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STATE OF MISSOURI

Mel Carnahan, Governor • David A. Shorr, Director

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF ENVIRONMENTAL QUALITY

P.O. Box 176 Jefferson City, MO 65102-0176

Mr. Steve McCracken
Project Manager
U.S. Department of Energy
Weldon Spring Site Remedial Action Project
7295 Highway 94 South
St. Charles, MO 63304

Certified Mail / Return Receipt Requested
Receipt No. P 162 259 090

Re: Draft Final *Feasibility Study* and *Proposed Plan* for the Quarry Residuals Operable Unit at the Weldon Spring Site

Dear Mr. McCracken:

We have reviewed the draft final *Feasibility Study for Remedial Action for the Quarry Residuals Operable Units at the Weldon Spring Site, Weldon Spring, Missouri*, January 8, 1998, ("Feasibility Study" or "FS") and the draft final *Proposed Plan for Remedial Action for the Quarry Residuals Operable Units at the Weldon Spring Site, Weldon Spring, Missouri*, January 8, 1998, ("Proposed Plan" or "PP") both prepared by the U.S. Department of Energy (DOE).

The proposed alternative, Alternative 6 , "Groundwater Removal at Selected Areas, with On-Site Treatment," is a significant step toward cleaning up the contaminated groundwater in the vicinity of the Weldon Spring quarry which threatens the St. Charles County well field. However, there yet remain significant unresolved issues regarding the proposed alternative; these are described below. A longer list of detailed comments is attached. Our comments are numbered sequentially beginning with #204 to follow the last numbered comment on your tabulated responses.

Remediation Goals

Plume containment should be included as a remediation goal. DOE states, "The primary remediation goal for the QROU is to reduce the amount of uranium currently located in the quarry area groundwater north of the slough, thereby reducing the amount of uranium that could migrate to the St. Charles County well field." PP, at p. 18. Plume containment could be effected under the proposed alternative by either active means (e.g., continued water extraction from the trench) or passive means (e.g., grouting the trench after active measures are completed).

Including plume containment as a remediation goal is appropriate since (1) "migration of uranium to the existing county well field is possible and is most likely occurring (albeit at very low rates)" (PP, at p. 17), (2) any contamination which migrates into the alluvium south of the Femme Osage Slough cannot leave the alluvium other than through the public wells (QROU *Remedial Investigation*, Figure 8-19 at p. 8-33), and (3) migration of any contamination into the public water supply should be avoided.

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RECYCLED PAPER

Performance Goals

The PP specifies that after two years the performance of the proposed action will be evaluated. DOE calculates that the mass of uranium currently in the quarry area groundwater can be reduced by 8 to 10% in two years.

While there is no objection to a two-year performance review, the scope of this review is unclear. Presumably, the purpose is to evaluate the technical impracticability of the remedial action. MDNR renews its offer to facilitate the review of a possible future application for a technical impracticability waiver by working with DOE to define a set of performance measures necessary and sufficient for granting such a waiver.

MDNR objects to the extent the two-year period is a fixed deadline to terminate the remedial action absent attaining the applicable ARARs or the granting of an applicable ARAR waiver. Rather, any decision to terminate the remedial action should be based on measurable performance criteria (e.g., rates of hydraulic capture and reductions in contaminant concentrations).

Missouri Water Quality Criteria as Applicable or Relevant and Appropriate Requirements (ARAR)

Missouri Water Quality Criteria (10 CSR 20-7.031(5)) exist for three nitroaromatic contaminants: Nitrobenzene, 17 µg/l; 2,4-Dinitrotoluene (2,4-DNT), 0.11 µg/l; and 1,3-Dinitrobenzene (1,3-DNB), 1.0 µg/l. Groundwater concentrations for 2,4-DNT and 1,3-DNB exceeding these levels have been detected in groundwater monitoring wells. While the Missouri Water Quality Criteria are identified as "potentially applicable" in the FS, compliance with these criteria are not discussed in the PP. The Missouri Water Quality Criteria should be identified as ARAR, and the text of the PP should be revised to address how compliance will be achieved.

Also, any monitoring done to provide an indication of potential impact to the St. Charles County Well Field should include nitroaromatics, not just uranium.

