ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue, Argonne, Illinois 60439

RESPONSIVENESS SUMMARY FOR THE ENGINEERING EVALUATION/ COST ANALYSIS FOR THE PROPOSED MANAGEMENT OF CONTAMINATED WATER IN THE WELDON SPRING QUARRY

by

Energy and Environmental Systems Division

June 1989

work supported by

U.S. DEPARTMENT OF ENERGY
Oak Ridge Operations
Oak Ridge, Tennessee

DOCUMENT NUMBER: I-1400-140.4-1.0

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue, Argonne, Illinois 60439

RESPONSIVENESS SUMMARY FOR THE ENGINEERING EVALUATION/ COST ANALYSIS FOR THE PROPOSED MANAGEMENT OF CONTAMINATED WATER IN THE WELDON SPRING QUARRY

by

Energy and Environmental Systems Division

June 1989

work supported by

U.S. DEPARTMENT OF ENERGY
Oak Ridge Operations
Oak Ridge, Tennessee

INTRODUCTION

The U.S. Department of Energy (DOE) issued the *Engineering Evaluation/Cost Analysis* [EE/CA] *for the Proposed Management of Contaminated Water in the Weldon Spring Quarry* (DOE/OR/21548-039) in January 1989. That EE/CA report examined various alternatives for management of contaminated water in the quarry; such management is needed because radioactive and chemical contaminants are migrating from the quarry pond into the local environment and the quarry is close to a county well field. The primary objective of the proposed action is to pump the contaminated water from the pond and to keep the pond pumped down, thereby limiting the potential for continued outward migration of contaminants.

This documentation is consistent with guidance from the U.S. Environmental Protection Agency (EPA) and with requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA). Following an evaluation of the various alternatives in the EE/CA, DOE determined that the best approach for management of the quarry water would be to treat the water to reduce contaminants to protective levels and then discharge the treated water to the Missouri River. The DOE applied for a permit from the Missouri Department of Natural Resources (DNR) under the National Pollutant Discharge Elimination System (NPDES) for release of this treated water to the Missouri River. The EE/CA provided a major source of technical input for this permit application.

The Missouri DNR conducted two public meetings regarding the permit application -- one on February 13, 1989, at the Ramada Westport in St. Louis, Missouri, and a second on February 14, 1989, at the Ramada Inn in Wentzville, Missouri. The DOE participated in these public meetings to provide additional information and answer questions consistent with the public participation process identified in CERCLA. Transcripts of the meetings are included as part of the administrative record associated with the proposed action. Questions raised by the public at these two meetings were addressed orally. The DOE has also received letters on the proposed action.

This document has been prepared to summarize and provide responses to the major issues identified in oral and written comments made regarding the proposed action. The first section presents general issues and responses. The second section, beginning on page 9, presents copies of letters received and responses to individual issues (comments) identified in these letters. An appendix, beginning on page 49, presents a floodplain assessment for the proposed action.

GENERAL ISSUES: COMMENTS AND RESPONSES

Issue 1

Comment. How does the proposed action relate to future actions at the quarry, such as evaluating the need to remove the bulk wastes and perform groundwater remediation?

Response. The proposed action is needed to respond to the current threat to the public and the environment from ongoing releases of contaminants from the quarry. This action is independent of future remedial action in the quarry area, but it is consistent with the proposed approach for remediation of the entire quarry.

Issue 2

Comment. How are public comments on the proposed action considered?

Response. Under CERCLA, the public is afforded an opportunity to provide meaningful input into the decision-making process for response actions at sites such as Weldon Spring. All public comments are retained in an administrative record that is available to the public. This EE/CA responsiveness summary has been prepared subsequent to DOE's receipt of public comments on the proposed action. Issues related to effluent release levels can be directed to the Missouri DNR in accordance with its rules and procedures under the NPDES permitting process.

Issue 3

Comment. The hazards of radiation exposure are not understood well enough to define a safe level of radiation exposure. In addition, the half-lives of uranium and thorium are so long that, once released to the environment, they remain a hazard for perpetuity.

Response. The risks of radiation exposure are understood better than those of many other carcinogens. The risks from low-level radiation exposure are conservatively estimated by extrapolating the risks from much higher rates of exposure. Uranium and thorium occur naturally in the environment. The increase in uranium concentration in the Missouri River as a result of the proposed action would be immeasurably small relative to naturally occurring levels. (See Section 5.2.1.1 of the EE/CA.)

Issue 4

Comment. Dilution of the contaminated water in the Missouri River is not an acceptable solution.

Response. Prior to discharge to the Missouri River, the quarry water would be extensively treated to meet federal and state standards and guidelines that are

protective of human health. The treatment goals were established without consideration of dilution. Discharge to the Missouri River is simply the most logical and environmentally acceptable means for managing this volume of treated water.

Issue 5

Comment. The statement is made in the EE/CA that the slough presents a hydrogeologic barrier to contaminant migration toward the county well field. This is not supported by current data. In addition, what about contaminant migration in the bedrock beneath the slough?

Response. The hydrogeology of the quarry area is complex. Current data indicate that the slough acts as at least a partial barrier to contaminant migration in the alluvium. There are many monitoring wells in the alluvium in the vicinity of the quarry (see Figure A.5 of the EE/CA). The concentrations of radionuclides are much lower in the monitoring wells south of the slough than in the wells north of the slough; the concentrations south of the slough are at background levels. Nitroaromatics were recently detected in monitoring wells just south of the slough, but the results of well resampling were negative. This detection of nitroaromatics may have resulted from the slough acting as only a partial barrier to contaminants migrating from the quarry via groundwater, i.e., by limiting the transport of radionuclides and metals, but not organics, beyond the slough. A more likely explanation is that the nitroaromatics originated from sediments in the slough itself (e.g., from past ordnance works discharges); this explanation is supported by the detection of nitroaromatics in these sediments during subsequent sampling.

Two additional observations support the migration-barrier hypothesis: (1) groundwater velocities in the vicinity of the slough are very low to almost stagnant and (2) water levels in the alluvium south of the slough are about 3 m (10 ft) lower than those in the slough itself. These are the bases for the statement in the EE/CA that the slough appears to act as a hydrogeologic barrier to contaminant transport toward the well field in the alluvium. Boreholes were taken in the vicinity of the slough to examine the vertical and horizontal profile of uranium contamination (see Figure A.6). Although this was not done to determine if the slough was acting as a hydrogeologic barrier, the information obtained from this investigation (shown in Figure A.7) is consistent with that hypothesis. However, over time, the slough may not continue to intercept contaminants migrating from the quarry toward the county well field. Thus, the continued quality of this drinking water supply may be jeopardized in the future. The DOE believes that it is imperative to eliminate the driving force for contaminant migration (i.e., the ponded water) as soon as possible. Monitoring of the well field would continue following removal and treatment of the quarry water. It is also possible that contamination may be moving in the bedrock beneath the slough toward the county well field. Plans are under way for expansion of the groundwater monitoring program to include bedrock sampling. Extensive monitoring will be continued to ensure the safety of the county well field until the problem is fully rectified.

Issue 6

Comment. The need for this action has not been demonstrated. Treatment of the contaminated quarry water should be delayed to allow for additional study of treatment alternatives. An alternate water supply to the county well field could be provided. Other alternatives should be examined for management of the contaminated water, such as evaporation or storage, until a better solution is identified.

Response. Contaminants in the quarry are known to be leaking to the groundwater in the direction of the St. Charles County well field (as discussed in Section 1.4 and Appendix A of the EE/CA). In order to respond to the resultant potential threat to public health and the environment, it is important to control the gradient for this migration by removing the water from the quarry. Under the proposed action, this water would be treated to protective levels and then discharged to the Missouri River. Provision of an alternate water supply was not considered as an alternative because the migration of contaminants has not yet affected the drinking water supply. A wide range of treatment alternatives was examined prior to selection of the conceptual design presented in the EE/CA. Factors that were considered in this evaluation included history of proven operation, local environmental factors, and consistency with the overall approach proposed for the quarry.

Issue 7

Comment. Has the proposed treatment approach been used elsewhere?

Response. The proposed water treatment plant utilizes conventional unit operations that have been successful in similar situations elsewhere. Small-scale treatability studies would be conducted prior to final design and construction of the treatment plant to ensure that the system would meet stringent performance specifications.

Issue 8

Comment. What is the time period during which the treatment plant would operate?

Response. The quarry pond currently contains 3 million gallons of water. Under the proposed action, the pond water -- as it was being removed for treatment -- would be replenished by both surface water and groundwater inflow. The treatment plant would be designed to operate at rates that would meet or exceed the rates of all potential inflows. The rate of operation would therefore reduce the hydraulic head in the area of the quarry pond such that the groundwater gradient in the immediate vicinity would reverse, thereby creating an active sump at the base of the quarry. This process might require two to five years or more to complete. The water treatment plant would continue to operate until there was no longer any reason to treat water at the quarry.

Issue 9

Comment. Would the treatment plant be used to treat other sources of contaminated water in addition to the quarry pond?

Response. The water treatment plant would be designed specifically to treat the radioactive and chemical contaminants in the quarry pond and all inflows to the pond. Other potential sources of inflow considered in determining the plant's capacity include: (1) surface runoff from the quarry and the immediate vicinity of the treatment plant (much of which would flow to the plant's equalization basin), (2) water used to decontaminate equipment during the planned removal of bulk waste from the quarry, (3) water used to wash down exposed rock surfaces during the bulk waste removal, and (4) incidental volumes of wastewater generated by related response actions at the quarry (see Table 12 of the EE/CA). As noted in Section 5.5 of the EE/CA, the treatment plant could also be used to treat contaminated groundwater if such action is deemed necessary in the future. The system would be conservatively designed to ensure an adequate capacity to respond to influent variations (including surface runoff from a 10-year, 24-hour storm) and to account for uncertainties in estimating inflows. The estimates of groundwater inflow reported in Table 12 are based on site characterization data, including historical (1960) data from pond-pumping tests performed by R.M. Richardson of the U.S. Geological Survey, and an approximation calculated using the Theis equation.

