in evaluating the need for treatment. It is specifically stated in the Order that treatment would likely not be required if the discharge satisfies U.S. DOE's guidelines without treatment. The discharge from the south plume wells would satisfy the guidelines. It is recognized that the FMPC discharge currently exceeds the U.S. DOE guidelines, but the advanced wastewater treatment plant is being planned to correct this noncompliance and to satisfy the requirements of U.S. DOE Order 5400.5.

COMMENT 179: Section 6.3, Page 6-3, Third paragraph: This paragraph should further describe "ongoing plans for a more comprehensive and effective treatment facility" and should state when the facility will be completed. Documentation that this facility will provide effective treatment should also be provided.

RESPONSE TO COMMENT 179: The FMPC is currently involved in the design of an Advanced Wastewater Treatment (AWWT) Facility for treating various wastewater streams at the FMPC. Title I design of this facility was initiated in June 1990. Based on the conceptual design studies and preliminary testing of several technologies, the facility is conceived to consist of two major systems. One system is being designed to process 700 gpm of water from the Storm Water Retention Basin (SWRB) and the Storm Sewer Lift Station (SSLS). The other system is being designed to treat 400 gpm of process wastewater. The AWWT is not designed to treat any of the water resulting from the removal or remediation activities associated with the contaminated aquifer.

The system for treating the flow from the SWRB, as currently conceived, will consist of sand filtration, for removal of suspended solids, and ion exchange, for removal of uranium. Some chemical pretreatment may also be included in the system. The ion exchange process is estimated to reduce the water from the SWRB from about 800 ppb uranium to less than 20 ppb uranium in the discharge stream. The use of ion exchange for uranium removal has been well documented. A specific reference is: A. Himsley and J. A. Bennett, "Uranium Recovery from Mine Water Treatment, A Case History," Canadian-American Chemical Congress, Montreal, June 1984. There are existing commercial facilities which remove uranium from aqueous streams, for both pollution control and uranium recovery. Additional testing will be conducted prior to the detailed design of the AWWT. The 700 gpm flow rate is based on the required flow to minimize overflow events in the SWRB from sequential rainfall events.

The system for treating the process wastewater, as currently conceived, will also include sand filtration and ion exchange. In addition to these technologies, it could include chemical pretreatment, carbon filtration, and reverse osmosis. The carbon filtration would be used to remove organics. The reverse osmosis would be used to remove various inorganics from the streams prior to release. The reverse osmosis unit would be used to ensure satisfying the limits for other contaminants required by the NPDES permit. The use of reverse osmosis for removal of inorganic contaminants is based on numerous existing commercial operations.

Preliminary testing has recently been completed that confirms the use of these technologies will substantially reduce the mass of uranium in the FMPC discharge stream. Additional testing is planned to establish the configuration that will be used in the detailed design of the system.

The AWWT facility is currently estimated to be on line in February 1994. The current capital cost estimates, based on the conceptual design, for the SWRB portion is approximately $10 million and for the process portion about $15 to 20 million. Included in these estimates is a 25 percent contingency.

The capacity of the AWWT is not adequate to treat the anticipated flow from the South Plume. However, when the water level in the SWRB is below minimum, a portion (700 gpm) of the flow from the South Plum could be treated in the SWRB portion of the AWWT.

COMMENT 180: Section 6.4, Page 6-4: It is unclear that the treatment option will not be necessary to be protective of public health and the environment in the future. Removal actions shall, to the extent practicable, contribute to the efficient performance of any

anticipated long-term remedial action with respect to the release concerned (40 CFR 300.415(c)).

RESPONSE TO COMMENT 180: The effectiveness of the various alternatives in satisfying the public health and environmental objectives was addressed in detail in the EE/CA report. The alternative of pumping without treatment was shown to meet the target levels established for the south plume removal action. Therefore, based on the criteria defined by the selected target levels, treatment would not be required for protection of public health and the environment. The target levels themselves have been challenged by the U.S. EPA, but U.S. DOE holds to its position that the levels are both protective of public health and the environment and consistent with identified ARARs and precedents at other sites (see the response to Comment 30 and related comments).

COMMENT 183: Appendix: Portions of the appendix would be more appropriate for the main text of the document.

RESPONSE TO COMMENT 183: While there is no right or wrong answer to this issue, U.S. DOE established the basic structure of the EE/CA report to highlight the most important issues and information in the main body of the text. The detailed backup information is then made available in an appendix for those individuals interested in pursuing the details.

COMMENT 184: Section A.3.0, Model calibration: The values that were used for hydraulic conductivity and recharge are required to be presented. An explanation on how these values were derived should also be presented. This information is necessary for evaluation of the modeling. Terms, such as, "reasonable estimates" are too vague to be of any use.

COMMENT 185: Section A.3.0: An explanation of the interaction between surface water and groundwater in the model is required. An explanation of how the primary sources areas, Paddys Run and drainage ditch, were addressed in the model is required.

RESPONSE TO COMMENTS 184 AND 185: Values used for hydraulic conductivity and recharge will be presented, along with an explanation on how these values were derived. We will also provide an explanation of the interaction between surface water and groundwater in the model. A brief explanation of how source areas were addressed in the model is given on page A-7. We will provide additional explanation. We note that

the models used to evaluate the alternatives discussed in the EE/CA report are complex. As mentioned in Section A.2.0, we are preparing a separate report that describes the model and its development. As mentioned on pages 6-5 and A-3, we are also completing a more refined calibration of the solute transport model. The model report will contain over 100 pages of text, more than 18 tables, and over 60 figures. We will supply copies of the model report at a date that is appropriate for the RI/FS. Meanwhile, we will attempt to provide sufficient information for the purposes of the interim removal action.

The Draft 1987 EE/CA Guidance for Non-Time Critical Removal Actions does however, recommend a 10 percent discount factor. This rate can be changed from 5 percent to 10 percent in the document as requested.

423

RESPONSE TO COMMENTS
SOUTH PLUME EE/CA
OHIO ENVIRONMENTAL PROTECTION AGENCY

GENERAL COMMENTS

COMMENT 1: Based on our review of the field data and groundwater flow and uranium transport analysis presented in the IT report. We agree conceptually that the proposed groundwater extraction is consistent with the stated removal action objectives.

RESPONSE TO COMMENT 1: U.S. DOE accepts the OEPA's agreement of the consistency of the proposed groundwater extraction system with the removal action objectives.

COMMENT 2: The model application is too poorly documented in the IT report to permit a thorough understanding of review of the simulated results. A thorough documentation of the model and its underlying bases should be presented prior to selection of a final groundwater recovery design.

RESPONSE TO COMMENT 2: See responses to U.S. EPA Comments 73, 184, and 185.

COMMENT 3: As noted, field data limitations hinder the ability to adequately assess the reliability and accuracy of the specific design of the proposed remedial action.

RESPONSE TO COMMENT 3: See response to U.S. EPA Comment 95 and related comments.

COMMENT 4: The planned future field data acquisition during the RI/FS and refinement of the model should resolve issues relating to well placement, extraction rates and remedial action duration.

RESPONSE TO COMMENT 4: See response to U.S. EPA Comment 95 and related comments.

96

COMMENT 5: U.S. DOE proposes Alternative 4, rather than Alternative 5, due to:

- the cost of providing additional effluent treatment (Alternative 5);
- the redundancy of such an expense with plans to construct a more comprehensive and effective wastewater treatment facility at FMPC, and,
- the expectation that uranium concentrations in the extracted groundwater will be relatively low during the early years of pumping

This rationale provokes the following questions:

- can loadings to the effluent pipeline be reduced in a less costly manner by more effective use of existing treatment capabilities and/or by modification of current production and wastewater management practices?
- can less costly effluent treatment processes be implemented that will not be redundant with future construction of a new wastewater facility?
- what happens if much higher-than-expected uranium concentrations are pumped prior to completion of the planned FMPC wastewater treatment facility?

RESPONSE TO COMMENT 5: The existing water treatment facilities are not capable of further reduction of uranium concentrations. However, the FMPC is investigating concepts that would involve slight modifications and would provide for uranium removal. To address the second question of this comment, see the responses to U.S. EPA Comments 86, 87, and related comments. The third question is addressed by the response to U.S. EPA Comment 84 and related comments.

