Response to City of Westminster Comments on the Draft Solar Ponds Plume Decision Document received June 3, 1999

Comment: The City of Westminster has reviewed the Draft Solar Ponds Plume Decision Document and appreciates the opportunity to comment on this important document. We are concerned that the Decision Document is being issued prior to the completion of the treatability studies for this remedial action. Information on the specific media to be employed in the treatment cells is also not included in the document. There are many other contaminants in the solar pond plume that iron filings will not remove.

Response: Since publishing the Final Draft Solar Pond Plume (SPP) Decision Document in April, preliminary results of the treatability studies are available which allow more detail to be incorporated into the document. Text in Section 5.1 has been modified to state that the first treatment cell will be filled with an iron/sawdust mixture and the second cell will be filled with 100 percent iron aggregate. Nutrient mulch, which will increase the denitrification rate, is being evaluated as a possible addition to the iron/sawdust treatment media.

With respect to reviewer's comment regarding "other contaminants" in the plume, it is recognized that metals and low levels of volatile organic compounds have been detected in the wells within the plume footprint. Exceedances of surface water standards and action levels are noted in the text and specifically identified on Tables 2-3 and 2-5 for groundwater in the SPP. However, evaluation of contaminant distribution in previous investigations, and additional evaluation of metals distribution and occurrence in the SPP conducted as part of Sampling and Analysis Plan (SAP) development concluded that there is no indication of other contaminant plumes from the Solar Ponds. Because the purpose of the Decision Document is to reflect the contaminants of concern which drive remedy selection for the SPP, treatment of metals or other contaminants detected in wells within the SPP footprint was not considered as part of the alternative analysis for remedy selection.

It is recognized that for the system to be effective the reactive media must be capable of removing metals, whether they are naturally occurring or waste related, from contaminated groundwater. Concentrations of metals in the influent to the treatment system were considered during treatability studies by using "background" groundwater from the site. Additionally, studies which evaluate metals removal by using iron (Cantrell et al. 1995) and organic (i.e., sawdust) media (Morrison and Spangler, 1992, 1995) indicate that the metals reacted similarly to uranium (i.e., metals were effectively removed from solution primarily by sorption, reduction, and/or precipitation mechanisms.) With respect to volatile organics detected at low levels in the SPP, volatile organics are being removed using iron at the Mound Site Plume remediation. Similar treatment would be expected for the SPP.

Comment: Westminster supports the use of the Reactive Barrier Design alternative with the addition of wetlands for additional nitrate removal and a detention facility on Walnut Creek at Indiana to allow for sedimentation of any other contaminants that could flow into Walnut Creek from the solar pond area. We would also urge the Department of Energy (DOE) to use phytoremediation (planting cottonwood trees) for additional removal of nitrate from the groundwater.

Respnse: Constructing a wetland to treat the SPP was evaluated and subsequently screened out as a viable alternative in the Solar Ponds Plume Remediation and Interceptor Trench System Water Treatment Study, RF/RMRS-97-093.UN, September, 1997. Reasons for screening out the technology include:

- *Construction would disrupt the Preble's Jumping Mouse habitat and extend into uncontaminated areas.*

- *The ability of the technology to treat the uranium in the plume and the effectiveness for treating nitrate was highly uncertain.*
- *The need to maintain the ITS and MSTs to provide sufficient water to sustain the wetlands opposed the long-term (beyond site closure) objective.*
- *Potential contamination of previously uncontaminated areas where the wetlands would be placed.*

However, a small wetland is expected to develop over the treatment system discharge area (within the plume area) and could provide additional benefit to contaminant removal.

Phytoremediation using cottonwoods was also considered in the above referenced study and was also subject to the detailed analysis along with the reactive barrier. It was determined that the remediation by cottonwood trees would not be as effective, particularly in the winter. The operation and maintenance costs were high, and water would need to be collected and spread over a wider area than it is presently to allow space for the number of trees required. The plume would have to be captured and supplied to the tree roots. This would greatly increase the cost of the project and disperse the plume beyond its current footprint.