Issue 10

Comment. The conceptual design of the water treatment plant identified a synthetic membrane liner beneath the holding pond. Has the effect of organic contaminants such as 2,4-dinitrotoluene on the stability of the liner been investigated?

Response. The concentrations of organic contaminants are sufficiently low that no adverse impact on the liner is anticipated. However, this potential impact will be addressed during the detailed engineering design phase.

Issue 11

Comment. What monitoring would be done to ensure that the requirements of the NPDES permit were met?

Response. Treated water would be released from the treatment plant as a batch discharge, and DOE would test all water prior to release to ensure that the NPDES discharge limits were met. No treated water would be released to the Missouri River until it was in compliance with permit requirements. The Missouri DNR would independently monitor the treated water to ensure permit compliance. In addition, any interested party could split samples of the treated water for independent analysis. The incremental concentration of uranium in the Missouri River due to discharge of the treated water would be immeasurably small relative to naturally occurring levels.

However, DOE intends to monitor uranium levels at the intakes of downstream water treatment plants on the Missouri River.

Issue 12

Comment. The proposed discharge limit for uranium is too high. The limit should be reduced to levels as close to zero as possible.

Response. The DOE is committed to reducing releases of hazardous materials to the environment to levels that are as low as reasonably achievable (ALARA). Treatment technologies were analyzed thoroughly in the EE/CA. Based on this analysis, it was determined that reducing the uranium concentration to a level of 30 to 100 pCi/L was reasonably achievable. For the potential maximally exposed individual, the incremental risk of incurring a fatal cancer as a result of this treated water being released to the Missouri River is estimated to be less than one in two billion. Treating to lower levels would not reduce this negligible risk commensurate with the increased cost.

Issue 13

Comment. The risk analysis assumed rapid dilution in the Missouri River using river flow rates that do not represent a worst-case situation.

Response. Rapid dilution was conservatively assumed in the risk analysis because the downstream water intakes are on the opposite side of the Missouri River from the discharge. Assuming incomplete mixing would have resulted in a lower risk estimate. The flow rate in the Missouri River was assumed to be 280 m^3/s (10,000 ft^3/s). At no time would the treated water be released to the Missouri River if the flow rate was less than this value. This conservative flow rate was based on input from the Missouri DNR (see Section 5.2.1.1 of the EE/CA) and the Kansas City District, U.S. Corps of Engineers. Using conservative assumptions, the incremental risk to the potential maximally exposed individual is estimated to be less than one in two billion. The actual risk is much lower.

Issue 14

Comment. How will worker safety be guaranteed?

Response. The DOE has established requirements in DOE Order 5480.11 to ensure the safety of occupationally exposed individuals. A major component of these requirements is the commitment to reduce occupational exposures to ALARA levels, consistent with project requirements. The water treatment plant would be designed to minimize exposure to radioactive and chemical materials. The plant would be built adjacent to the quarry, and all process wastes would be packaged and stored in the quarry, thereby reducing occupational exposures from these wastes. Workers would be trained with regard to the hazards associated with radiation and chemical exposure and would be

provided with appropriate protective equipment as needed. A record of occupationally incurred exposure would be maintained and made available to each worker. The estimated levels of exposure associated with the proposed action are considerably below those necessary for any protective measures. However, DOE is committed to fully evaluating the potential for exposure to ensure not only compliance with regulatory requirements but also implementation of the ALARA process.

Issue 15

Comment. What would happen to the wastes generated by plant operation?

Response. The wastes would be packaged in containers and stored in the quarry in a designated area, pending a decision on the disposition of all bulk wastes currently being stored in the quarry. The impact associated with storage of these wastes would be low. An estimated volume of 22 m^3 (28 yd^3) of process wastes would be generated per year. The surface exposure rate associated with these packaged wastes is estimated to be 10 μR/h. The current exposure rate in the quarry, which is highly variable with location, averages about 60 μR/h.

Issue 16

Comment. Removal of the quarry water could result in increased releases of radon gas as solid wastes are uncovered and the water table in the bulk wastes is lowered.

Response. Radon gas emissions may increase somewhat as the quarry water is removed and treated. However, the major source of radon gas emissions causing the elevated readings at the quarry perimeter is the surficial deposit of radium-contaminated wastes on the eastern side of the quarry, not the area covered by the pond. Neither removing the pond water nor lowering the water table in the bulk wastes would affect radon releases from those areas that are currently causing the elevated levels. Monitoring systems and contingency plans would be in place to identify and respond to increases in radon levels at the quarry perimeter, as appropriate, if such increases occurred.

Issue 17

Comment. The potential for adverse environmental impacts, e.g., on local biota and archeological resources, should be considered.

Response. The effects of the proposed action on local biotic populations would be minimal. The water treatment plant would be constructed in a relatively small area outside the currently fenced quarry. The size of the affected area, 5.6 ha (14 acres), would be negligible relative to the size of the surrounding wildlife area, 6,000 ha (15,000 acres). Although mobile wildlife could be displaced during the action period, the quarry area does not provide unique wildlife habitat and its plant species are not restricted in distribution (see Section 5.2.1.2 of the EE/CA). A positive effect that

would result from removing the contaminated water is the reduced potential for future biological uptake of radioactive and chemical contaminants originating from the quarry pond or from areas to which the contaminants may have migrated.

In Section 4.1 of the EE/CA, it was stated that an archeological survey of the quarry area potentially affected by the proposed action would be conducted prior to the initiation of any response activities. The area has been surveyed, and one archeological site was found (Missouri file number 23SC709). This site consists of a small quantity of stone flakes in the uppermost portion of the modern soil that appears to have been disturbed by past railroad construction activities. It does not meet the criteria for inclusion in the *National Register of Historic Places*, which are listed in 36 CFR 60.4. This determination is based on the recommendations of the survey report, which have been supported by the Missouri Department of Natural Resources, Division of Parks, Recreation, and Historic Preservation. The DOE will obtain a "formal determination of no effect" from the State Historic Preservation Officer pursuant to the National Historic Preservation Act prior to initiating the proposed action.

Based on the preliminary engineering design for the proposed treatment system, one of the two effluent ponds and the below-grade discharge pipe would be partially located in the 100-year floodplain of the Missouri River. Therefore, a floodplain assessment has been prepared for the proposed action and is attached as an appendix to this responsiveness summary. As described in the floodplain assessment, no significant adverse impacts are expected to result from this action. Potential impacts to floodplain habitat and biota would be similar to those discussed for the treatment plant location (see Section 5.2.1.2 of the EE/CA). In fact, the overall emphasis of the proposed action is to improve environmental conditions in the quarry area, which includes the Missouri River floodplain.

WRITTEN COMMENTS AND RESPONSES

Letters on the proposed action were received from the following individuals:

- Robert L. Morby (Chief, Superfund Branch, Waste Management Division, U.S. Environmental Protection Agency Region VII, Kansas City, Kansas) -- letter to Rodney R. Nelson dated December 23, 1988;

- William C. Ford, P.E. (Director, Division of Environmental Quality, Missouri Department of Natural Resources, Jefferson City, Missouri) -- letter to Robert L. Morby dated January 19, 1989;

- Louise McKeon Belt (St. Louis, Missouri) -- letter to Steve McCracken and Roger Nelson dated February 17, 1989;

- Marilyn Spirt Lanson (St. Louis, Missouri) -- letter to Christopher Bond (U.S. Senator from Missouri) dated February 28, 1989; and

- Robert J. York (Acting Chief, Installation Restoration Program, U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, Maryland) -- letter to Rod Nelson dated March 15, 1989.

The letters from Robert L. Morby and William C. Ford were received prior to publication of the final version of the EE/CA, and revisions based on the issues raised in these letters were included in the final EE/CA, as appropriate.

Each of these letters has been assigned an identification letter according to date of receipt, and specific issues within each letter have been identified with a number. For example, the earliest letter received is Letter A; issues (comments) identified within Letter A are labeled A-1, A-2, and so forth; and the respective responses to these comments are labeled Response A-1, Response A-2, and so forth. A copy of each letter is reproduced in this section, and the responses to identified comments are presented on succeeding pages.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
726 MINNESOTA AVENUE
KANSAS CITY, KANSAS 66101

DEC 23 1988

Mr. Rodney R. Nelson
U. S. Department of Energy
Weldon Spring Site Remedial
Action Project
Route 2, Highway 94 South
St. Charles, Missouri 63303

Dear Mr. Nelson:

We have reviewed the revised "Engineering Evaluation/Cost Analysis for the Proposed Management of Contaminated Water in the Weldon Spring Quarry" dated December 1988. In general, the revised document is well developed, technically sound, and adequately addresses most of our comments from our September 28, 1988 meeting.

We believe the EE/CA document, in its current form, is sufficient to allow meaningful public comment on the proposed action. Outlined below are aspects of the proposal which require further clarification; however, we believe that these concerns can be appropriately addressed in the responsiveness summary.

A-1 5.1 Requirements Potentially Relevant to the Proposed Action. Tables 9 & 10 contain potential effluent discharge limits, however the text contains inadequate discussion on what criteria was used to determine the appropriate cleanup levels. Also, Table 9 does not appear to contain an effluent limit with the superscript letter c as the footnotes would indicate. Table 2 and this section should have included the Missouri Safe Drinking Water Act and the Missouri Public Drinking Water Regulations.

A-2 5.2.1.2 Environmental Risk Analysis. This section does not address the potential ecological impacts of effluent discharge to the Missouri River. The last sentence on page 60 says "In terms of residual contaminant levels, the treated water would meet effluent requirements that are based on ensuring protection of human health and the environment, including biotic populations (see sections 5.2.1.1 and 5.5)." However, potential ecological impacts on the Missouri River were not discussed in these additional sections either.