COMMENT 6: The proposed pipeline location is advantageous because it backtracks through an area where the groundwater is already contaminated and because releases from much of the proposed pipeline would be within the capture zone of the recovery well system.

RESPONSE TO COMMENT 6: U.S. DOE concurs with this comment by the OEPA. In addition, the proposed pipeline location is advantageous for several other reasons as discussed in the response to U.S. EPA Comments 84, 85, 96, and 101.

COMMENT 7: A uranium concentration of 37 ug/l was detected in Well 2127 adjacent to Paddys Run south of Fernald. What additional work will be done to investigate the potential presence of uranium in groundwater that may have been contaminated from Paddys Run south of the southern plume?

RESPONSE TO COMMENT 7: See response to U.S. EPA Comment 39 and related comments.

SPECIFIC COMMENTS

COMMENT 1: Executive Summary, Page 2, First paragraph: The last sentence in this paragraph is misleading. The NCP was finalized in March 1990 and therefore, there are no proposed revisions pending. This last sentence should be changed as follows: "Additionally, based on the recent (March 1990) revisions to the NCP, removal actions..."

RESPONSE TO COMMENT 1: The first draft of the South Plume EE/CA was written before the revisions to the NCP were finalized. This sentence will be changed to reflect the finalization of the NCP in March 1990.

COMMENT 2: Executive Summary, Page 4, First paragraph: U.S. DOE must use the most current analytical data available as part of their evaluation of the south plume removal action. The most recent data that is used in this EE/CA is more than 9 months old. Surely conditions have changed somewhat since then which will effect assumptions that are used in the EE/CA.

RESPONSE TO COMMENT 2: See response to U.S. EPA Comments 24 and related comments.

COMMENT 3: Executive Summary, Page 5, Second full paragraph: The EE/CA must discuss the basis for and appropriateness of using the U.S. DOE Derived Concentration Guide's 50-year committed effective dose equivalent limit of 4 mrem for setting a removal action limit of 33 ug/l for uranium in groundwater. This 33 ug/l limit represents approxi-

mately 1 x 10^{-4} excess lifetime cancer risk level or uranium. While this may be acceptable for use in the removal action as an interim action criterion, this is well above the 1 x 10^{-6} risk level that the NCP uses as the point of departure for assessing long-term cleanup goals and will likely be unacceptable to Ohio EPA if used as a standard for long-term cleanup of either on-site or off-site groundwater. In addition, current U.S. EPA risk assessment guidance (see Comment 13 below) requires the use of 72 years as the lifetime for exposed years, not 50 years as is used in this EE/CA.

RESPONSE TO COMMENT 3: See response to U.S. EPA Comment 30 and related comments concerning the use of 33 ug/l limit for uranium in groundwater. As stated in Section 5.1.1, the calculated radiation doses are the committed effective dose equivalents (50-year) as a consequence of intake for one year.

COMMENT 4: Section 1.0, Introduction, Page 2, top partial paragraph: See Comment 1 above.

RESPONSE TO COMMENT 4: See response to OEPA Specific Comment 1.

COMMENT 5: Section 2.3, Analytical Data, Page 25, First paragraph: See Comment 2 above.

RESPONSE TO COMMENT 5: See response to OEPA Specific Comment 2.

COMMENT 6: Section 2.3, Table 2.2: Analytical data on uranium from sampling rounds 7 and 8 which should be available by now, should be included in the EE/CA.

RESPONSE TO COMMENT 6: See response to U.S. EPA Comments 24, 32, 43, and 44.

COMMENT 7: Tables 2.3, 2.4, 2.5: It is incredible that data validation for sampling rounds 5 and 6 are still not complete. These sampling rounds were conducted from 9 months to over a year ago!

RESPONSE TO COMMENT 7: The data from Rounds 5 and 6 have been verified and laboratory validation is complete. However, complete validation of the data is still in progress.

COMMENT 8: Section 2.4.3.3, Potential Receptors, Page 45, Last paragraph: A third potential future receptor of uranium in groundwater south of the FMPC would include any individual who may install a well for potable use, crop irrigation or livestock feeding from areas located within the existing south plume. In addition, under the no action alternative, future unrestricted potable use of private and industrial wells which exist and have been found to be contaminated with uranium at levels exceeding established health or risk-based criteria, must also be considered. Wells falling into this category would include 2060, 2061, and 3062.

RESPONSE TO COMMENT 8: See response to U.S. EPA Comments 61 and 62.

COMMENT 9: Section 4.2.3, Last paragraph: Has U.S. DOE explored the possibility of speeding up the process of bringing a public water supply to Crosby Township?

RESPONSE TO COMMENT 9: U.S. DOE is currently evaluating the possibility of a public water supply for Crosby Township from Cincinnati or the Butler Water Authority.

COMMENT 10: Section 4.2.4.1: Has U.S. DOE considered the option of pumping from both the center of the plume (to remove the highest concentrations) and the leading edge (to control plume movement)?

RESPONSE TO COMMENT 10: See response to U.S. EPA Comments 77, 79, and 182.

COMMENT 11: Section 4.2.4.3: Discuss the discharge options of discharging directly south to the Great Miami River and via Manhole 175 in greater detail. This discussion should include costs, administrative controls, etc., to justify U.S. DOE's decision to pump the groundwater back to FMPC.

RESPONSE TO COMMENT 11: See response to U.S. EPA Comments 84, 85, 96, and 101.

COMMENT 12: Section 4.2.4.6, Alternative 5: Has U.S. DOE considered the option of treating the contaminated groundwater with an anion exchange system for uranium removal?

RESPONSE TO COMMENT 12: U.S. DOE has considered the use of an anion exchange system for uranium removal in groundwater, and has reviewed available technologies as part of the design process for the advanced wastewater treatment (AWWT) plant. The current design is an anion exchange using a reference resin of DOWEX21K at a pH of 8.

COMMENT 13: Section 5.1, Evaluation Criteria, Page 3: The EE/CA must show how the acceptable daily intake of 2.7 ug/kg/day was derived and not just reference another report. The EE/CA is a stand alone document and all exposure assumptions (such as the estimated daily intake and acceptable daily intake) and attendant calculations must be provided. In addition, the risk assessment must be consistent with U.S. EPA's document titled: Risk Assessment for Superfund, Volume I--Human Health Evaluation Manual (Part A). (Also see Comment 3 above.)

RESPONSE TO COMMENT 13: See response to U.S. EPA Comments 115 and 120 for an explanation of the acceptable daily intake. The response to U.S. EPA Comment 14 addresses the concern of consistency of the risk assessment with the U.S. EPA method.

COMMENT 14: Section 5.2.1, Pages 6 nd 7: The EE/CA must show how radiation doses were calculated for the drinking water pathway as well as for all pathways for both the hypothetical maximally exposed off-site receptor (35 mrem and 88 mrem, respectively) and for the average exposed off-site receptor (18 mrem and 47 mrem, respectively). The individual data that was used to calculate average exposure conditions must also be provided as it is unclear what data was averaged or how it was averaged.

RESPONSE TO COMMENT 14: See response to U.S. EPA Comment 2 and related comments.

COMMENT 15: Section 5.2, Page 8, Second paragraph: The EE/CA must show how the Hazard Indices were calculated for the exposed individuals mentioned here.

RESPONSE TO COMMENT 15: See response to U.S. EPA Comment 2 and related comments.

COMMENT 16: Section 5.6.2: Discuss the impact of this increased flow (4.5 CFS) on the capacity of the effluent line. What is the ultimate capacity of the effluent line? As more contaminated water is treated from the site (waste pits, stormwater, production area), will the effluent line become overloaded?

RESPONSE TO COMMENT 16: See response to U.S. EPA Comment 41.

COMMENT 17: Section 5.6.2: Aquatic and public health impacts are usually evaluated at critical low flows (30-day, 10-year low flows) to determine worst case. Low flow in the Great Miami River should also be used along with average flows for these determinations.

RESPONSE TO COMMENT 17: Aquatic and public health impacts were evaluated using low flow conditions (7-day, 10-year low flow) in the Great Miami River as stated on Page 5-7 of the text. Calculations will be done considering critical low flow (30-day, 10-year low flow). Use of the average flow would result in less risk.