The proposed treatment system will treat the contaminants of concern in the SPP. As discussed in the response to the previous comment, removal of metals and volatile organics, if present, are an added benefit of the system. Consideration of a detention facility on Walnut Creek at Indiana is considered out of scope with respect to this project and the Decision Document.

Comment: The Department of Energy has acknowledged that building an 850 foot long collection system with passive flow-through treatment cells containing reactive iron will not fully cover the extent of the plume and a large quantity of the plume flow will bypass the barrier. The Decision Document does not provide adequate information as to what amount of the groundwater plume flows will not be collected by the barrier but will flow into Walnut Creek without treatment.

Response: Problems with bypass are more notable for the existing ITS rather than the barrier system proposed in the Decision Document. Because the drains associated with the ITS were not entirely keyed into bedrock, an estimated 200,000 gallons bypass the system annually. The collection trench will penetrate 10 feet into the weathered bedrock, thus minimizing any potential for underflow. The barrier extends southwest on the north side and, a well cluster to the north of the barrier will be installed to provide additional data and for performance monitoring purposes.

Comment: We request that this information as well as documentation regarding performance monitoring, methods for replacing the reactive barrier media, as well as the ability of the barrier to withstand a 100 year flood be included in the final document.

Response: The performance monitoring section (Section 5.5) of the Decision Document has been expanded. Specifically, the section now states:

> *"Performance monitoring will be conducted to determine the effectiveness of the system in meeting the project objectives. Monitoring of the treatment system will be accomplished by comparing results of the treatment system influent and effluent. Additionally, surface water quality will be monitored at a point of evaluation in North Walnut Creek at a location downgradient of the SPP. The current stream standard for nitrate, 100 mg/L, is a temporary modification to the 10 mg/L water quality standard. The current stream standard is effective through 2009. After expiration of the temporary modification, the stream standard will decrease to 10 mg/L. Preliminary decision rules for the project are presented below. The performance monitoring data will initially be used to evaluate and optimize the treatment system efficiency and effectiveness. As goals for*

post-closure conditions are established, the performance monitoring data will be used to further refine the decision rules for the treated effluent. Decision rules for this monitoring will be defined and evaluated as a special project within the Integrated Monitoring Program (IMP) and refined as necessary in the final Site Corrective Action Decision/Record of Decision (CAD/ROD).

The schedule for monitoring is shown in Table 5-1. After sufficient data are gathered to demonstrate stable conditions have been achieved, the requirements may be changed to annual or less frequent monitoring.

***Table 5-1.** Schedule for Water Quality Sampling and Water Level Measurements.*

Task	Month 1-6	Months 7-12	Subsequent Years
Treatment System Influent	Monthly	Quarterly	Semi-Annually
Treatment System Effluent	Monthly	Quarterly	Semi-Annually
Downgradient Surface Water Quality	Monthly	Quarterly	Semi-Annually
Hydraulic Head in Collection Trench	Monthly	Quarterly	Semi-Annually

Influent concentrations will be measured at the piezometer nearest to the collection cell. Effluent concentrations will be measured at the metering manhole to determine treatment efficiencies. The influent will be sampled at the same frequency as the effluent. Physical problems, not treatment limitations, are expected to determine when the treatment media will require replacement. It is expected that the organic treatment media will provide a carbon source in excess of what would be needed for nitrate reduction and therefore would not require replacement. However, the organic media may plug due to bacterial growth blocking the pore spaces. To detect such a condition, piezometers will be installed near the treatment cell to monitor water levels. Steadily increasing water levels may be an indication that the media is plugged, requiring replacement. Replacement will be accomplished by digging up the spent treatment media and replacing it with new.

If effluent concentrations exceed system performance objectives, then monthly or more frequent sampling will be performed until the cause is determined. If a corrective action is required, then monthly effluent sampling will continue for at least three months after a corrective action is implemented to ensure that the action is sufficient.

Based on preliminary calculations provided by CDPHE, the current stream standard will be achieved if effluent concentrations are 500 mg/L. Effluent concentrations are expected to achieve this level. These preliminary calculations indicate that effluent concentrations must meet 50 mg/L to achieve surface water standards after 2009. Decision rules will be refined as performance monitoring trends are established and in anticipation of the decrease in the stream standard from 100 mg/L to 10 mg/L after 2009.