A-3 5.5 Treatment Plant Specifications. Descriptions of the monitoring program do not indicate what specific parameters are to be monitored. Will the program include monitoring for those contaminants which do not currently, but potentially could exceed appropriate discharge limits at some point during plant operation?

Response A-1

Tables 9 and 10 include consideration of the Missouri Safe Drinking Water Act and the Missouri Public Drinking Water Regulations. The cleanup levels were conservatively identified, e.g., from drinking water standards, where available, as identified in the footnotes to the tables. The superscript c in Table 9 appears after the "asbestos" entry in the first column. (Note: the 8-hour time-weighted average for asbestos given in Section 5.1.1.10 of the EE/CA should be 0.2 fibers/cm^3, corrected from 2.0 fibers/cm^3.)

Response A-2

The EE/CA includes a discussion of the river component of environmental impacts in Section 5.2.1.2 (page 61). The reference to Sections 5.2.1.1 and 5.5 is related to the effluent requirements, which in certain cases (e.g., ambient water quality criteria) include consideration of biotic populations other than humans. In addition, plans are currently under way to assess potential impacts on fathead minnows from the release of treated water.

Response A-3

The monitoring requirements are included in the NPDES permit issued by the Missouri DNR and address (1) parameters to be monitored, (2) sample type, and (3) monitoring location and frequency, as appropriate.

A-4 5.5 Treatment Plant Specifications. The plan should specify performance criteria, if not the actual specifications, for containment and storage of the process wastes.

Thank you for the opportunity to review the revised EE/CA. Please call if you have any questions.

Sincerely yours,

Gale A. Wright

Robert L. Morby
Chief, Superfund Branch
Waste Management Division

cc: David Bedan, MDNR

Response A-4

The performance criteria and specifications for the containment and storage of process wastes would be included with those for the treatment system in the final design package.

JOHN ASHCROFT
Governor
G. TRACY MEHAN, III
Director

STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL QUALITY
P.O. Box 176
Jefferson City, MO 65102

Division of Energy
Division of Environmental Quality
Division of Geology and Land Survey
Division of Management Services
Division of Parks, Recreation, and Historic Preservation

January 19, 1989

Mr. Robert L. Morby, Chief
Superfund Branch
Waste Management Division
U.S. Environmental Protection Agency, Region VII
726 Minnesota Avenue
Kansas City, Kansas 66101

Dear Mr. Morby,

The Missouri Department of Natural Resources (MDNR) has reviewed the Engineering Evaluation/Cost Analysis for the Proposed Management of Contaminated Water in the Weldon Spring Quarry (USDOE/OR/21548-039, December 1988).

The document is generally well written and adequately documents the need to remove the contaminated water from the Quarry in order to remove the bulk waste from the Quarry.

The contaminated water should be treated to drinking water standards. In the case of uranium, where there is no drinking water standard, the levels should be as low as reasonably achievable. In no case should water exceeding 100 pCi/l of uranium be discharged. The proposed design goal of treating the water to 30 pCi/l should be adequate for achieving this level. Specific comments are attached.

The MDNR will also require that the U.S. Department of Energy apply for a state NPDES permit to discharge the non-radioactive contaminants in the water.

The MDNR has also consulted with the Missouri Department of Health (MDOH) regarding the risk analysis for the proposal and the MDOH has concurred that the proposed levels are protective of human health. MDOH's comments are attached.

Mr. Robert L. Morby
January 4, 1989
Page 2

If you have any questions on these comments please contact me or Dr. David Bedan of my staff.

Sincerely,

DIVISION OF ENVIRONMENTAL QUALITY

William C. Ford, P.E.
Director

DEB/cjj

Attachments

cc: Mr. Ron Kucera, Deputy Director, MDNR
Dr. David Bedan, DEQ Administration
Mr. Robert Hentges, WPCP
Mr. Jerry Lane, Director, PDWP
Ms. Hilda Chaski, MDOH
Mr. Rod Nelson, USDOE

Missouri Department of Natural Resources Comments on EE/CA for Weldon Springs Quarry Water Treatment Proposal (Dec 1988)

B-1 Page 20, Table 2: The listing of Missouri requirements should include the Missouri Safe Drinking Water Act and Rules.

B-2 Page 41, Table 9: A footnote should be added to indicate EPA has proposed to change the drinking water standard for lead from 0.05 mg/l to 0.005 mg/l.

B-3 Page 42, Table 9: The concentration and potential effluent limit for Gross Beta should be included. Footnote [e] should indicate that a drinking water standard for uranium is being considered by EPA.

B-4 Page 43, Table 10: The concentrations and potential limits for Gross Alpha and Gross Beta should be included.

B-5 Page 59, Section 5.2.1.2: Is the 170 cubic yards of process wastes per year a dry volume? If so, how will wastes be dried? Does this volume include wastes from the ion exchange units?

B-6 Page 66, last paragraph: A discussion of in-stream monitoring in the Missouri River should be added. Samples should taken upstream and downstream of the point of effluent discharge and at the St. Louis County and St. Louis City water intakes at mile 37.

Response B-1

The noted requirements are included in Table 2 and Section 5.1.3 of the EE/CA.

Response B-2

Although the proposed revision is not included in the EE/CA, the treatment system would be modified to accommodate such a revision if it were promulgated and determined to be either applicable or relevant and appropriate to the release of treated water into the Missouri River.

Response B-3

Consideration of a proposed standard is difficult when no actual numbers are available; thus, an addition to footnote e of Table 9 was not included. However, the issue would be addressed, as appropriate, if such a standard were promulgated. The limit for gross beta was not included in the table because, based on characterization data (see Appendix A of the EE/CA), it is neither applicable nor relevant and appropriate to the proposed action.

Response B-4

Gross alpha as such is not a contaminant that requires treatment; therefore, it is not included in Table 10. In the quarry water, gross alpha is essentially represented by uranium, and uranium is included in Table 10. (Measured differences between gross alpha and uranium levels in Table 9 reflect differences in the respective analytical methods.) Gross beta is not included in Table 10 for the reasons discussed in Response B-3.

Response B-5

Process wastes are discussed in Section 5.5 of the EE/CA. The total volume of dewatered process wastes, including ion-exchange wastes, is estimated to be 22 m^3 (28 yd^3) per year. The wastes would be dewatered using a conventional process (e.g., filter press) that would be identified in the final design package for the proposed treatment system.

Response B-6

In-stream monitoring requirements, including those identified here, are established in the NPDES permit issued by the Missouri DNR.

MEMORANDUM

Missouri Department of HEALTH

TO: Dave Bedan
Division of Environmental Quality
Administration
Department of Natural Resources

FROM: Daryl W. Roberts
Chief
Bureau of Environmental Epidemiology

SUBJECT: Comments on Weldon Spring Quarry Water Treatment Plant

DATE: December 15, 1988

The following comments pertain to three issues that were raised and discussed at the coordination meeting of December 7, 1988, at Weldon Spring. All these issues relate to the Quarry Water Processing Plant.

B-7 1. The treatment process that was recommended for clean-up of the quarry water was targeted to reduce the uranium level of the effluent to 30 pCi/L, but in actual practice that level would range between 30 and 100 pCi/L. We would concur with the Department of Natural Resources (DNR) suggestion of expressing this as "the effluent level will range from 30-100 with an average of about 60 pCi/L". This further implies that 100 pCi/L would be the maximum level discharged into the river, and indeed this level will be guaranteed.

B-8 2. With regard to the question of whether the 100 pCi/L level is protective of public health we would refer to the memorandum to you of December 12, 1988 (attached) which discusses some health aspects of the contaminants of concern at the quarry. Based on the Department of Energy's (D.O.E.) Missouri River Plume Study of December 1, 1988, the 100 pCi/L uranium level in the effluent would be diluted immediately to a concentration of from 2×10^{-2} to 2×10^{-4} pCi/L in the river water. And in the Revised Final Draft report on the Quarry Plant of November 1988, the D.O.E. states that the incremental uranium concentration in the river following its receipt of the effluent flow would be about 0.0007 pCi/L at the intakes of the water treatment plants. This extra amount of radiation in the river water would result in an increased risk of 4.6×10^{-10} to any one maximally exposed individual, and in considering the entire exposed population, the odds are 1.3×10^{-4} that someone in that population will be affected. The latter figure is based on a population of 1,000,000 but DNR has determined that the exposed population would be closer 1.5 million.

AN EQUAL OPPORTUNITY AFFIRMATIVE ACTION EMPLOYER
SERVICE DEVOTED TO A BETTER QUALITY OF HEALTH, SAFETY

Response B-7

This issue was addressed in the published EE/CA.

Response B-8

This issue was addressed in the published EE/CA.

3. The third issue involves the removal of lead. Since lime softening and ion exchange are individual steps in the treatment process, most of the lead should be removed through these processes. Experience has shown that lime softening will remove insoluble lead and ion exchange will remove the soluble form. Furthermore, the dilution effect of the river would reduce the concentration of lead to well below the proposed drinking water standard of 0.005 mg/l, even if no lead were removed from the influent stream; the quarry water has a lead concentration of about 0.04 mg/l.

This assessment is based on the assumption that all the uranium and lead in the effluent flow stays in the water and is not lost in the sediment of the river, and is not removed through the treatment processes at the downstream water treatment plants. Thus, it would appear that the process proposed for treating the quarry water would reduce the uranium and lead content to levels that would be protective of public health.

If you have any questions, please contact Gale Carlson or Dr. Richard Gnaedinger at (314) 751-6102.

DWR:RHG:vlh

MEMORANDUM

Missouri Department of HEALTH

TO: Dave Bedan
Planner III
Office of Administration
Department of Natural Resources

FROM: Daryl W. Roberts
Chief
Bureau of Environmental Epidemiology
Missouri Department of Health

SUBJECT: Comments on treatment of water from Weldon Spring Quarry

DATE: September 12, 1988

With regard to the four issues listed in your memorandum of September 2, 1988, the following comments are offered on issue #2 "are the proposed effluent levels protective of human health and environment."