COMMENT 18: Section 5.3.1, Page 10: Calculations and assumptions used in the calculations on this page for determining maximally and average exposures to off-site receptors must be provided. It is difficult to provide a meaningful review of this document when this information is not given.

RESPONSE TO COMMENT 18: See response to U.S. EPA Comment 2 and related comments.

COMMENT 19: Section 5.4, Alternative Water Supply: Alternatives which evaluate an alternate water supply should include provisions for the proper abandonment of existing contaminated water supply wells to discourage any use of this contaminated water. For various reasons, some individuals will continue to use an old well that is contaminated even though an alternate supply has been provided.

RESPONSE TO COMMENT 19: See response to U.S. EPA Comment 142.

COMMENT 20: Section 6.0: What is the estimated time difference for implementation between Alternate 4 and Alternate 5.

RESPONSE TO COMMENT 20: The estimated time difference between Alternatives 4 and 5 is four months. Alternative 4 (Pump and Discharge) will be operational within 16 months and it is estimated that treatment can begin under Alternative 5 in 20 months.

COMMENT 21: Appendix A: It appears, based on groundwater modeling of the proposed extraction system for the south plume, that contaminants from the Paddys Run Road site will be drawn into the U.S. DOE interceptor wells. The effects of this scenario must be taken into account by U.S. DOE before such an extraction system is implemented. Further, installation of the south plume interception system should be coordinated closely with the Paddys Run Road site companies so as not to adversely impact the progress of the RI/FS or potential future remedial actions at that site.

RESPONSE TO COMMENT 21: Figure A-5 shows where particles will be drawn from to the pumping wells. From this model run, it is not expected that contaminants from the Paddys Run road site will be captured. The drawdown shown in Figure A-6 should not be mistaken as the area from which contaminants will be drawn but instead only where the groundwater table will be lowered. Additionally, particle tracking runs will be conducted for final placement of the pumping wells.

COMMENT 22: Appendix A: What is the chemical form or complex of the uranium found in the south plume?

RESPONSE TO COMMENT 22: Geochemical modeling using EQ3NR code indicates that the expected uranium complexes in groundwater recovered from Fernald monitoring wells are dominantly $UO_2(CO_3)_3^{-4}$ and $UO_2(CO_3)_2^{-2}$. $UO_2(H_2PO_4)_3$ may form when phosphorous is present (IT Corporation, 1989).

COMMENT 23: Appendix A: Discuss the potential impacts of the high concentrations of phosphorus in the groundwater around the Paddys Run Road site on the mobility of uranium if the two plumes overlap or if one plume is drawn into the other through this removal action.

RESPONSE TO COMMENT 23: The high concentrations of phosphorus in the groundwater around the Paddys Run Road site could increase the mobility of uranium if the two plumes mix. We expect uranium to be extracted from the plume regardless of whether it is mobilized by high phosphate concentrations.

DETAILED COMMENTS ON MODEL APPLICATION

COMMENT 24: There are twelve blocks in the northern section of the grid in which the block thickness of layer 3 is negative 1.0 feet. This is, of course, incorrect, but probably does not impact the transport analysis because the waste is not near this area. The cause for the negative thickness probably results from an auxiliary calculation in a spreadsheet or other format in which elevation data are calculated from thickness or thicknesses from elevation files. Either way, the result should be consistent and non-negative block thickness for input to the model.

RESPONSE TO COMMENT 24: This error will be corrected and its impact on model results quantitatively analyzed. We expect no significant impact.

COMMENT 25: The geologic structure is not presented. There are numerous features in the layering of the grid (as interpreted from the input data files) that are not presented. It is important to present the geologic interpretation and conceptual model. As an example, the attached figure displays the grid through column 12 which corresponds approximately to Section D-D'. While most of the hydrostatic structure is very important to the flow and transport analysis; other features are unnecessarily included, but they do not contribute to the realism of the model. For example, there is a crescent shaped anticlinal structure in layers 3, 4, and 5 in the southwest corner (J=12-30). The rise is approximately 13 feet. The impact of this feature on the assessment of the remedial alternative is probably minor.

RESPONSE TO COMMENT 25: We do not think any important geologic structural features are present in the model area. We will perform computer mapping of the elevation of the surfaces of layers 2 through 5 to verify that no significant anomalies are present.

COMMENT 26: Incomplete data files do not allow confirmation of the water supply wells. The two wells AW-3 and AW-4 in the two files provided (no action and pump & treat) are pumping continuously at 112 gpm throughout the 5-year predictive simulation. The data file for an alternate water supply was not provided and could not be reviewed.

RESPONSE TO COMMENT 26: IT is willing to accommodate reasonable requests for data files. We will review the simulated rates and durations of pumping of the water supply wells to verify that they are correctly reported.

COMMENT 27: The choice of hydraulic conductivities is not documented in the report.

RESPONSE TO COMMENT 27: Values used for hydraulic conductivity will be presented along with an explanation of how these values were derived.

COMMENT 28: The source term rates and positions are not documented or supported. In the model, a mass flux rate is imposed along Paddys Run. The most significant mass is assumed to enter a section of the reach between Willey Road and New Haven Road (0.054 lbs./day at 27 blocks). This totals to 1.5 lbs. per day.

RESPONSE TO COMMENT 28: A brief explanation of how source areas were addressed in the model is given on page A-7. We will provide additional explanation.

COMMENT 29: The basis for "present conditions" distribution of uranium in Figure A-2 is not defined. It is not known whether the model was used to recreate the historical evolution of the plume. Possibly the concentrations were simply initialized by significantly extrapolating the Round 4 measurements (Figure 2-11). Because there is generally little movement over the next five years (Figures A-2 versus A-3 and A-7), the "current conditions" overwhelm the additional sources applied along Paddys Run.

RESPONSE TO COMMENT 29: The basis for the "present conditions" distribution of uranium in Figure A-2 is described in Section A.3.0 of the EE/CA report. The calibration of the solute transport model involved recreating the historical evolution of the plume. We will attempt to state the origin of the concentration distribution more clearly.

COMMENT 30: The simulated vertical distribution of uranium is not presented. It is not known how much simulated vertical spreading of uranium occurred and whether this significantly reduced simulated uranium concentrations in the uppermost layer.

RESPONSE TO COMMENT 30: The conclusions presented are valid regardless of the effect of vertical spreading on the concentrations in the uppermost layer. Uranium present at concentrations above 30 ug/l in all layers will be intercepted. As mentioned on page A-3, only the most pertinent information is presented in the EE/CA report.

COMMENT 31: The dispersivity value reported does not match with the data files. The report indicated that longitudinal and transverse dispersivities of 50. and 1.0 feet were used. The data set (F3DSOL9-DAT) uses values of 10. and 0.5 feet.
COMMENT 32: The dispersivity values will probably cause oscillation. The grid in the areal plane is uniformly chosen as 125 feet. The longitudinal dispersivity is 10.0 and the transverse is 0.5 feet. This results in a cell Peclet number of 12.5. Because a central difference in space is used, the concentration solution will probably cause severe oscillations. Switching to backwards-in-space is not recommended. The current modeling approach will probably result in significant artificial negative uranium concentrations around the edge of the plume. Mathematically the minimum longitudinal dispersivity is 62.5 feet. Based on our experience, a value as low as 30 may be acceptable, but not as low as 10 feet. Furthermore, it is not clear how such a low value is justified. However, dispersivities of 50. and 1.0 ft., if used in other runs as indicated in the report, are appropriate.

RESPONSE TO COMMENTS 31 AND 32: Longitudinal and transverse dispersivities of 50. and 1.0 feet were used in the EE/CA modeling. We must have supplied the wrong input file. We did experiment with dispersivities of 10. and 0.5 feet and one result was, indeed, significant negative concentrations around the edges of the plume.

COMMENT 33: The uniform grid spacing is not very efficient. The grid is composed of 78 x 102 blocks of equal spacing at 125 feet. Generally, the flow solution requires greater extent than the transport equation in order to utilize sensible hydrologic boundaries. In the northern portion of the site, source terms are introduced, but are not significant to this model demonstration. The grid layout and orientation seem to be simply a convenient mesh that nests with the regional flow model, but is not overly efficient in the transport analysis. The technique behind nested grids can easily accommodate rotated grids. It is strongly recommended that a rotation be included to reduce the total number of blocks. The edges of the grid could also be graded with increasing space at the edges. There are few field problems that require almost 40,000 grid blocks to adequately represent the physical system. With good engineering judgement, the number of grid blocks could be significantly reduced.