Remedial Design Issues

Trench and Water Treatment. Regarding the design of Alternative 6, two significant issues should be addressed. One, the trench design can be significantly improved. It may be deeper than 16 feet deep over much of the proposed length, since the depth to bedrock is 21.3 feet at MW 1014. Also, the plan view positioning of the trench should be as close to the slough and parallel to the slough as possible without being so close as to require a slurry trench or other structure for stability and safety. This may result in a slightly longer trench than as proposed. Construction might benefit by selecting the driest time of the year. The depth should be as deep as possible. This would result in a design somewhat between Alternative 3 and Alternative 6. Much of the length of Alternative 3 is beyond the known plumes. The proposed end points of Alternative 6 nearly encompass all of the known plumes. Hence, the end-points of Alternative 6 are appropriate. However, there is no reason to place it in a straight line.

The second design issue is the capacity of the treatment plant. A plant capable of more than 20 gpm should be selected and may be implicated by the suggested adjustments to the trench design discussed above.

If the aquifer materials have a low-yield as anticipated, the trench should capture water from the majority of the contaminated alluvial materials once equilibrium is reached. Since these materials are low-yield, the time to reach equilibrium will be somewhat longer than it would be for more permeable materials. Alternative 3 or Alternative 6 should provide substantial, if not complete, hydraulic containment of the known plumes. This conclusion contrasts with statements in Table 2.5 on page 2-24. Also, any difficulty in excavating to the base of the alluvium should not preclude installation of the trench. The trench, if pumped to maintain a minimum level, should draw water from beneath. Barriers to excavation may alter the location of the sumps, however.

Regarding the long-term monitoring as detailed in Alternative 2 and included by reference in Alternative 6. Some work should be done to establish how contamination has traveled to RMW-2. This well may be impacted by contaminants flowing from the Little Femme Osage Creek vicinity via depositional features which parallel the slough or the Missouri River. A pair of wells southwest and a well downgradient of RMW-2 may be appropriate. DOE has proposed additional wells for the long-term monitoring scheme, and these should be included in that effort.

Changes to the monitoring well frequency on page 4-6 of the FS should be considered. Highly contaminated wells in the middle of a plume can be sampled fairly infrequently. The greatest concern, and so the highest frequency, should be associated with clean wells or low-level wells at the down-gradient margin of the plumes. That frequency can be coupled to Darcy groundwater velocity, and low-velocity materials can be sampled less frequently. The velocity can be expected to increase dramatically as the plumes enter the thicker portions of the alluvium, however. The contingency plan for action to prevent exposure at the County Well Field must take that fact into consideration. The plan must be designed to allow lead times for action that are less than travel times for contaminants to impact the County Well Field. Whether the decision to act is based on first arrival of contamination or health-based levels must be carefully considered because the residents may reasonably choose to not allow any impact to their water system.

Questions regarding these comments may be directed to me at the Weldon Spring Field Office, 314-441-8030.

Sincerely,

HAZARDOUS WASTE PROGRAM

Glenn A. Carlson, P.E.
Program Manager

Attachments

cc: Weldon Spring Citizens Commission
Joe R. Nichols, St. Charles County Water
Dan Wall, EPA Region VII

Attachment

MDNR Comments on
the Draft Final *Feasibility Study for Remedial Action for the Quarry Residuals Operable Unit at the Weldon Spring Site, Weldon Spring, Missouri*, January 8, 1998, and
the Draft Final *Proposed Plan for Remedial Action for the Quarry Residuals Operable Units at the Weldon Spring Site, Weldon Spring, Missouri*, January 8, 1998

204. DOE continues to cite EPA guidance ("Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites," EPA/540/G-88-003, OSWER Directive 9283.1-2, December 1988) as authority for its statement, "A reasonable time is defined to be 100 years." While at p. 5-2 of the cited EPA guidance is the statement, "The restoration time frame is defined as the period of time required to achieve selected cleanup levels in the ground water at all locations within the area of attainment," we can locate no statement in the cited document which *defines* 100 years as a reasonable time.

Other EPA guidance addresses reasonable restoration timeframes differently:

"Defining a reasonable time frame is a complex and site-specific decision." *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites*, OSWER 9200.4-17, December 1, 1997.

"Although restoration timeframe is an important consideration in evaluating whether restoration of ground water is technically impracticable, **no single time period can be specified which would be considered excessively long for all site conditions**." Emphasis added. *Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Ground Water at CERCLA Sites*, EPA 540/R-96/023, OSWER Directive 9283.1-12, October 1996.

"While restoration timeframes may be an important consideration in remedy selection, no single timeframe can be specified during which restoration must be achieved to be considered technically practicable. However, very long restoration timeframes (*e.g.*, longer than 100 years) may be indicative of hydrogeologic or contaminant-related constraints to remediation." *Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration*, OSWER Directive 9234.2-25, September 1993.