The contaminants of concern are arsenic, manganese, 2,4-DNT, and uranium.

1. The arsenic and manganese effluent levels meet the federal and state drinking water standards and thus are protective.

2. The uranium effluent level of 100 pCi/L will be diluted immediately to 2×10^{-2} to 2×10^{-4} pCi/L which is well below the proposed drinking water level of 20 pCi/L. Based on this, the uranium level in the river water should be protective.

3. For DNT the ideal level should be zero in order to be protective of human health. The target effluent level of 0.11 micrograms per liter would give an additional cancer risk of 10^{-6}. However, after dilution in the river, the DNT level may be so low as to be non detectible. Therefore, if the actual effluent level approaches the target level, it would also be protective.

If you have any questions, please contact Dick Gnaedinger at (314) 751-6102.

DWR:RHG:vlh

AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER
Serving people through a national primary mission

COMMENTS ON THE ENGINEERING EVALUATION/ COST ANALYSIS FOR THE PROPOSED MANAGEMENT OF CONTAMINATED WATER IN THE WELDON SPRINGS QUARRY

2559 Oak Springs La.
St. Louis, Mo. 63131
February 17, 1989

To Steve McCracken and Roger Nelson:
From Louise McKeon Belt

PAGE

C-1 5. Re your comment that the Femme Osage Slough presents a hydrogeologic barrier to further contaminant migration from the quarry toward the well field to the south. According to Fig. A. 6,p.99, there is only one location sampled in the alluvium south of the Quarry. That is hardly enough proof for such a statement. When I mentioned this at the Westport Ramada hearing Feb. 13, Roger Nelson said that they had readings from at least 10 wells south of the slough, and they all had background readings no more than 8 picoCuries per liter. But I have been told

C-2 that background in groundwater is .01 pCi/L; the surface water background number is .15 pCi/L .Why do you use 8 as a background number?

C-3 You repeat this hydrogeologic barrier idea three times, like a mantra, in this report. Wishing won't make the readings low. I expect that cleaning out the radioactive material will.

C-4 24. Access restrictions must be strengthened. Tamper-proof signage, some sort of alarm which alerts security when the fence is breached or a sign torn off, prosecution of trespassers at hazardous waste sites, should all be accomplished speedily.

C-5 36. 4.1.4. Best available Black Bag Technology should be implemented to control asbestos, radon, and radioactive dust. Release levels should be zero. Have you researched this?

C-6 46. 5.5.5.14. Line 4. Shouldn't that figure be 20pCi/m cubed?

C-7 70. Vapor recompression/distillation process would cost 2,150,000 over the 5 year period. At the Westport hearing I asked if this were omitted from consideration because it would cost over two million dollars, and Mr. McCracken answered that this was not the problem, that ion exchange would bring the count down to 30, and that VR/D is not as reliable, and that this is not being funded through Superfund. Would you please explain where the money is coming from? If from one of DOE's funds, which one?

C-8 81. Thorium at 7 feet down in the quarry is 4 1/2 times the count in deeper levels. The inventory of uranium-238 at 40 feet is 7.2 times the average inventory at the 25,14,7 and .5 feet levels. Is it because the uranium was dumped first or because it migrated down there? Roger Nelson answered this question of mine

Response C-1

The hydrogeology of the quarry area is complex. Current data indicate that the slough acts as at least a partial barrier to contaminant migration in the alluvium. There are many monitoring wells in the alluvium in the vicinity of the quarry (see Figure A.5 of the EE/CA). The concentrations of radionuclides are much lower in the monitoring wells south of the slough than in the wells north of the slough; the concentrations south of the slough are at background levels. Two additional observations support the migration-barrier hypothesis: (1) groundwater velocities in the vicinity of the slough are very low to almost stagnant and (2) water levels in the alluvium south of the slough are about 3 m (10 ft) lower than those in the slough itself. These are the bases for the statement in the EE/CA that the slough appears to act as a hydrogeologic barrier to contaminant transport toward the well field in the alluvium. Boreholes were taken in the vicinity of the slough to examine the vertical and horizontal profile of uranium contamination (see Figure A.6). Although this was not done to determine if the slough was acting as a hydrogeologic barrier, the information obtained from this investigation (shown in Figure A.7) is consistent with that hypothesis. However, over time, the slough may not continue to intercept contaminants migrating from the quarry toward the county well field.

Response C-2

The comments on background radiation levels in nearby water supplies have been addressed by Dave Bedan of the Missouri DNR in his letter to you dated March 10, 1989 (copy provided on pages 29-30 of this document).

Response C-3

We agree that it is imperative to initiate cleanup activities at the quarry as soon as possible. See Response C-1.

Response C-4

The issue of safeguarding the public from the hazards at the quarry is valid. We agree that security measures are important in preventing unlawful entry. Although this issue is beyond the scope of the EE/CA, the DOE is currently investigating options for strengthening existing access restrictions.

Response C-5

Black bag technology is used to reduce airborne emissions from demolition activities in metropolitan areas. This technology will be investigated for relevance to bulk waste removal activities at the quarry. However, it is not relevant to the proposed treatment of contaminated water.

[Page intentionally left blank.]

Response C-6

The radon flux limit for uranium mill tailings following remedial action is 20 pCi/m^2-s (see Section 5.1.1.14). This value is a flux, i.e., the amount of radon gas that crosses a given area in a specified amount of time.

Response C-7

The funding for the Weldon Spring Site Remedial Action Project comes from the DOE as provided for by Congress. After DOE obtains its funding guidance from Congress, the money is allocated to various programs based on programmatic requirements.

Response C-8

The distribution of radioactive contaminants in the quarry bulk wastes is largely due to the manner in which the wastes were placed in the quarry. Any contaminant migration that has occurred subsequent to their placement has had a relatively small impact on this distribution.

C-8 at the Wentzville hearing by saying that the uranium is there because it was placed at that level.

C-9 85-89. During high water stages does the radioactivity wash from the slough towards the river? Someone else asked this question , and Mr. Nelson said that after floods the count is zero and then it begins to rise again, and he doesn't know why. I assume there is migration from the quarry. But what happens to the radioactivity that washes to the river? Do we St. Louis Countians end up drinking it?

C-10 EPA's drinking water standard is 15 pCi/L gross alpha, excluding uranium and radon. How are you meeting that standard?

C-11 The pipe from your retention basin storage will trickle water into the Missouri, right? Do you need a third retention basin just to be sure you are never tempted to pipe the water to the river at any rate greater than a trickle?

C-12 116. B.3.1.4. By-passing the ion exchange columns to meet the appropriate effluent limits directly contradicts the As Low As Reasonably Achievable Levels DOE requires in order to minimize total risk to potential receptors. Also, it is unclear whether by-passing is just for arsenic or for arsenic and uranium. I ask that the water be put through the columns twice so as to bring the count down to REAL ALARA levels. No by-passing, ever, should be allowed. Don't you agree?

C-13 119. At first there were five, then three, now you're back to five alternatives, and the reader must be a detective to figure which these three are. Can't you state their names, or else at least let each alternative keep the same number throughout the paper?

C-14 125. Is density separation applicable? Text doesn't say.

C-15 137. Does rapid resin exhaustion occur with limestone (rich in calcium) quarry water? How will you deal with such a problem?

C-16 Please answer the questions I have put to your team. I fully expect that you will carry out the job of ridding Weldon Springs of radioactive materials, arsenic, manganese and 2,4-DNT, without letting any contaminants escape to the air or water.

Sincerely yours,

Louise H. Belt

(314) 432-4214

cc. Meredith Bollmeier
Kay Drey
Dave Bedan

Response C-9

Some of the surficial contamination in the slough and alluvium would wash to the Missouri River if the river flooded. Some might also be displaced, e.g., deposited at a new location in the alluvium, prior to reaching the Missouri River. The proposed action is an essential component of quarry remediation that would reduce the potential for contaminant migration and subsequent displacement.

Response C-10

The DOE would meet the requirements of the NPDES permit, which include monitoring for gross alpha (see also Response B-4). This would be accomplished using conventional unit operations that have been used successfully in similar situations elsewhere.

Response C-11

The water treatment plant would be designed to treat water at a rate of 31 gallons per minute (gpm) and to hold the treated water in a retention basin for testing to ensure compliance with discharge requirements prior to batch release. Thus, although the release rate would be greater than 31 gpm during a discrete batch release, the average rate of discharge over time (e.g., several weeks) would be 31 gpm. Relative to the flow rate of the Missouri River, the discrete discharge rate could still be considered "a trickle."

Response C-12

The DOE is not proposing to bypass the ion-exchange columns. The statement in the EE/CA simply indicates that the ion-exchange columns could potentially be bypassed by a portion of the flow without exceeding the NPDES discharge limits. In fact, the inclusion of these ion-exchange columns in the treatment scheme demonstrates the project's commitment to implementing DOE's ALARA process (see Chapter 6 of the EE/CA). Twice-through operation is not needed for effective performance of the treatment system.

Response C-13

Consistent with EPA guidance, preliminary alternatives (in this case, six) were identified as being potential alternatives for management of the contaminated water in the quarry. Again, consistent with EPA guidance, these alternatives were screened to identify final alternatives (in this case, three) for detailed evaluation. The renumbering of these final alternatives was an editorial decision, documented in the footnote on page 38 of the EE/CA. The five alternatives referred to in the comment are simply *treatment* options, which are discussed separately in Appendix B of the EE/CA.

Response C-14

Density separation was discussed under three categories in Section C.1.2 of Appendix C. A separate determination of the applicability of each of these categories was made (see Sections C.1.2.1, C.1.2.2, and C.1.2.3).