RESPONSE TO COMMENT 33: The grid spacing and orientation result in a solute transport model that supports the conclusions presented in the EE/CA report and avoids exceeding guidelines on cell size anywhere in the model. We recommend that it be left as it is. Please consider the following points:

- Source terms in the northern portion of the site are included because the model is to be used for sitewide RI/FS work after it has been calibrated against additional uranium data. Its application is not limited to the EE/CA work, and we have no reason to construct a separate model for the EE/CA work. Also, due to lateral dispersion, uranium from sources in the northern and southern parts of the site mix, so a model that includes all sources is a better model.

- We recommend including all monitoring wells in which uranium has been found above background within the model grid, as we have done. If all these wells are included, we could only reduce the area of the model by about 17 percent of the present area by rotating the grid. The larger area of the present grid represents some additional computing time for each calibration run, but does not affect the number of runs that can be made in a day. We share OEPA's concern for efficiency in federal projects; however, since the client is paying a fixed monthly fee for computer use, this extra computing time does not affect cost. Consequently, we see no reason to add the complexity of a rotated grid, especially since some additional labor cost would be involved.

- We recommend that this particular model not use a grid that grades toward larger cells at the edges. There are uranium source areas along the entire length of the grid. This condition results from the presence of Paddys Run extending north-south through the model area, and from the waste storage area and the plant production area extending east-west across the model. We recommend maintaining small cells near the sources. We have considered grading the cell size as a means of bringing the SOWC wells and the Great Miami River within the boundary of the solute transport model. However, the large cells would cause guidelines for cell size to be exceeded, and we have no verification that excessive undershooting would not occur within the range of dispersivities that we wish to use. Considerable labor would be required to experiment with this possibility. We also prefer to avoid introducing more subjective judgement into the construction of the model than is necessary, so we prefer to use small cells when

there is no compelling reason to do otherwise. Properly done, the Fernald solute transport model will be a large, complex model regardless of the details of the grid spacing and orientation.

COMMENT 34: The choice of retardation is not well documented, justified and may not be conservative. The retardation factor of 9 was used in the simulations. Attempts of using factors of 1, 6, and 12 were tried. Because the approach used to define the source loadings and initial plume distribution are not provided, it is difficult to assess the confidence and implications associated with presenting the one value of 9. A higher retardation causes an approximate linear increase in the remediation time required. A higher retardation also implies that a greater release of uranium is required when the source is calibrated with water concentrations.

RESPONSE TO COMMENT 34: Justification for using retardation factor 9 is presented on page A-7. Documentation would seem to involve presentation of results that are too voluminous for inclusion in the report.

We agree that a higher retardation factor would result in a longer remediation time and implies greater source loading. We do not think that remediation time is a significant issue in the EE/CA, which deals with mitigating contaminant migration prior to final action. As shown in Figure A-5, little remediation is expected for the duration of the removal action. We note that a higher retardation factor would slow the rate of advance of the plume under the no-action alternative. Consequently, using a low retardation factor is conservative with regard to this alternative, which is a significant issue related to the EE/CA.

COMMENT 35: The general travel time for uranium to reach the extraction wells is substantially greater than the simulation period. The particle (unretarded) travel time from Paddys Run to the extraction well is on the order of 5 years as evidenced by the particle position time markers and independently confirmed by Darcy calculations. Based on the assumed retardation, the uranium travel time is 9 times this value or approximately 50 years. The predicted concentration at the extraction wells (Figure A-8) displays ever increasing concentration levels up to 5 years, at which time the simulations were terminated. It is not clear why simulations were stopped at 5 years. The time required to remediate the site, based on current degree of adsorption, must be on the order of decades.

RESPONSE TO COMMENT 35: Five years is the expected duration of the removal action. See page 5-6 of the EE/CA report. Final action on remediating the site will be addressed in a separate report under the RI/FS.

APPENDIX A

Comments Made During Public Comment Period

Engineering Evaluation/Cost Analysis, South Plume

COMMENT 1: More recent RI/FS analytical data should be incorporated than September 15, 1989.

COMMENT 2:"Potential Risks," first sentence of Page ES-6 - U.S. DOE states that there is "no known use of groundwater with uranium levels exceeding the derived concentration limit 33 $\mu g/\ell$ from the South Plume areas for drinking water, feedstock watering or crop irrigation." U.S. DOE should conduct a complete investigation to confirm the validity of this statement.

COMMENT 3:"Scope of Removal Action EE/CA," (second sentence on page E5-6) - The scope and objectives of the removal action should be expanded to expressly include the objectives set forth in the U.S. EPA/U.S. DOE FMPC Consent Agreement. Under the Consent Agreement, the basic objective of the South Plume removal action is to "abate, minimize, stabilize, mitigate or eliminate the release or threat of release of hazardous substances, pollutants, contaminants, or hazardous constituents at or from the FMPC." (Consent Agreement, Section IX.A.).

COMMENT 4:"Alternative 5, Pump and Treat" - This treatment alternative should be designed to accomplish the objectives of the Consent Agreement rather than to merely ensure that "the total mass of uranium released via the effluent pipeline does not exceed the existing FMPC release value." (Note: The existing FMPC release already currently exceeds the FMPC's National Pollutant Discharge Elimination System, or NPDES, limits approximately 15 percent of the time.)

COMMENT 5:In Section 4.2.2, the proposed institutional controls involve communication with notification of local officials and monitoring. Table ES-1 states that alternatives 4 and 5 will provide "institutional controls restricting access to groundwater within the South Plume area." U.S. DOE needs to explain what the institutional controls referenced in Table ES-1 are that would "restrict" access to groundwater within the South Plume area. If the institutional controls anticipated by U.S. DOE could impact the existing rights of landowners to utilize the aquifer (including increasing pumping rates or installing new wells), an opportunity for public comment on such institutional controls should be provided.

COMMENT 6:Referring to Table ES-1, U.S. DOE states that exposure to uranium is from an "assumed historical release" and that "concentrations are assumed to decrease with time." On page ES-11, Table ES-1 states that the removal alternatives provide "no reduction in the amount of uranium crossing the southern boundary of the FMPC." Other statements in the EE/CA indicate that no source control is considered as a part of any of the removal alternatives.

> These statements invite two comments. First, U.S. DOE does not adequately define the source of releases into the south plume and does not demonstrate that the releases were solely historical. Indeed, continuing releases may be contributing to contamination in the South Plume. Second, source control should be considered in the EE/CA if U.S. DOE is to meet its stated objectives of abating, minimizing, stabilizing, mitigating, or eliminating the release of hazardous substances, pollutants, contaminants, or hazardous constituents at or from the FMPC.

COMMENT 7:Referring to Table ES-1, U.S. DOE nowhere states what "Alternative A" is that is referenced under Alternative 5 with respect to "Ability to Construct and Operate."

COMMENT 8:Why does the EE/CA use effluent discharge data from 1985-1987? The 1988 monitoring report is out and the 1989 data should also be available (Section 2, page 5).

COMMENT 9:Table 2-1 in Section 2 says organics are in the water of the South Plume, but that the magnitude and extent are unknown. Why is this unknown? How can the EE/CA go forward, not knowing what else may be in the water and what the total environmental effects might be? Also, could the organics cause violations of discharge permits when added to the usual FMPC discharges?

COMMENT 10:Figure 2-17 of the EE/CA shows dark triangles to be residences with unknown water supplies. There are many on the map. Have the residents been asked about their water supply? The note says the map may not show every groundwater user in the area. Will further RI work be done to determine all users of the groundwater? Accuracy of this information is important to the public and for making decisions.