Please identify the page in the document cited by DOE which defines 100 years as a "reasonable time." If no such definition can be found, determine a site-specific reasonable timeframe and reevaluate the necessity for a technical impracticability waiver considering this site-specific value.

205. FS, Page 1-9, Figure 1.5 lacks a legend that would allow identification of the strata and symbols used in the figure.

206. FS, Page 1-17, the Little Femme Osage Creek may have been impacted by the quarry through overland flow or secondary porosity features.

207. FS, Page 1-18, Section 1.2.3 indicates that the reducing zone has halted plume movement. That is not known with certainty. Co-location may be coincidental or may reflect a lack of dilution in this part of the alluvium as suggested elsewhere in the report.

208. FS, Page 1-20, Where did the other metals come from, if not from the bulk waste?

209. FS, Page 1-26, How close was the 14 pCi/L detection to the Little Femme Osage Creek? If it is close to the Creek, is it reasonable to consider it to be background?

210. FS, Page 2-7, Contrary to statements here, the Plattin is in hydraulic communication with the alluvium.

211. FS, Page 2-24, Contrary to statements in Table 2.5, hydraulic containment is possible. The statements regarding the sloping base of the alluvium are not understood.

212. FS, Page 3-6, This language implies that contamination will reach the County Well Field before action is taken. Language on page 3-46 is preferable, assuming that the plan is to prevent impact to the County Well Field.

213. FS, Page 4-6, The frequency for highly contaminated wells located in the middle of plumes can be fairly low. The highest frequency should be for wells located at the downgradient margins of the plume(s). Some wells may be added surrounding the downgradient edge of the current system. New wells should be sampled quarterly to establish a data set for each well and to provide a reliable measurement of aquifer condition at each new well. The Darcy velocity should be used in conjunction with the well spacing to determine sampling frequency. Travel times between wells and the edge of the plume or trigger locations for further action can be estimated using Darcy velocity. Sampling frequency is then set to insure detection of any further plume movement.

214. FS, Page 4-18, The EPA guidance regarding TI also states that the agency would expect to require an alternative remedial strategy that is technically practicable, consistent with the overall objectives of the remedy and controls the sources of contamination and human and environmental exposures. What would this alternative remedy be in this case? Containment is a valid alternative remedy and may be adequately executed hydraulically through Alternatives 3 or 6.

Also, the guidance states that thorough site characterization is essential. Since characterization is not adequate to closely evaluate the redox conditions or the actual retardation of the uranium, can DOE state that this standard has been met? These issues also have a significant affect on the projected efficacy of the various proposed and excluded remedies.

The National Research Council, in *Groundwater Models, Scientific and Regulatory Applications* (ISBN 0-309-03996-7) states: "The processes associated with transport modeling

are greatly compounded when the solutes are reactive. In this case, chemical rather than hydrologic processes may govern the behavior of a contaminant plume." " Most models of reactive solutes are based on small-scale laboratory studies, which may not accurately mimic conditions found in the actual subsurface environment." "Although models for important reactions like oxidation/reduction, precipitation, and biodegradation exist, they are complicated to formulate and solve, difficult to characterize in terms of kinetic parameters, and largely unvalidated in practical applications. Thus, the transport of multiple reacting constituents such as trace metals and organic compounds cannot be modeled with confidence."

Region VII guidance also requires " Demonstration that available technologies could not achieve cleanup levels within a reasonable time frame due to limitations imposed by site characteristics." Also: "In any case, it is important where 'complete' cleanup is impracticable, to have a way of demonstrating the effectiveness of the best practicable site-specific remediation strategy." This demonstration is different than the predictive analysis already offered by DOE.

Finally, OSWER Directive 9234.2-25 states: "Restoration timeframe analyses, therefore, generally are well suited for comparing two or more remediation design alternatives to determine the most appropriate strategy for a particular site. Where employed for such purposes, restoration timeframe analyses should be accompanied by a thorough discussion of all assumptions, including a list of measured or assumed parameters and a quantitative analysis, where appropriate, of the degree of uncertainty in those parameters and in the resulting timeframe predictions."

215. FS, Page 4-19. The "heterogenous underlying stratigraphy" and "complex geology" are mute points when an interceptor trench is used at the downgradient margin to intercept the plume(s).