Response C-15

The potential for resin exhaustion by calcium has been addressed by the ordering of each unit operation in the proposed treatment scheme. That is, precipitation and filtration precede ion exchange to minimize the potential for calcium interference.

Response C-16

All activities would be conducted in a manner that would minimize the release of radioactive and chemical contaminants from the site into the environment. The nearby environment would be monitored to ensure compliance with federal and state standards and guidelines that are protective of human health.

JOHN ASHCROFT
Governor

G. TRACY MEHAN, III
Director

STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES

P.O. Box 176
Jefferson City, MO 65102

Division of Energy
Division of Environmental Q
Division of Geology and Land
Division of Management Serv
Division of Parks, Recreatio
and Historic Preservation

March 10, 1989

Mrs. Louise Belt
2559 Oak Springs La.
St. Louis, MO 63131

Dear Mrs. Belt,

I recently received a copy of your comments on the water treatment proposal for the Weldon Spring Quarry which you sent to Mr. Steve McCracken of the U.S. Department of Energy.

In your marginal note you asked whether there is a report background on background levels in groundwater and surface water in Missouri.

I do not know of such a report and, in any case, unless it is specific to Missouri River alluvium it would not be of much help since natural background levels in groundwater vary greatly depending on the type of aquifer, type of rock, depth of well, etc. In fact, we have found a deep well in Missouri with a Gross Alpha level over 80 pCi/l. The deep well in my own town (Holts Summit) has tested as high as 10 pCi/l for Gross Alpha. In any case, I have not seen reports of a level of 0.01 pCi/l Gross Alpha as a background level for groundwater.

In November of 1988, the Missouri Department of Natural Resources (DNR) took two samples of water from a private well in St. Charles County in the Missouri River alluvial aquifer upstream from the Weldon Spring wellfield. The results of analysis by the Missouri Department of Health laboratory were as follows:

	Gr. Alpha	Ra-226	Ra-228	Th-230	Th-232	Uranium	Gr. Beta
Sample 1	8.7	ND	0.7	ND	ND	5.3	6.5
Sample 2	10.9	0.2	0.9	ND	ND	5.4	7.0

Based on these results and our previous monitoring in the well-field I believe that background levels in the alluvial aquifer probably range from about 1 pCi/l to about 10 pCi/l of Gross Alpha with most samples falling in the 2 to 4 pCi/l range.

We intend to do more sampling in Missouri River alluvium to try to obtain more data. Also, I believe that the U.S. Geological Survey also plans to do the same. We also intend to take some samples of Missouri River surface water.

Mrs. Louise Belt
March 10, 1989
Page 2

I have enclosed the results of DNR's sampling in the Weldon Spring wellfield for several years. Note that the average of the gross alpha levels in the raw water from the production wells is 3.8 pCi/l. Given our present information this seems to be in the range of background levels.

Please call me at (314) 751-4533 if you have any questions on this issue.

Sincerely,

DIVISION OF ENVIRONMENTAL QUALITY

David E. Bedan

David E. Bedan
Weldon Spring Site Coordinator

DEB/cjj

Enclosure

cc: Mr. Steve McCracken, DOE
Mr. Jim Barks, USGS
Mr. Jerry Lane, PDWP
Mr. Bob Hentges, WPCP
Mr. William Ford, DEQ
Dr. Jim Williams, DGLS
Mr. Jim Van Dyke, DGLS
Mr. Daryl Roberts, DOH

[Page intentionally left blank.]

146 Pinehurst Estates Drive
St. Louis, Missouri 63141
February 28, 1989

Senator Christopher Bond
815 Olive Street
St. Louis, Missouri 63101

Dear Senator Bond,

D-1 I am very distressed that the U.S. Department of Energy is proposing to release into our drinking water source i.e., the Missouri River, millions of gallons of "treated" water from the Weldon Spring quarry. This water, after it has been treated, will still contain toxins including Uranium and other radioactive materials.

Enclosed are the comments and questions which I and my sons presented at the hearing on February 13, 1989 regarding permit application number MO-0108987, Weldon Spring Quarry Site. I urge you to give this matter your careful consideration. Once that "treated" water is released into our river system, it can never be retrieved.

I would appreciate communication of your position on this matter. Thank you.

Sincerely yours,
Marilyn Spirt Lanson
Marilyn Spirt Lanson

Response D-1

To ensure the health and safety of the public, the water treatment plant effluent would meet very stringent standards and guidelines. The treatment goal is for the average concentrations of residuals in the effluent to meet levels established as drinking water standards (for arsenic and manganese), or be within the range being considered for such a standard where none currently exists (for uranium), or be more conservative than that identified as an ambient water quality criterion (for 2,4-dinitrotoluene, i.e., for the residual level to be one-tenth of the level identified in the federal ambient water quality criteria and accepted as protective by the Missouri Department of Health). There would be no reason to retrieve this water from the Missouri River because it would be treated to very protective levels in an advanced treatment system prior to its release. The DOE is committed to taking conservative approaches throughout site cleanup to ensure protection of public health and the environment.

Natural Background Radiation
Marilyn Spirt Lanson

D-2 Since the discovery of radiation, people have recognized its harmful effect on living things. There is no radiation that is benign. Over the years, the experts have consistently revised downward their recommendation of what is a permissible level of exposure, as knowledge of the degree of hazard has increased.

We are all, at all times, exposed to natural background radiation. We must examine the naturally occurring radiation and then ask whether we can afford to add to it in light of the knowledge that any increase in the exposure to radiation, alpha radiation especially, increases the risk of harm from cancer and genetic abnormalities.

Interest in measuring exposures to the sources of background radiation has been limited.

D-3 There are five sources of natural background radiation as described in the National Council on Radiation Protection and Measurements report no. 94, entitled "Exposure of the Population in the United States and Canada from Natural Background Radiation:"

1) cosmic radiation, which includes solar radiation and galactic radiation. Exposure varies with altitude, the dose equivalent, i.e. relative biological effectiveness, doubling at every 2000 meter increase in height.

2) radiation from cosmogenic radionuclides, which are a result of the interaction of cosmic rays with atmospheric gases. Four cosmogenic radionuclides contribute a measurable dose to man: C14, H3, Na22, Be7.

3) external gamma radiation, also known as terrestrial radiation. This is naturally occurring radionuclides in soil or rock, especially Potassium 40 (K40,) Uranium 238 (U238,) and Thorium 232 (Th232.) The U238 chain includes its daughter gas, Radon 222 (Ra222) which can diffuse through the soil and into the atmosphere. The Th232 decay chain includes Radon 220 (Ra220.) K40, found in our blood, is the principal contributor of our internal dose. Information for alpha and beta rays has been neglected.

4) inhalation exposure. The most significant dose from inhallation is that from the decay products of Radon.

5) radionuclides in the body, i.e. internally deposited. They derive mainly from food, air and drinking water. Of particular concern are U238, Th232, Po210, Rb87 because they are widespread in the biosphere, and many of the members of their decay series are alpha emitters, the most deadly of the rays.

Drinking water contributes a substantial portion of the Uranium intake, five to ten times greater than food derived Uranium. There is no standard for Uranium in water supplies as a

D-4 radioactive element. In addition to ingesting Uranium and its Radon daughters by drinking water, when water is used for cleaning, dishwashing, bathing or washing clothes, Radon escapes from the water into the air where we inhale it, and where it decays into alpha emitting daughters which we inhale.

One picocurie is the amount of a radioactive material that

Response D-2

The risks of radiation exposure are understood better than those of many other carcinogens. The risks from low-level radiation exposure are conservatively estimated by extrapolating the risks from much higher rates of exposure. As noted in the comment, uranium occurs naturally in the environment. The increase in uranium concentration in the Missouri River as a result of the proposed action would be immeasurably small relative to naturally occurring levels. (See Section 5.2.1.1 of the EE/CA.)

Response D-3

The discussion of radiation sources is appropriate, with a few minor clarifications: information for alpha and beta particles in the "external gamma radiation" category have not been neglected in the referenced report, they are simply separate and distinct from gamma radiation and are therefore addressed in other categories (e.g., incorporated in the radon [Rn] discussion). The contribution of drinking water to total natural uranium intake relative to other dietary contributions is dependent on many factors. The risk analysis for the proposed action was redundantly conservative, i.e., a number of conservative assumptions were made to ensure that the potential risks would not be underestimated. The report referenced in the comment constituted one source of technical input for this analysis. Based on the risk analysis (see Section 5.2.1.1 of the EE/CA), the incremental risk to the potential maximally exposed individual that would result from the proposed release is estimated to be less than one in two billion. This risk is extremely low and clearly insignificant.

Response D-4

The federal standard for uranium discharge to surface water is DOE's derived concentration guide of 550 picocuries per liter (pCi/L) of total uranium, plus ALARA (as low as reasonably achievable). By applying the ALARA process to the derived concentration guide, DOE is committed to reducing the level of total uranium in the quarry pond water from over 2,000 pCi/L to less than 100 pCi/L prior to release. During plant operation, DOE will continue to implement the ALARA process with the goal of reducing the actual effluent level to 30 pCi/L. This value is consistent with those currently being discussed by the U.S. Environmental Protection Agency for an eventual drinking water standard.

D-5 gives off 2.22 radiation particles per minute. According to a 1985 study of the "Occurrence of Radioactivity in Public Water Supplies in the U.S.," Uranium concentration in picocuries per liter for both surface and domestic water in Missouri is .15. It averaged .29 according to the April, 1981 Oak Ridge National Laboratory Report, "Uranium in U.S. Surface, Ground, and Domestic Waters," vol. 1. It is your intention to reduce the 2314 average picocuries per liter of Uranium in the contaminated water to a maximum of 100 picocuries per liter, and then dump it into the Missouri River. According to Tom Burke of the Missouri River Kansas City District Corps of Engineers, the River has a total flow of 272,800 gallons per minute at Herman, mile 98, upstream of the proposed discharge pipe. The river is very low at present, and at best, using the target amount of flow for navigation, the total flow would be 432,000 gallons per minute. You are banking on even dilution which may or may not occur. With three million gallons of water, even at your proposed 100 picocuries per liter, and an additional fifty-seven million plus gallons waiting, just how many picocuries per liter of water would we be consuming? By how much will that 100 picocuries per liter increase our natural level of .15-.29 picocuries per liter?