COMMENT 11:Reference Section 2.2.2 - There is insufficient data to support U.S. DOE's conclusion that pumping of the Southwest Ohio Water Company wells influences the groundwater flow patterns in the EE/CA study area. Hydrogeologic features of the aquifer could account for any observed easterly flow. Additionally, there are insufficient data to conclude that the entire flow regime from the FMPC is pulled to the east. Insufficient data generation points (monitor wells) are available to draw any absolute conclusions on the flow and transmission regime. The uranium found in the well of a private resident in the western portion of the Paddys Run drainage could be the result of a western component in the groundwater flow and not solely the result of the discharge/recharge relationship of Paddys Run Creek to the aquifer. U.S. DOE should develop more data points in order to fully assess the flow and transmission regime.

In Figure 2-11, severe discrepancies exist between the uranium concentration contours shown on Figure 2-11 and the simulated concentrations depicted in Figure A-2. The unexplained lack of coincidence between observed levels of uranium and levels projected by the model call the conclusions of the model into doubt. The proper performance of the proposed removal action requires more information about groundwater flows and contaminant concentrations.

COMMENT 13:Section 2.4, First paragraph - Copies of U.S. DOE Order 5400.5 should be published for review. Additionally, U.S. DOE should document that its guidelines for the discharge of radionuclides are as stringent as U.S. EPA's guidelines for such discharges.

COMMENT 14:Section 2 states that the plume is moving at about 220 feet per year. Table E-1 says the leading edge of the plume would migrate between 440 and 1100 feet depending on the chosen alternative. Is this per year? If so, then the alternatives would <u>increase</u> the plume flow? Or is the term leading edge different from that used on page 40? This is confusing to the public.

COMMENT 15:Section 2.4.1 - U.S. DOE states that two distinct areas of elevated uranium concentrations may exist in the groundwater beneath the FMPC and adjacent off-FMPC areas. The dual plume theory stems from the potential existence of multiple sources of uranium. U.S. DOE's conclusions regarding the source of the two plumes are based on "current understandings" of unspecified plant operations and records, site hydrology, and results of the groundwater modeling study. U.S. DOE should specify the plant operations and records, the hydrological studies, and the details of the modeling study that support its conclusions regarding the supposed sources of contamination. Additionally, U.S. DOE should explain why it is addressing only one of the two plumes in the proposed removal action.

COMMENT 16:Section 2.4.1, Third paragraph - U.S. DOE does not adequately state anywhere in the EE/CA what its basis is for the conclusion "that no continuing source contributes significantly to further groundwater contamination in the south plume."

COMMENT 17:Section 2.4.2, Second paragraph - U.S. DOE has failed to adequately state how it has "accounted for" the effects of the existing industrial wells "in the interpretation of field data and the evaluation of removal actions." U.S. DOE should specify which wells were considered and at what pumping rates and whether the conclusions would be affected if pumping rates were to change. Such an explanation is essential to the adequate review of the proposed removal action.

COMMENT 18:Section 2.4.3.1, First sentence - U.S. DOE states that the proposed action for uranium "will also provide protection against other radionuclides and chemicals due to the low levels present." Until U.S. DOE tests for such other contaminants, U.S. DOE cannot assume that the considered actions will protect human health and the environment. Testing for such other contaminants should be performed until the nature of the contaminant plume is fully characterized.

COMMENT 19:Section 3.2, First Sentence - The scope of the proposed removal action should not be limited to "management of radioactively contaminated groundwater in an off-site area south of the FMPC." At a minimum, this section should be revised to reflect the objectives specified in the Consent Agreement.

COMMENT 20:Section 3.2 - The statement that a "continuing source of uranium appears to exist from on-site areas to the north" is inconsistent with other statements in the EE/CA, see e.g., ES-10, Table ES-1; Section 2.4.1, at 2-41, third paragraph; and appropriate comments above.

COMMENT 21:Section 4.2.2, First paragraph - U.S. DOE does not specify which wells in the South Plume will be selected for continued additional monitoring. U.S. DOE should state which wells will be monitored and the criteria used for their selection.

COMMENT 22:Section 4.2.3, First sentence - Alternates 3, 4, and 5 propose provision of an alternative water supply for two existing industrial users. The EE/CA should consider contingency plans for providing alternate water to other users in the South Plume area. In fact, U.S. DOE should consider providing an alternate water supply to owners of every well that contains contamination attributable to the FMPC in excess of state or U.S. EPA established health-based standards.

COMMENT 23:Section 4.2.3, Second paragraph - U.S. DOE does not state the basis for its conclusion that a pumping rate of 50 gpm will not draw contaminated groundwater in the shallow zone downward into the lower aquifer. The conclusion is apparently based on an unsubstantiated premise that the hydrogeologic conditions are well documented, understood, and static. U.S. DOE also fails to consider the effects of increased pumping rates or the installation of an additional well by the user at the same depth in order to increase capacity.

COMMENT 24:Section 4.2.1 - It does not appear that U.S. DOE evaluated an extraction well scenario that included wells near the presumed center of the plume in conjunction with wells near the presumed southern boundary of the plume. U.S. DOE should evaluate the potential advantages and effectiveness of such a scenario.

COMMENT 25:Section 4.2.4.3, First paragraph - Reinjection of groundwater into the aquifer after treatment to meet drinking water Applicable or Relevant and Appropriate Requirements (ARARs) is not discussed as a discharge option. On-site reinjection should be fully evaluated because it could mitigate the effects of the removal action on area groundwater users.

COMMENT 26:Section 4.2.4.3 - Discharge from the current FMPC effluent pipe into the Great Miami River has several problems not adequately addressed in the EE/CA. Not only would this option necessitate pumping the water a considerable distance uphill, but there is also no evidence that the existing pipe can accommodate the 1500 to 2500 gpm additional flow. At a minimum, U.S. DOE should investigate the suitability of the existing effluent pipeline and test its integrity. U.S. DOE should provide the basis for rejection of the discharge of extracted, untreated groundwater via a pipeline running directly south to the Great Miami River. U.S. DOE should also consider discharging the water directly south into the river after treatment at the pumping center.

COMMENT 27:Section 4.2.4.4 - U.S. DOE should consider developing a treatment system using the same technology that the existing industrial treatment system uses rather than eliminating this treatment option due to the limited capacity of the existing facility. This treatment system could be located near the pumping center and easily expanded to accommodate large volumes of water. As an alternative, U.S. DOE should consider expanding the proposed capacity of the "new treatment plant" (assumed to be located at the FMPC) to accommodate pumping from the South Plume area as well as the storm water runoff wastewater stream.

COMMENT 28:Section 5.1.1 - Support documentation should be provided for the exposure pathway analysis and risk assessment. The assumptions used should be specified and the conclusions as to health effects supported. It would be helpful if U.S. DOE could compare its evaluation to a risk assessment performed in accordance with U.S. EPA's CERCLA guidance "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)," No. 9285.701A, July 1989 (Interim Final) and the "Risk Assessment Guidance for Superfund, Volume II: Environmental Evaluation Manual," U.S. EPA/540/1-89/001, March 1989 (Interim Final).

COMMENT 29:Section 5.5.2, Third paragraph - U.S. DOE has not substantiated its conclusion that the projected pumping rates will not affect local groundwater users.

COMMENT 30:Section 5.7, Table 5-1, In addition to expanding the ARARs evaluation to address potential non-radioactive contaminant requirements, U.S. DOE should provide some discussion as to which requirements listed in Table 5-25 are considered final ARARs and whether and how ARARs will be attained by the selected removal alternative.

COMMENT 31:Page A-7, The distribution coefficient used for uranium of 0.016 cubic feet per pound (approximately 1 ml/gm) is lower than that generally reported in the literature (10-4400 ml/gm). U.S. DOE should explain its departure from the generally accepted distribution coefficient. U.S. DOE should also provide the specific "results of the geochemical investigation" and further state its basis for the statement that "the uranium is in complexes which have neutral or negative charges. Such charges imply low retardation."

COMMENT 32:Section A.4.0 - There is no indication of whether decay of uranium is an important process. There is no way to determine if SWIFT III can accommodate decay factors and what the decay rates are likely to be.

COMMENT 33:Page A-12 - The pumping interception scenarios examined in the EE/CA suggest that the grid spacing may be as large as 280 feet. A smaller grid spacing is necessary to evaluate possible pumping scenarios.

COMMENT 34:Section A.4.3 - More information is necessary on the particle tracking program, STLINE. The particle tracking data presented in the report only addresses particles within the South Plume (see Figure A-5). To demonstrate the impact of U.S. DOE's proposed extraction well locations, hypothetical particles outside the assumed boundaries of the plume need to be run in the model.