216. The document named above does not bear the seal of a geologist who is registered in the State of Missouri. The document incorporates or is based on a geologic study or on geologic data that had a bearing on conclusions or recommendations reached after January 1, 1997. The Missouri Board of Geologist Registration is charged with the enforcement of the Missouri Geologist Registration Law that includes the requirement that geologic work where public health, safety or welfare are at risk or potentially at risk be completed by or under the direct supervision of a geologist registered in Missouri. The following review comments and/or recommendations convey no endorsement as to the validity of the work being completed in accordance with the Missouri Geologist Registration Law or the Board of Geologist Registration. Further, the review comments and/or recommendations cannot be accepted as being fully completed until the reviewed document is properly sealed/stamped by a geologist registered in Missouri in accordance with the law and the rules as administered by the Board.

217. MDNR and the DOE have not yet resolved the issue of the point of compliance. For example, see the response to Comment #142.

218. Response to Comment #165: It has previously been proposed that the uranium detected in the bentonite grout used in a new monitoring well originated at the bentonite source and was not absorbed from contaminated site groundwater, as suggested in this response.

219. We partially disagree with the response to Comment #172. There are no hydrological reasons why the truncation of the Decorah Group would prevent groundwater migration beyond the slough area. No hydrological barriers such as an aquitard or fault are present. The probability of bedrock discharge to the Missouri River alluvium is discussed on page 1-10 of the FS (DOE 1998).

220. Usually, in a Feasibility Study, a proposal for a long-term remedy to remediate, in this case, contaminated groundwater is made. Alternative 6 falls short of this goal. The active phase of Alternative 6, due to its limited duration, two years or less, is considered a pilot project rather than a long-term remedy. GSP suggests that after the first two years of operation, that an evaluation be conducted to determine if specified performance criteria have been achieved. Then a decision should be made whether or not to continue the active groundwater extraction and treatment.

221. Section 1.1.1, Site History and Description, p. 1-6, paragraph 4. Please identify the source of the soil to be used for the engineered soil to be used to cover fractures at the bottom of the quarry.

222. Section 1.1.1, Site History and Description, p. 1-6, paragraph 4. It was stated by the DOE at the December 9, 1997 meeting attended by the MDNR, the EPA, and Argonne National Laboratory representatives, that the quarry fractures would be grouted with bentonite. The use of bentonite to seal the quarry fractures is not discussed in this section. Please describe how the backfill will be "engineered to reduce the potential for mobilization of residual contaminants into the groundwater" if the fractures are not first sealed with bentonite.

223. Section 1.1.1, Site History and Description, pp. 1-6 through 1-7. Please explain what techniques will be used to "force groundwater flow to go around the inner quarry area, or alternatively, cause the groundwater within the footprint of the inner quarry area to pass through an attenuation layer to prevent the flow of contamination". Please explain how these actions will be coordinated with Alternative 6.

224. Section 1.1.2.1, Soil and Geology, p. 1-7, paragraph 2. Two major soil units, the Ferrelview formation and glacial till, have been left out of the description of the Weldon Spring upland soils.

225. Figure 1.5, p. 1-9. WE did not comment on this figure previously, but would like to recommend that the units in the cross-section be identified. Of particular interest are the lens shaped units located between the units presumed to be the Kimmswick Limestone and Decorah Group. The graphics are also misleading; the pattern used to identify the presumed

loess unit above the "Kimmswick" at the quarry proper is also used beneath the upper fine alluvial unit. Revisions to this figure are in order.

226. Section 2.2.2, Natural Processes, p. 2-5, paragraph 2. It has been previously stated in QROU documentation that no reduction of uranium has been detected. That information is contradictory to the last sentence in this paragraph which states, "At least one of the natural processes mentioned above is responsible for the slow reduction with time of the uranium concentration in other locations within the aquifer". Please identify the "other locations within the aquifer" where uranium reduction has reportedly occurred.

227. Figure 3.6, p. 3-24. No narrative is provided to explain what is meant by "Series 1" and "Series 2". Please explain. Also please describe how the data points on this graph were derived. Approximately 95 years are omitted from this graph; it would be of interest to see the mass of uranium remaining after 25 and 50 years (i.e., or when thresholds of 50% and 75% reduction would be achieved).

228. Section 3.4.4.2, Implementability, p. 3-41, paragraph 2 and Section 3.4.6.2, Implementability, p. 3-48, paragraph 1. Following industry standards, to properly key into the bedrock, the trench bottom should be extended through the weathered, uneven bedrock surface to the unweathered portion, thus reducing the potential for leakage. Refer to Section 4.3, p. 4-12, paragraph 1 for further details.

229. Section 3.4.6.1, Effectiveness, p. 3-47, paragraph 3. Please explain what would cause the "dilution of the coarse-grained materials south of the slough".