D-6 To have a safe level of Uranium and its by-products is a conradiction in terms. We already have an adequate amount occurring naturally. Any increase in exposure increases the risk of damage to our health. Water affects every living thing. You are proposing to increase, therefore, the bioconcentration of toxins in all living things in contact with our water. We will be drinking it, consuming foodstuffs affected by the water, and even exporting it in the form of food, Busch beer, Coca Cola. Can we not find a safer, if more expensive alternative?

Addendum:

D-7 I was disappointed that the panel members did not respond to my questioning of the Department of Energy's ability to assure us that the contaminated water would be uniformly distributed throughout the Missouri River's entire flow. At what rate do you intent to discharge the treated water? Will the rate be adjusted at times of higher or lower flows? Will the rate be adjusted depending upon the concentration levels of gross alpha, gross beta, Uranium and non-radioactive toxins?

D-8 Clearly the water must be treated. Why don't you "treat" the water and then store it in glass lined tanks until such time as a method is found to detoxify it completely? Once you put it into our river system, you can never retrieve it.

Response D-5

Prior to any release to the river, the water would be extensively treated to meet stringent discharge requirements. The treatment goals were established without consideration of dilution. Discharge to the Missouri River is simply the most logical and environmentally acceptable means for managing this volume of treated water. Potential inflows to the proposed quarry water treatment plant do not include the 57 million gallons of water in the raffinate pits, which are located in the noncontiguous raffinate pits and chemical plant portion of the site. The increase in uranium concentration in the Missouri River as a result of the proposed action would be immeasurably small relative to naturally occurring levels (see Section 5.2.1.1 of the EE/CA) and would have no impact on the concentration naturally ingested. Flow rates of the Missouri River measured at Hermann were provided by the Missouri Department of Natural Resources (and subsequently corroborated by the Kansas City District, U.S. Corps of Engineers) to support the risk analysis for the proposed action. Based on conservative assumptions, the incremental risk to the potential maximally exposed individual is estimated to be less than one in two billion. This risk is a very small fraction (about 1/23,000,000) of the potential risk due to exposure to natural radiation in the environment and is clearly insignificant.

Response D-6

Cost is never considered in assessing cleanup alternatives until DOE first ensures the protection of public health and the environment. In fact, having ensured this protectiveness, the DOE has applied its ALARA process to the proposed action to reduce potential exposures as far below conservatively identified levels as can reasonably be achieved. Therefore, the proposed treatment system is comprised of advanced technologies that include an ion exchange process so that the contaminated water can be treated to very safe levels prior to any effluent release. (See Responses D-4 and D-5.)

Response D-7

Rapid dilution was conservatively assumed in the risk analysis because the downstream water intakes are on the opposite side of the Missouri River from the discharge. Assuming incomplete mixing would have resulted in a lower risk estimate. The water treatment plant would be designed to treat water at a rate of 31 gallons per minute (gpm) and to hold the treated water in a retention basin for testing to ensure compliance with discharge requirements prior to batch release. Thus, although the release rate would be greater than 31 gpm during a discrete batch release, the average rate of discharge over time (e.g., several weeks) would be 31 gpm. Both the discrete and average discharge rates would be indistinguishable from the flow rate of the Missouri River, whether the river is at high flow or low flow stages. The levels of treatment residuals in the effluent would not exceed conservative discharge limits and would therefore have no impact on the rate of release.

Response D-8

See next page of responses.

A Question from the Next Generation
Ben Lanson

D-9 I would like to be able to go to any faucet and drink water without increasing my risk of cancer or having children with birth defects. I may be only 10, but I'd be willing to pay extra taxes to clean up this water properly, and not have it dumped into the river. We live in a high tech society. We can send

D-10 people deep into space, or deep below the sea. Shouldn't we be able to come up with a less dangerous solution to clean up this water? Can we only solve pollution by dilution and distribution?

Response D-8

The DOE agrees that it is imperative to treat the contaminated quarry water. The volume of treated water that would require storage, as recommended in the comment, would be so great as to render this alternative infeasible. The water would be treated to meet very conservative limits prior to any release. Thus, there would be no reason to retrieve the water. Discharge to the Missouri River is simply the most logical and environmentally acceptable means of managing this volume of treated water. (See Response D-5.)

Response D-9

Under the proposed action, DOE plans to treat the contaminated quarry water to meet very stringent discharge limits prior to its release (rather than dumping it in the Missouri River) to ensure protection of public health and the environment. Cost is never considered until this protection is ensured. In fact, contaminants would be removed from the quarry water in an advanced water treatment plant comprised of unit processes that have been developed by our "high-tech" society. These contaminants would then be containerized and stored on-site until a comprehensive decision is made on the final disposition of all of the site's contaminated material. The potential risks associated with discharge of the treated water are extremely low and clearly insignificant. (See Response D-5.)

Response D-10

The DOE's proposed response to the potential threat posed by contaminated quarry water is very protective of public health and the environment and is supported by such agencies and departments as the U.S. Environmental Protection Agency, the Missouri Department of Natural Resources, and the Missouri Department of Health. The water would be treated to meet stringent discharge requirements prior to its release, and the resultant potential risks would be extremely low and clearly insignificant. The treatment goals were established without consideration of dilution. (See Response D-5.)

ALPHA RADIATION
Terry Lanson

Radioactive particles damage living things by disrupting the molecular and subsequently cellular structures through their transfer of energy.

There are three types of radiation: alpha, beta, and gamma rays. The alpha rays are the most dangerous to life. Alpha particles can be shielded and they do not penetrate skin. When inhaled or ingested, however, the alpha particles are deadly. They can cause twenty times as much damage as beta particles. Once a radioactive particle has been ingested or inhaled, it cannot be shielded. Even low doses of alpha radiation are extremely dangerous, and one single particle of alpha radiation can pass through a cell and initiate a malignancy. Cell damage caused by radiation doesn't always result in cancer. Sperm and ovum cells can be damaged, which could result in damage passed to sons and daughters. If a cell that was part of a developing fetus were damaged, birth defects could result. The body can sometimes repair damage caused by gamma and beta radiation, however alpha particles inflict their damage so quickly that the body has almost no chance of repairing damaged cells.

Our bodies cannot distinguish the fact that radioactive elements such as uranium are emmiting harmful radiation and these elements are processed based on their physical and metallic charachteristics. Uranium is deposited primarily in bone, and bone marrow is very sensitive to radiation.

In the decay chain of uranium, which is an element which you plan to dump inyo my water supply, a good portion of the radioactive particles emmitted are of the alpha variety. For the first 4.51 billion years if its half-life, Uranium emits only alpha particles. Are we not at a great enough risk of cancer, birth defects, liver disease, and all of the other horrible diseases caused by your chemicals without having you dump them into our water supply?! D-11

Response D-11

The quarry water would not be dumped into the Missouri River; contaminants would be removed from the water prior to its release (see Response D-9) such that treatment residuals would meet protective discharge limits and would be indistinguishable from background levels in the Missouri River. The potential risks associated with this action are very low and clearly insignificant. (See Response D-5.)

[Page intentionally left blank.]

The following letter was received by Senator Christopher Bond as a response to the letter he had received from Mrs. Marilyn Spirt Lanson.

Department of Energy
Washington, DC 20585

April 13, 1989

The Honorable Christopher S. Bond
United States Senate
Washington, D.C. 20510-2503

Dear Senator Bond:

We appreciate your forwarding the comments submitted to you by Mrs. Marilyn Spirt Lanson on the Department of Energy's proposed quarry water treatment plan. Enclosed is some detailed information on some specific issues raised by Mrs. Lanson, but her comments will be addressed in the proposed plan being prepared by the Department for public comment.

In developing the plan to address quarry water treatment, the Department has worked closely with Federal and State agencies, including the U.S. Environmental Protection Agency, the Missouri Department of Natural Resources, and the Missouri Department of Health. Each of these agencies has indicated acceptance of the proposed plan after ensuring that it meets all applicable environmental regulations and that agency concerns and comments have been adequately addressed. The proposed water treatment plant discharges will meet or exceed all applicable Federal and State regulatory standards.

In summary, the Department of Energy will continue to be very responsive to concerns about health and safety and is committed to taking a conservative approach during remedial work at the site to continue to ensure that public health is safeguarded.

Sincerely,

Mary Ann Novak
Acting Assistant Secretary
for Nuclear Energy

Enclosure

Information on Quarry Water Treatment Activities

There are over 100,000 cubic yards of contaminated debris in the Weldon Spring Quarry. In addition, the quarry contains about three million gallons of radiologically and chemically contaminated water which is leaking into the ground water under the site and posing a potential threat to the nearby St. Charles County well field. In response to this situation, the Department of Energy has developed an overall strategy for cleanup of the quarry. This strategy addresses: treatment and removal of contaminated quarry water; bulk waste removal; characterization and cleanup of residual materials in the quarry; and, further ground-water studies to evaluate the need for a ground-water restoration program.

Four contaminants of concern at the quarry were identified at concentrations in excess of current regulatory levels: arsenic, manganese, 2,4-dinitrotoluene (2,4-DNT), and uranium. To ensure health and safety of the public, the Department will employ treatment technologies designed to reduce contaminants in treated discharges or effluent to average concentration levels at or close to those established as drinking water standards, where such Federal or State standards exist. Thus, arsenic and manganese will undergo treatment to reduce levels to meet the Missouri drinking water standard of 0.05 milligrams per liter. Because no Federal or State drinking water standard exists for 2,4-DNT, an effluent limitation of 0.11 micrograms per liter will be employed, based on the Federal ambient water quality criteria set by the U.S. Environmental Protection Agency for priority pollutants. This limitation corresponds to a 1 in 1 million risk level.