COMMENT 35:Page A-16, First paragraph, and Figure A-6 - The potentiometric surface map shown in Figure A-6 implies that the selected removal action will have an impact on existing groundwater users within the area of the South Plume. Further evaluation of the effects of the removal on existing users should be performed.

COMMENT 36:Section A.4.4 - Since other non-radioactive contaminants from the FMPC may be migrating into the uranium plume, or may already have intercepted the uranium plume, the model should include the possibility of multiple, potentially overlapping contaminant plumes.

COMMENT 37:The poor correlation between the simulated plume depicted in Section A.4.4, Figure A-2, the observed potentiometric and contaminant concentration data demonstrates that the model representation does not accurately reflect actual plume conditions. The model should be further developed with better field data input and improved assumptions so that the simulations more closely parallel observed data.

COMMENT 38:Would ingestion while showering be another exposure pathway that should be considered?

COMMENT 39:Not all of the <u>reasonable</u> alternatives have been presented in the EE/CA. All alternatives that the public might believe would be possible should be discussed, at least briefly, with the reasoning as to why they were eliminated from consideration early on. That way the public could have confidence that the final alternative chosen was truly the best.

COMMENT 40:How is removing U from groundwater and discharging it untreated into the river an improvement? At least in the plume we can locate the U for the final remedial action. Once in the river, it is not retrievable. You have actually increased its mobility, which would be counter to the goals of a removal action. It hardly seems fair to the downstream population and environment to simply throw our contaminants into

their water. The total uncontrolled U in the environment remains the same. It's just spread over a larger area.

COMMENT 41:The alternative of pump and treat from the edge and the center of the plume simultaneously should have been discussed.

COMMENT 42:All contaminants, both chemical and radiological, should be considered, not just uranium. They are all of concern.

COMMENT 43:A chart showing all radionuclides and potentially hazardous chemicals that are in the South Plume should be included in the EE/CA, perhaps in the appendix. For each, the established drinking water limits should be shown with a reference as to the source of the information. If there is no established limit, a full discussion of what theoretical limit to use and how it was derived would be useful.

COMMENT 44:The EE/CA states that the plume will not reach the Great Miami River in the next 5 years. When is it projected to actually reach the river?

COMMENT 45:None of the alternatives discussed addressed controlling the sources of the contamination. It is stated that the full RI/FS will address this. However, did any of the earlier eliminated EE/CA alternatives attempt to do so?

COMMENT 46:Was the possibility of a new effluent line to the Great Miami River explored, rather than pumping the water back up to the FMPC?

COMMENT 47:It is the public's understanding that the FMPC regularly exceeds the U.S. DOE discharge limits. If this is true, how can any additional discharge of uranium be considered?

COMMENT 48:The EE/CA needs to explain in greater detail how the treatment possibilities work. Be sure to include those mentioned in Section 4, page 14 and any others the public might think might be reasonable. Could a distillation process remove the uranium?

COMMENT 49:Insufficient support documentation

Throughout the EE/CA, factual statements and conclusions are made without sufficient documentation to enable the public to objectively assess their validity. Of particular concern is the lack of information about the groundwater model, which is the foundation of many key technical conclusions reached in the EE/CA. Based on the information U.S. DOE has provided to date, it is impossible for an observer to replicate and independently verify the model results.[1] At a minimum, U.S. DOE should provide clear documentation of the assumptions and aquifer coefficients that are being utilized in the model.

Other background information is lacking as well. For example, U.S. DOE has not actually specified the number and location of extraction wells or the anticipated pumping rates. Without this background information, it is impossible for the public to ascertain the credibility of U.S. DOE's modeling conclusions.

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[1]In the letter granting the Paddy's Run Road Site (PRRS) companies' request for an extension of time to comment on the EE/CA, DOE stated that Appendix A contained groundwater modeling information used for this removal action. Other assumptions and background information used in the model were to be placed in the Administrative Record. The companies have determined, however, that the information contained in Appendix A together with documents placed in the Administrative Record are still insufficient to allow independent verification of the model.

The lack of supporting documentation is a pervasive problem throughout the EE/CA. Not only does this result in several erroneous conclusions, but in several instances appears also to produce conflicting conclusions. For example, in the EE/CA Executive Summary, U.S. DOE states that the model predicts that the contaminant plume will not migrate to the Great Miami River within the projected life of the removal action i.e., five years (ES-5, third paragraph). Later in the EE/CA, however, U.S. DOE states that "the South Plume is expected to continue to migrate southward and will eventually be released into the Great Miami River" (Section 2.4.2). Without further information, its is impossible to determine if the second statement is at odds with the first. If, in fact, this statement simply means the plume will reach the river in a time frame that exceeds five years, then U.S. DOE should indicate the estimated time period and the basis for its calculation.

Likewise, U.S. DOE states that at the present time there have been insufficient observations to determine "the degree to which the (contaminant) plumes have already mixed" (emphasis added) (EE/CA Section 5.1.2). Yet, in the very next sentence, U.S. DOE states that the model indicates no mixing of the plume occurs. With the information provided, it is impossible for a reviewer to determine if there is, in fact, a mixing of the plumes.

Potential inconsistencies and unsubstantiated remarks[2] influence all of the basic conclusions reached in the EE/CA. Consequently, the conclusions

[2]For example, there is no substantiation for the comment in Table 2-1 that organics detected in the groundwater south of the Albright & Wilson plant are associated with other industrial plant discharges and not due to DOE operations. As noted in Section II of these comments, the organics may have migrated from the FMPC. The comment in Table 2-1 should be deleted.

reached regarding the nature of the contamination, the boundaries of the South Plume(s), the exposure pathways, the levels of risk, etc. are highly suspect.

COMMENT 50:The conclusion that uranium is the sole contaminant of concern is unsubstantiated.

The scope of the removal action delineated in the Consent Agreement in Section IX.A. requires U.S. DOE to address all hazardous substances, pollutants, contaminants, and constituents. Nevertheless, U.S. DOE's sampling efforts in the South Plume have focused almost exclusively on uranium. The EE/CA does not include sufficient support documentation to justify U.S. DOE's focus on uranium alone.

U.S. DOE's failure to adequately test for contaminants other than uranium in the South Plume study area was addressed at some length in the Companies' comments on the FMPC Consent Agreement. Those comments are attached and incorporated by reference as comments on the EE/CA.

Because of the inadequacy of the testing for contaminants other than uranium in the South Plume study area, statements throughout the EE/CA that uranium is the only contaminant that presents a potential public health risk are uncorroborated supposition. As noted in the comments on the Consent Agreement, U.S. DOE already has evidence that there are areas of floating layers of petroleum products and solvents underlying portions of the FMPC. There is no evidence that these pollutants have not migrated into the South Plume. Moreover, U.S. DOE has provided no support for the EE/CA assumption that there are no continuing

sources of contaminants that can migrate to the off-FMPC portion of the South Plume.

Given the fact that "large quantities of liquids and solid wastes are (and were historically) generated by the various operations of the FMPC," including oils, sludges, spent degreasing solvents, and PCB-contaminated materials, it is extremely difficult to believe that uranium is the sole contaminant that has migrated in any significant quantity into the South Plume. As noted in the EE/CA, surface water runoff from the Waste Storage Area, fly ash piles, the Southfield Area, and other possible disposal sites drain into the outfall ditch or Paddys Run, both of which feed the groundwater due to highly permeable channel bottoms (Section 2.1 and 2.2.2). The EE/CA further acknowledges that leachate from the various waste disposal areas at the FMPC can migrate vertically into the groundwater aquifer (see, e.g., Section 2.1). Accordingly, there are a large number of source areas and a broad range of migration pathways for contaminants besides uranium to enter the aquifer.

In summary, sampling of potential contaminants besides uranium in the South Plume completed to date is insufficient to support the EE/CA conclusion that uranium is the only contaminant of concern. Since the removal action has been designated as "non-time critical," U.S. DOE should expand its sampling activities, as suggested in the Companies' comments on the Consent Agreement, to fully characterize the South Plume. This activity should not, however, impede the provision of alternate water supplies for existing contaminated wells.