230. Section 4.3 Alternative 6: Groundwater Removal at Selected Areas, with On-Site Treatment, p. 4-13, paragraph 2. The description of the geofabric installation in this section is inconsistent with both Figure 3.2 and the text description on page 3-9. On page 3-9, it is stated that the geofabric will only be placed on the trench bottom, while in Figure 3.2 the geofabric is shown lining the sides, as well as the trench bottom. According to the text on page 4-13, geofabric will also be placed around the top of the gravel prior to backfilling with soil. This would prevent downward migration of clay materials into the gravel which in turn could prevent clogging of the perforated pipe. GSP has previously commented on the geofabric design, stating that it would be most prudent to install the geofabric completely around the gravel layer.

231. Section 4.3.2, Compliance with Potential ARARs, #5 Hydraulic Conductivity of the Contaminated Aquifer (less than 1×10^{-4} cm/s), p. 4-19. WE has stated in previous comments that hydraulic conductivities in the range of 1×10^{-5} to 1×10^{-3} cm/s are considered to be moderate according to most references. If the hydraulic conductivity range determined for the alluvial aquifer north of the slough is correct, the yield is expected to be greater than the pump tests results (0.5 gpm) indicate.

232. Section 4.3.2, Compliance with Potential ARARs, p. 4-19, paragraph 1. The description of the Kimmswick Limestone, Decorah Limestone (Group) and the Plattin Limestone (Group) as three separate bedrock aquifers is incorrect. These bedrock units are part of one aquifer group, the Kimmswick-Joachim aquifer (Miller, 1974).

233. Section 4.3.3.2, Protection of the Public, p. 4-22, paragraph 1. WE does not understand the point of the last sentence. Please clarify.

234. Table A.1, Missouri General Protection of Groundwater Quality and Resources (10 CSR 23-4.050), p. A-18. There is a slight misinterpretation of these regulations. Well drillers are required to be permitted to install monitoring wells in Missouri. After the monitoring wells are installed, the well driller is required to certify the wells according to 10 CSR 23-4.020 (1).

235. Section 2, Site Background, p. 7, paragraph 2. Please provide more specific details related to the methods that will be used to "force groundwater flow to go around the inner quarry area or to pass through an attenuation layer". See Comment #223 above.

236. Section 2.1.4, Nature and Extent of Contamination, p. 10, paragraph 1. The third entity of contaminated media at the QROU was changed from "contaminated groundwater in the shallow aquifer system (primarily north of the slough)" in the Proposed Plan, June 1997 to "contaminated groundwater in the shallow bedrock (primarily north of the slough)" in the subject document. Because the contaminated alluvial aquifer is a major concern of the QROU, it is suggested that the June 1997 description (which would include the alluvial aquifer) be reinstated in the current document.

237. Comment #68. DOE responds that "Residual contamination remaining in the cracks and fissures of the quarry cannot be removed fully without also removing the bedrock itself." What alternatives have been evaluated to arrive at this conclusion?

238. Page 11 - 2.1.4.2 Femme Osage Slough and Creeks, Paragraph 1 Sentence 4. *Silver and low levels.....were detected in surface water in the creek only.* Which creek are they referring to or is it both the Little Femme Osage and the Femme Osage Creeks?

239. PP, Page 11 - 2.1.4.2 Femme Osage Slough and Creeks, Paragraph 2 Sentence 2. *Uranium, calcium, magnesium. . .elevated in creek sediment.* Does this apply to both creeks or is it only in the Femme Osage Creek?

240. PP, Page 11 - 2.1.4.2 Femme Osage Slough and Creeks, Paragraph 4 Sentence 2. Species samples form. . . . The word "form" should be "from."

241. PP, Page 22 - 4 Summary of Preliminary Alternatives, Alternative 3. Basis for eliminating Alternative 3 seems to contradict the evaluation time for Alternative 6. While the remediation

time frame was too long for Alternative 3, DOE feels that two years is sufficient for evaluating Alternative 6.

242. PP, Page 28 - 5.2.2 Compliance with Potential ARARs, Paragraph 1 Sentence 5. *Such a waiver would be supported by performance data. . .the site.* What factors are going to be measured for performance? Are preliminary goals going to be set for comparison against this performance data?

243. PP, Page 36 - 6 Proposed Action, Paragraph 4 Last Sentence. *It is expected. . .will be obtained within the two-year period.* What field determinations will be used to gauge the performance? If it is shown in the preliminary testing for site-specific parameters indicated that yields will be lower or higher than expected, will the action continue after the two years?