The applicable Federal standard for uranium discharge to surface water is the Department's derived concentration discharge guide of 550 picocuries per liter of total uranium. Applying as low as reasonably achievable to this standard, the Department is committed to reduce total uranium in treated water to less than 100 picocuries per liter. During plant operations, the Department will continue to apply the concept of as low as reasonably achievable with the goal of achieving effluent discharge of 30 picocuries per liter for total uranium. This is consistent with the value currently being discussed by the Environmental Protection Agency for uranium drinking water limits. Using a very conservative flow rate in the Missouri River (10,000 cubic feet per second), the uranium concentration of 100 picocuries per liter in effluent discharge results in a risk to an individual downstream that is less than 5 in 10 billion. This risk is extremely low and is insignificant.

DEPARTMENT OF THE ARMY
US ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010-5401

REPLY TO ATTENTION OF

March 15, 1989

Installation Restoration Division

Mr. Rod Nelson
U.S. Department of Energy
Route 2, Highway 94 South
St. Charles, MO 63303

Dear Mr. Nelson:

Per your request, this memorandum serves to provide the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) comments/concurrence on Engineering Evaluation/Cost Analysis for the Management of Contaminated Water in the Weldon Springs Quarry. The following are this Agency's comments:

E-1 a. It would be helpful if a table of costs associated with each alternative were provided for easy comparison (including Operations & Maintenance).

E-2 b. After the water that is currently standing is removed, treated, and discharged, will water continue to pond and be subsequently treated and discharged? If so, for how long is the treatment system envisioned to operate?

E-3 c. What is the ultimate fate of the treatment process wastes? If left in the quarry as proposed in the preferred alternative, contaminated run-off and leachate may develop. Also, care should be taken not to exceed 90 days of temporary storage of the process wastes as a permit may be required.

E-4 d. Request USATHAMA be provided with milestones with respect to this action (i.e. award date, treatability study initiation, design initiation, etc.).

If you have any questions please contact Mr. Ali Alavi at (301) 671-2270.

Sincerely,

Robert J. York
Acting Chief
Installation Restoration Division

Copy Furnished

Mr. Karl Daubel, U.S. Department of Energy, Oak Ridge Operations, Weldon Spring Site, Route 2, Highway 94 South, St. Charles, MO 63303

Response E-1

A cost table was compiled to support identification of the best treatment alternative during preparation of the EE/CA; this table is reproduced below. The table was derived from the technical report that supported preparation of the EE/CA (No. 5121-Q:EN-R-01-0467-00, corrected from MKE Doc. No. 5121-Q:EN-N-01-0611-00 as listed in the EE/CA references).

Estimated Operation and Maintenance (O&M) Costs and Present Worth Analysis of the Proposed Alternatives

Alternative	Operating Cost ($/day)			Waste Disposal ($/day)	Maintenance Labor ($/day)
	Energy	Chemicals	Labor		
1	45	88	180	188	22
2	123	89	180	188	22
3	45	80	225	150	22
4	123	81	225	150	22
5	568	2	75	292	11

Alternative	Monitoring Labor ($/day)	Total O&M Costs		Present Worth ($)	
		$/day	$/1,000 gal	One Year	Total
1	60	583	5.06	1,132,990	1,338,377
2	60	662	5.75	1,185,236	1,418,456
3	60	582	5.05	1,239,848	1,444,884
4	60	661	5.74	1,294,093	1,526,958
5	60	1,008	8.75	1,794,489	2,149,603

Response E-2

The quarry pond currently contains 3 million gallons of water. Under the proposed action, the pond water -- as it was being removed for treatment -- would be replenished by both surface water and groundwater inflow. The treatment plant would be designed to operate at rates that would meet or exceed the rates of all potential inflows. The rate of operation would therefore reduce the hydraulic head in the area of the quarry pond such that the groundwater gradient in the immediate vicinity would reverse, thereby creating an active sump at the base of the quarry. This process might require two to five years or more to complete. The water treatment plant would continue to operate until there was no longer any reason to treat water at the quarry.

Response E-3

The wastes would be packaged in containers and stored in the quarry in a designated area, pending a decision on the disposition of all bulk wastes currently being stored in the quarry. The impact associated with storage of these wastes would be low. An estimated volume of 22 m^3 (28 yd^3) of dewatered process wastes would be generated per year. Because the wastes would be containerized and stored for only a limited time, no contaminated runoff or leachate would be associated with these materials. No RCRA permit would be required because the action would be an on-site action at a CERCLA site and would therefore be exempt from such permitting requirements.

Response E-4

Provided the proposed action is approved, the contract award date for design and construction of the water treatment plant is forecast for June 1989. Treatability studies and design activities would be initiated at that time. Completion of the design report is forecast for August 1989, and completion of plant construction is forecast for June 1990.

APPENDIX

FLOODPLAIN ASSESSMENT FOR THE PROPOSED TREATMENT SYSTEM

A.1 PROJECT DESCRIPTION

Pond water in the quarry at the Weldon Spring site is radioactively and chemically contaminated as a result of leaching from wastes that were placed in the quarry between 1942 and 1969. The surface of the pond is higher than the surrounding groundwater table. Therefore, this water currently provides a gradient for the migration of contaminants into the nearby environment. A county well field is located within 1.6 km (1 mi) of the quarry and, in order to avoid potential adverse impacts to this drinking water supply, the proposed response action is to remove and treat the pond water in a newly constructed treatment plant. The treated water would then be released to the Missouri River through a 10-cm (4-in.) diameter pipe over a distance of about 2.4 km (1.5 mi). Based on the preliminary engineering design for the proposed treatment system, the buried discharge pipe and one of the two effluent ponds would be partially located in the 100-year floodplain of the Missouri River. The location of the proposed water treatment plant and the demarcation of the floodplain* at that location are shown in Figure A.1. The relationship of the effluent pond and discharge pipe to the Missouri River floodplain in the vicinity of the quarry is shown in Figure A.2.

A.2 FLOODPLAIN EFFECTS

It is DOE's policy to avoid adverse impacts to floodplains to the extent possible (10 CFR Part 1022). All response actions at the Weldon Spring site would be carried out in compliance with Executive Order 11988 (Floodplain Management). The area affected by the proposed action is very small and would be restored to essentially original conditions following the action period. In addition, the affected portion of the floodplain is agricultural land rather than pristine habitat, and the discharge pipe would follow an existing right-of-way. A dike would be constructed around the effluent pond to preclude entry by waters of a 100-year flood. The proposed action is not a critical action as defined in 10 CFR 1022.4(c), i.e., an activity for which even a slight chance of flooding would be too great, such as the storage of highly volatile, toxic, or water-reactive materials. On the contrary, water in the effluent pond would be of high quality (e.g., storm water and pond water that had been treated in the quarry treatment plant to meet protective water quality limits). Even if the pond were to flood, the floodwaters would be mixed with "clean" water and no adverse impacts would occur. (The chance of the pond flooding is less than 0.2% in a given year, less than 1.0% over an estimated 5 years

---

*Demarcation of the floodplain is based on a memorandum from S.G. Lauer (Planning Director, St. Charles County Planning & Zoning Commission, St. Charles, Missouri) to R. Ferguson (MK-Ferguson Company, Weldon Spring Site Remedial Action Project, St. Charles, Missouri).