COMMENT 51:There is no documentation that the preferred alternative complies with ARARs.

The recently revised NCP confirms U.S. EPA's policy to attain ARARs during removals to the extent practicable. 50 Fed. Reg. 8695-96 (March 8, 1990). In determining the practicability of complying with ARARs, U.S. DOE is to consider the urgency of the situation and the scope of the removal action. 40 CFR Part 300.415(i). Since the removal action is non-time critical and the scope of removal requires the remediation of all hazardous substances, pollutants, contaminants, and constituents, a number of potential federal and state ARARs may exist.

The potential ARARs identified or guidances "to be considered" (TBCs) in the EE/CA stem from the conclusion that uranium is the sole contaminant of concern. The only standards given more than cursory mention are U.S. DOE's uranium standards. No meaningful consideration is given to any other potential federal or state ARARs or TBCs - particularly cleanup standards for non-radioactive contaminants. U.S. DOE's analysis, therefore, should be revised to identify all potential state and federal ARARs and TBCs for both radioactive and non-radioactive contamination. U.S. DOE should also document whether the ARARs finally chosen will be attained by the proposed removal alternatives, and, if not, why.

Even if uranium were the sole contaminant of concern, the EE/CA's ARARs analysis for radioactive contaminants is still lacking. The cleanup standard selected in the EE/CA is a "derived concentration limit" of 33 $\mu g/\ell$ for uranium. No basis is provided for this number or support given for human health and the environment. For example, there is no analysis of how U.S. DOE's standard compares with U.S. EPA's NCP requirement that remediation exposure levels should represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6}.

Furthermore, for a thorough review of potential radioactivity-based ARARs, U.S. DOE should consider the existing radioactivity-related maximum contaminant levels (MCLs)[3] as potential ARARs. Additionally, we understand U.S. EPA is currently considering a uranium drinking water standard of 20 to 40 pCi/l based on the potential effect of uranium on livers in children. For uranium-238, this translates to approximately 4.8 $\mu g/\ell$ to 9.6 $\mu g/\ell$. While U.S. EPA's tentative position is certainly not an ARAR, under the circumstances some consideration of these levels may be warranted. Other U.S. EPA guidance on estimating exposure to releases of radionuclides from waste disposal facilities should also be considered.

COMMENT 52:The plume boundary is inadequately delineated and the recovery system does not ensure protection of down gradient wells.

The data presented in the EE/CA does not confirm the U.S. DOE's suggested definition of the southern plume boundary. Objective data points are sparse, highlighted by the fact that the key wells used to set the contours of the plume boundary (Wells 2061 and 2094) are nearly four-fifths of a mile apart. Without additional downgradient data points, U.S. DOE cannot delineate the boundaries of the plume with any degree of certainty.

Additionally, the optimal location of the proposed groundwater extraction wells cannot be determined without additional data points. The proposed

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[3]The MCL for combined radium-226 and radium-228 is 5 pCi/l and the MCL for gross alpha particle radioactivity is 15 pCi/l (40 CFR 141.15(a) and (b)). Leachate from the "fly ash piles" and "other disposal activities" at the FMPC may have caused contamination of the South Plume by radioactive substances other than uranium, notably radium-226 and -228.

location of the wells, as discussed in 4.2.4.5, does not ensure that contamination will be removed from existing wells along New Haven and Paddys Run Roads. For example, U.S. DOE has already established that Well No. 2127 may exceed the cutoff of 33 $\mu g/\ell$ of uranium, but that well may be beyond the zone of influence of the extraction wells. Sufficient data needs to be collected to accurately define the plume boundaries and to support the location of the proposed extraction wells.

Furthermore, the proposed screen interval for the extraction wells does not appear sufficient to capture the full vertical extent of the contaminant plume. The proposed recovery well system would have a 40-foot screened interval at the top of the aquifer, yet U.S. DOE's data from the 3000-series sampling wells indicates that contamination extends to much greater depths. Thus, the currently designed recovery well system fails to effectively capture contaminants for not only the breadth of the plume, but also for the depth of the plume as well.

Another area of concern is the impact of the proposed pumping rates on local groundwater availability. U.S. DOE states that the rate of groundwater flow is 1300 feet per year (EE/CA Section 2.4.1) and concludes that the "projected pumping rates are not expected to impact local groundwater availability" (EE/CA Section 5.5.2 and Figure A-7). Hydrogeologically, it is not possible to evaluate this conclusion without access to the aquifer coefficients (e.g., transmissivities, storage coefficients, screened intervals, etc.) used by U.S. DOE in the model. U.S. DOE should provide this information to allow independent evaluation.

Finally, U.S. DOE has not evaluated the impact of its proposed extraction on areas of the aquifer that are currently uncontaminated. Contaminated groundwater may be pulled laterally into clean areas of the aquifer.

Similarly, contaminated groundwater in upper portions of the aquifer may be pulled downward into lower, cleaner portions of the aquifer. U.S. DOE should fully analyze each of these possibilities and document its conclusions.

COMMENT 53:None of the alternatives considered in the EE/CA accomplishes the goal established in the FMPC Consent Agreement.

The recently finalized Consent Agreement between U.S. DOE and U.S. EPA specifies the south groundwater plume removal action is to "abate, minimize, stabilize, mitigate, or eliminate the release or threat of release of hazardous constituents at or from the FMPC" (Section IX.A.). As noted previously, the EE/CA wholly fails to address the remediation of any possible contaminants besides uranium. Moreover, even with respect to the narrow issue of minimizing or eliminating the release of uranium, the EE/CA alternatives are inadequate.

In the first instance, the preferred alternative would discharge untreated, contaminated groundwater directly to the Great Miami River. While dilution of the FMPC's current discharge with contaminated groundwater extracted from the aquifer would lower the concentration of the uranium in the effluent, the total mass of uranium would be increased.

Additionally, the treatment alternative addressed in the EE/CA would also fall short of the mark. The proposed treatment system would only handle approximately 700 gpm (EE/CA Section 4.2.4.6), yet the extraction wells would be producing 1500 to 2500 gpm (EE/CA Section 4.2.4.5). Thus, even if the treatment system were operating full time to decontaminate South Plume groundwater, between half and three-fourths of the contaminated water would not be treated. Moreover, U.S. DOE has

expressed an intent to only treat South Plume groundwater when storm water from the retention basin is not being treated in the system. At the EE/CA workshop held on May 30, 1990, U.S. DOE representatives predicted that South Plume water would be pumped through the treatment system only 50 percent of the time. Consequently, no more than one-eighth to one-quarter of the South Plume water would ever be treated.

Rather than "minimizing" or "eliminating" the amount of uranium released to the river, the EE/CA treatment option is only designed "to ensure that the uranium discharged to the Great Miami River is not increased over current levels." (Id., at Section 4.2.4.6). The EE/CA acknowledges that an industry-owned treatment system is already in operation that effectively filters out contamination from the groundwater pumped out of the south plume. Utilization of this type of treatment system was eliminated from consideration (Id., Section 4.2.4.4). No consideration is given to employing the industry's technology in a larger, U.S. DOE-operated treatment system capable of treating the large volumes of water generated by the South Plume extraction. (See Specific Comment 23 for additional discussion of this option.) At a minimum, U.S. DOE should consider a treatment alternative that truly will treat the extracted groundwater and minimize or eliminate the release of contaminants.

In addition to these obvious drawbacks, the pump/discharge and pump/"treat" alternatives have not been adequately studied to determine their impact or implementability. For example, EE/CA Section 5.5.2 concludes that the projected pumping rates of the extraction wells are not expected to impact local groundwater availability, but U.S. DOE neither states the pumping rates of the local wells nor provides a basis for the conclusion that withdrawal rates from industrial wells should not be

affected by the drawdown. There is also no discussion of the impact if local water use increases. Each well in the area must be documented and considered individually.

Moreover, one of the alternate water supply sources would simply entail the installation of a well at greater depth. The EE/CA does not substantiate the conclusion that pumping from this well or the U.S. DOE extraction wells will not draw contaminants from the upper aquifer to the apparently less contaminated lower aquifer. Furthermore, little attention is given to the regulatory or community acceptance of these alternatives. For example, a lengthy and potentially hostile NPDES revision process for Alternate 4 should be considered. The OEPA may be adverse to allowing additional discharges to the Great Miami River given that the FMPC is not meeting its current NPDES Discharge limits (see EE/CA Section 5.5.1, which indicates that current discharge exceeds established limits by about 15 percent.)

In summary, the alternatives presented in the EE/CA are not well thought out and are poorly documented. They fail to achieve the goals of the FMPC Consent Agreement and the overarching goals of CERCLA. Moreover, little attention is given to the requirement that the removal action contribute, to the extent practicable, to the efficient performance of any anticipated, long-term remedial action. 40 CFR Part 300.415(c). To accomplish this goal, it would be necessary to install a treatment system designed to accommodate the long-term remediation of the plume.

COMMENT 54:General comments on Appendix A.

As noted throughout these comments, it is impossible to evaluate many technical conclusions of the proposed alternatives because of the lack of

information about the assumptions that were made for the model simulations. If the model cannot be verified, none of the decisions based on it are credible.

In sum, more detail is essential to assess the actual application of the model. U.S. DOE indicates in Appendix A that a "detailed presentation of the model, its development and the baseline input data will be issued as part of the overall modeling report being prepared under the RI/FS." Additionally, a "comprehensive verification study of the SWIFT III code has been completed and a report will be forthcoming under a separate cover." Both of these reports should be made available to the public as part of the EE/CA since, if complete, they should make it possible to evaluate the model inputs and its application and thereby enable independent verification of the EE/CA conclusions.

COMMENT 55:U.S. DOE has proposed institutional controls to prevent the installation of new groundwater wells within the South Plume area. Since Ruetgers-Nease operates a manufacturing plant located within this area, we are concerned about the impact of such institutional controls on our ability to install new groundwater pumping wells to supply our site. Such restrictions could severely limit our ability to provide adequate water supply for our manufacturing operations in the future.

COMMENT 56:As part of the removal action proposed in the EE/CA, U.S. DOE has proposed to install an alternate water supply for two industrial facilities located to the north of the Ruetgers-Nease site. With one of the manufacturing facilities withdrawing substantial quantities of water from existing groundwater wells, it has been suggested on a number of occasions that these wells may have in the past acted as a barrier to prevent the migration of the FMPC groundwater contaminant barrier to plume south toward our facility. With a proposed alternate water supply for this facility and the possible shutdown of the existing groundwater wells, Ruetgers-Nease is very concerned

that the groundwater contaminant plume from the FMPC will rapidly migrate to the Ruetgers-Nease groundwater well and prevent its future use within our operations. Based on existing piezometric data, groundwater flows in a south/ southeasterly direction, and therefore it is very likely that contaminants in the wells located north of the Ruetgers-Nease property will migrate to the Ruetgers-Nease well.

COMMENT 57:U.S. DOE has also proposed the installation of a series of groundwater recovery wells to prevent the further spread of the contaminant plume from the FMPC. While we support the overall groundwater recovery concept, we do have some concerns about the proposed groundwater recovery system. Depending on the precise location of the groundwater recovery wells proposed in the EE/CA, the FMPC contaminant plume will actually be pulled more rapidly to the south to the location of the recovery wells. Since the Ruetgers-Nease facility and several other properties also along New Haven Road are located north of the proposed location of these recovery wells, the proposed removal action will make it very likely that contaminants will make their way to these private wells.

> In addition, with the high rate of pumping proposed in the recovery system (approximately 2000 gpm), Ruetgers-Nease would like to know if U.S. DOE considered the possibility that Paddys Run may become a discharge zone as a result of the depression of the groundwater table. The impact of this would be that any potential contaminants located in the water/sediments in Paddys Run may be drawn toward the recovery wells. As a result, wells located along New Haven Road including the Ruetgers-Nease well, could possibly become a receptor for contaminants associated with the FMPC operation that are located in Paddys Run.

COMMENT 58:Recommendation:

With the above facts in mind, Ruetgers-Nease believes that U.S. DOE should extend the alternate water supply to Ruetgers-Nease (and others within the South Plume area who may face the same fate as a result of the planned removal action) to ensure that the facility is provided with a water supply which is free of contaminants (e.g. uranium) from the FMPC. The proposed removal action is based on a groundwater model which at best is a crude approximation of what may happen after the removal action is implemented. Since this model is based on a number of assumptions, we believe that U.S. DOE must ensure that all properties within the South Plume area which have the potential to be adversely impacted by groundwater contaminants for FMPC are provided with a water supply which is free of contaminants.

COMMENT 59:U.S. DOE should cover the expense for a public water supply to the community as an alternate water supply in corrective action. Show the community that you do want to improve the area.

COMMENT 60:"I couldn't conscientiously let the extended public comment period ... past without adding my opposition to pumping untreated uranium water into the Great Miami. Granted existing wastewater treatment technologies are inadequate. ... But going back to the old policy of diluting pollution is grotesquely invalid."

COMMENT 61:There is "no longer scientific pretense that some level of radiation exposure is safe."

COMMENT 62:In 1951, a waste water filtration system to trap uranium was deemed too expensive. Now "pump and dump" is recommended because of the expense of treating the South Plume. Why can't public servants demand the resources to do an adequate job of cleaning up the contamination?

COMMENT 63:Why weren't any alternative technologies, such as in situ vitrification, explored as alternatives for the South Plume EE/CA? Behram Shroff, a U.S. DOE Environmental Engineer at the FMPC, said vitrification was one possibility at the June 12, 1990 EIS Scoping Meeting.

COMMENT 64:The proposal to "solve" 30 percent of Fernald's contaminated waste disposal problem by dumping into municipal dumps is "insulting."

COMMENT 65:Does the government really intend to clean Fernald? Or is the government just "playing with people's minds," having agreed to pay $73 million for emotional distress to area residents?

COMMENT 66:Pumping and dumping uranium into the river is unacceptable. The contamination should be cleaned up on site, and not spread around.

COMMENT 67: Why is uranium not a contaminant of concern for the river when it is a contaminant of concern for the South Plume?

COMMENT 68:Why isn't the objective to stabilize, isolate and remove the contaminant to prevent public exposure and environmental change?

COMMENT 69:Isn't dumping into the environment contrary to your stated objectives?

COMMENT 70:Won't you lose control of containing the contamination if you dump into an unstable environment an element that has an extremely long lifespan and negative health effects -- both known and unknown -- on humans?

COMMENT 71:This contamination problem needs to be solved with the best technology on site.

COMMENT 72:I like the plan because it means we ship Fernald's problem to New Orleans, via the river system.

COMMENT 73:What are the levels of contamination, and where are those levels located in defining the South Plume?

COMMENT 74:Why aren't you treating the water before discharging it to the river?

COMMENT 75:U.S. DOE should pay for an alternate water supply for the community. Why isn't that part of the corrective action?

COMMENT 76:Discharging the South Plume into the river without treatment is not viable; in fact, it was that practice during the preceding 38 years that has created the problem of the South Plume.

COMMENT 77:What will be the impact on aquatic life with the discharge?

COMMENT 78:Will the soil get contaminated along the river with the pump and dump alternative?

COMMENT 79:The argument that the contamination will be diluted upon discharge does not hold up because it only takes a minute amount of these contaminants to enter a gene, which could become a cancer or be passed on to offspring.

COMMENT 80:Alternative 4 is just an expensive Band-aid to justify more expenditures for research and jobs.

COMMENT 81:Treat the water for uranium, thorium and chemicals before discharging it to the river.

COMMENT 82:On Section 4.0, page 3, the EE/CA discusses extending the nearest water supply and how that idea was investigated. The report also says Cincinnati Waterworks is negotiating a contract to bring a water supply to Crosby Township. There is no such negotiation, so where did that information come from?

COMMENT 83:We need to test for chemicals that could possibly be coming from the two industries on Paddy's Run Road as the water flows to the river.

COMMENT 84:Water must be treated before it is released into the river.

COMMENT 85:Go with Alternative 5, not Alternative 4.

COMMENT 86:I don't care about costs, and I don't want to hear about cost assessments or evaluations or anything else. I want the people who live near me to be protected.

COMMENT 87:I think a better treatment facility must be built to treat the releases that will go into the river.