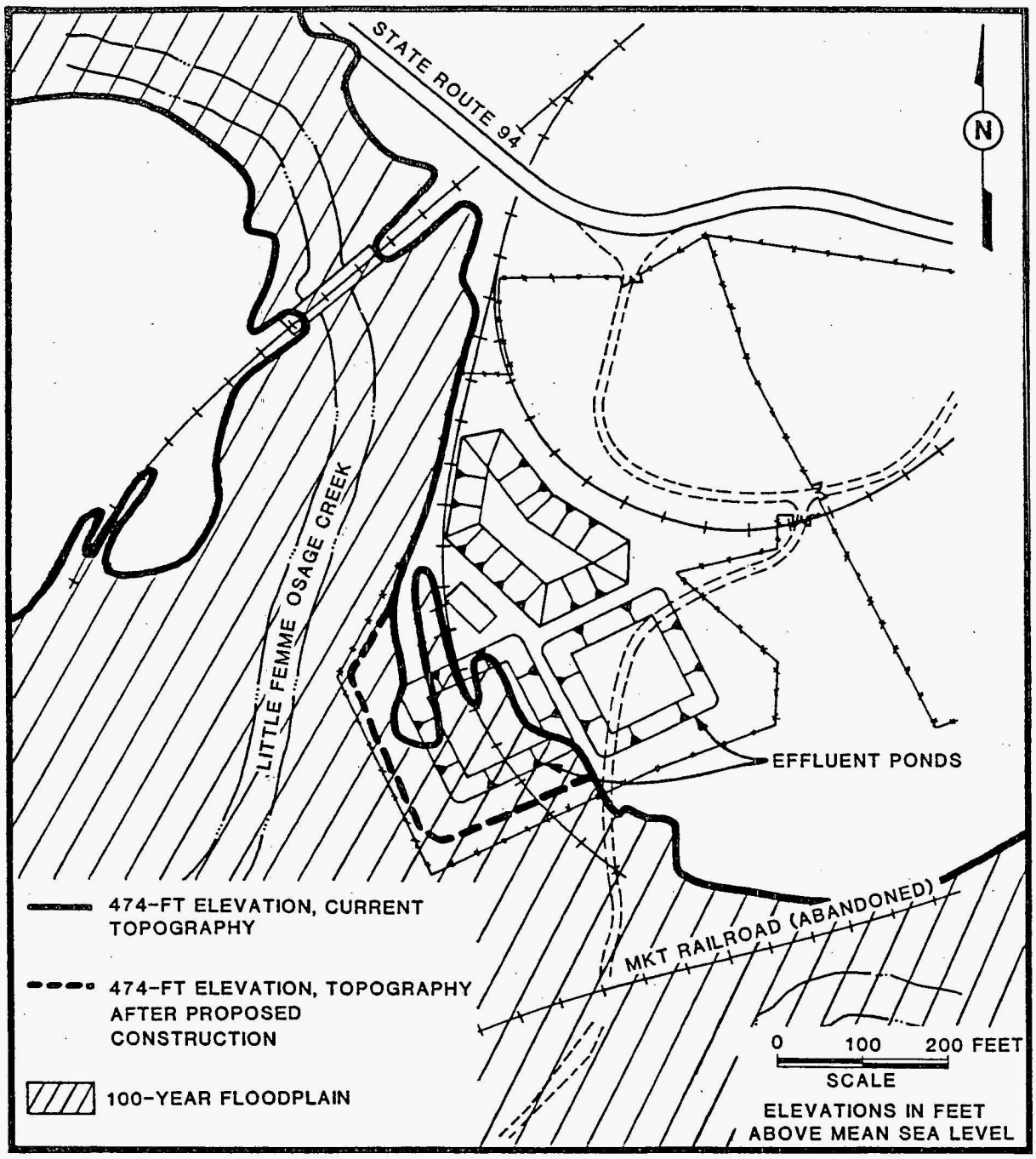

FIGURE A.1 Demarcation of the 100-Year Floodplain at the Location of the Proposed Water Treatment Plant

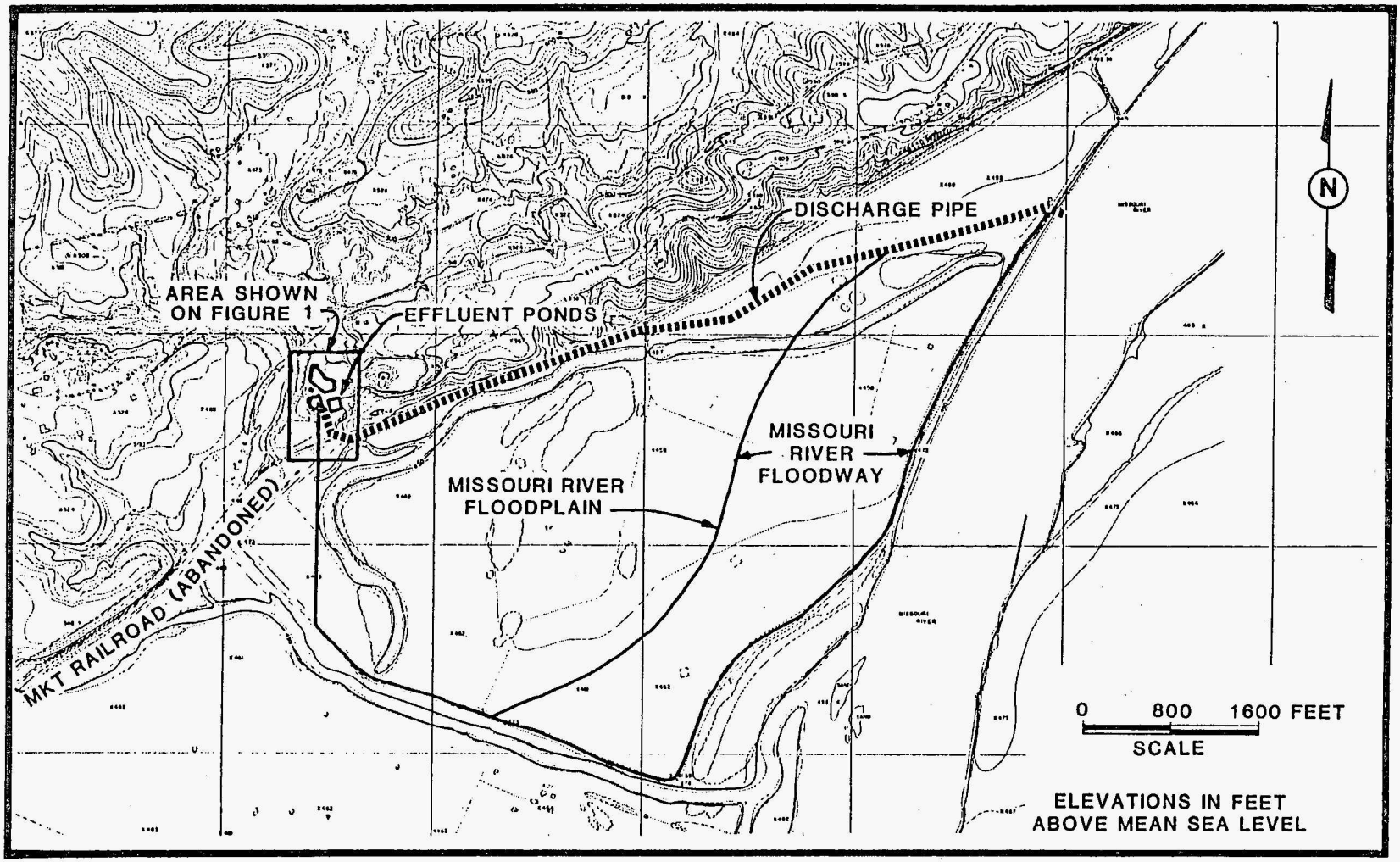

FIGURE A.2 Area of Potential 100-Year Flood Inundation (Floodplain and Floodway) near the Proposed Water Treatment Plant

of operation, and less than 2.0% over an estimated 10 years of operation.) Hence, based on the nature and location of the proposed action, no significant adverse impacts to the Missouri River floodplain would occur during either the short term or the long term.

Concerns about floodplain effects relate primarily to displacement of floodplain storage volume, e.g., by structures, roads, or fill material. However, under the proposed action, no significant impoundment, destruction, or other modification of floodwaters or impact on floodplain storage volume would result from the temporary presence of the effluent pond or discharge pipe, nor would any improvement or development of the floodplain be adversely affected. No roads would be constructed in the floodplain, nor would fill material be stockpiled therein. Both the discharge pipe and the dike of the effluent pond would be constructed with clean (i.e., uncontaminated) material. No material would be brought into the area for dike construction. The estimated 3,200 m^3 (4,200 yd^3) of material for the dike would be obtained from the area excavated for the treatment system's effluent ponds. Less than 1,500 m^3 (about 1,900 yd^3) of this dike material would be located in the 100-year floodplain during the action period.

The storage volume that would be affected by the effluent pond and discharge pipe is estimated to be less than 1,500 m^3 (about 1,900 yd^3). This volume is a very small fraction of the volume that would be inundated during a 100-year flood at this location. For comparative purposes, the storage volume of the area in the immediate vicinity of the quarry -- between the quarry and the Missouri River, east-northeast along the route of the proposed discharge pipe and south from the location of the proposed effluent pond (see Figure A.2) -- is estimated to be about 9,000,000 m^3 (11,000,000 yd^3). The storage volume that would be affected by the pond and pipe is less than 1/500 of the storage volume of this immediate vicinity, and it is a much smaller fraction of the total storage volume of the area. (This total storage volume is considerably larger than 9,000,000 m^3 because the floodplain extends both upstream and downstream on both sides of the Missouri River.)

The proposed action has been designed to minimize potential harm to or within the floodplain. No adverse impacts to floodplain habitat or biota would result. Although mobile wildlife could be displaced during the short term, the quarry area does not provide unique wildlife habitat nor are its plant species restricted in distribution. No long-term impacts would occur because the area would be restored following the action period. Beneficial effects that would result from the proposed removal and treatment of contaminated water from the quarry pond include the reduction of ongoing contaminant migration into the floodplain and the reduction of both current biouptake and potential future biouptake of radioactive and chemical contaminants originating from the pond.

A.3 ALTERNATIVES

No practicable alternative exists for the location of the proposed treatment plant; it must be located adjacent to the quarry to minimize the distance over which contaminated water would be pumped, and the availability of land at this location is very limited. No practicable alternative exists for placement of either of the two treatment-system components that would be partially located in the floodplain during the action period. These components are (1) the effluent pond, which is needed to hold the treated

water for testing prior to discharge (i.e., to ensure compliance with the discharge limits established in the National Pollutant Discharge Elimination System permit for the planned release), and (2) the discharge pipe, which is needed to transport the treated water to the Missouri River. It is impracticable to move the effluent pond to circumvent the small portion of floodplain at its southwest corner because the space available for the water treatment plant is very limited. Further, it is impracticable to reduce the size of the pond to circumvent this small floodplain area because of design requirements to contain all potential inflows. Building a smaller pond would create the risk of releasing untested water to the Missouri River during high flow conditions (e.g., during a 10-year, 24-hour storm). It is also impracticable to reduce the pond's surface area because of capacity requirements; sizing limitations preclude decreasing the surface area while increasing the depth to maintain the same volume because the base of the pond would then be situated near the water table during certain times of the year. Similarly, no practicable alternative exists for the location of the discharge pipe; this pipe must cross the floodplain to permit effluent release to the Missouri River, which has been identified as the most environmentally acceptable means of managing the treated water (see Chapter 5 of the EE/CA).

Removal and treatment of contaminated water from the quarry would limit ongoing contaminant migration and ensure the short-term and long-term protection of public health and the environment. Therefore, it is proposed to initiate construction of the treatment system in a timely manner. The action would conform to applicable state and local floodplain protection standards. Proper construction and maintenance procedures would be used to minimize potential impacts to the floodplain during the action period. Mitigative measures would be employed to further reduce the risk of significant adverse environmental consequences. Such measures might include water sprays (e.g., during excavation), minimum grading, and runoff controls to limit erosion and sedimentation.