Groundwater monitoring will continue during and after the remedial action has been completed, as described in the IMP. Groundwater wells 1786 and 1386 currently monitor the drainage and will be, at a minimum, monitored for nitrate and uranium. An additional well cluster to the north of the barrier will be installed to provide additional data and for performance monitoring purposes. The frequency of sampling and analytical suites will be consistent with the IMP and will measure uranium and nitrate concentrations.

Performance monitoring in the North Walnut Creek Drainage will be implemented at station GS13 to monitor changes in surface water quality as a result of the selected remedy. This location was selected because it is immediately downstream of where the

groundwater plume intersects the drainage. The loading to the stream will be evaluated to determine long-term system performance and will be reported on an annual basis. In accordance with the Action Level Framework, if the stream concentrations exceed stream standards, then an evaluation will be performed after consultation with the regulators.

If stream standards are being met consistently at GS13 and if simple modeling techniques show that the stream standards would be met without treatment, based on the influent plume concentrations and flow rate, and the stream concentrations and flow rate that exist at that time, then treatment will be discontinued. This system is expected to continue operations until after Site closure when stream flow and concentrations have stabilized. The system will be abandoned in place as a flow-through system. System shutdown will be re-evaluated as part of the final Site CAD/ROD."

As indicated in the above discussion, "decision criteria" with respect to when the treatment media will be replaced has been added to the performance monitoring section of the Decision Document. As stated, the method of replacement will be to dig up the spent treatment media and replace it with new treatment media.

With respect to the effects of a 100 year flood on the barrier, most stormwater and floodwaters will run-off and the effect on the treatment system will be limited by the slow infiltration of the water to below surface areas. The collection trench has an impermeable cover to prevent direct infiltration into the barrier system.

Comment: Monitoring data indicate that higher concentrations of nitrate are likely in the future and are moving toward North Walnut Creek. The Future exceedances of the 100 mg/l stream standard for nitrate is likely with the higher concentrations of nitrate reaching Walnut Creek between the years 2005 and 2010. The draft document does not include what additional measure will be taken by DOE to protect Walnut Creek from the additional nitrate loading. Wastewater treatment plants located on Walnut Creek could exceed their nitrate level discharge permits due to the additional amount of nitrate flowing into the creek from the SPP.

Response: As contoured, the peak of the nitrate plume (i.e., >1,000 mg/L)has not reached North Walnut Creek. Without treatment, stream standards in the plume may be exceeded in groundwater adjacent to North Walnut Creek and it is possible that concentrations above stream standards in North Walnut Creek could be observed. As stated above, performance monitoring in the North Walnut Creek Drainage will be implemented at station GS13 to monitor changes in surface water quality as a result of the selected remedy. This location was selected because it is immediately downstream of where the groundwater plume intersects the drainage. The loading to the stream will be evaluated to determine long-term system performance and will be reported on an annual basis. In accordance with the Action Level Framework, if the stream concentrations exceed stream standards, then an evaluation will be performed after consultation with the regulators.

Comment: At least two reactive treatment cells should be operated in series to provide a backup treatment should the initial cell fail to remove all the contaminants. A back up cell would also be useful when one of the barriers require maintenance. Westminster also requests that monitoring include routine effluent testing of the first treatment cell to detect breakthrough and allow for replacement of the treatment media in the first cell before the second cell can be compromised.

Response: Two treatment cells will be used; however, the cells are not considered redundant. The first cell will be filled with a mixture of organic media (sawdust) to act as a carbon source to induce denitrification and iron to remove the uranium by chemical reduction. Nutrient mulch, which will increase the denitrification rate, may also be added to the iron/sawdust treatment media. The second

cell will be filled with 100 percent granular activated iron aggregate. Results from the treatability studies indicate that this configuration will effectively remove uranium from solution to less than 2 ug/L. The nitrate-N removal efficiency is approximately 13 mg/L/day for the first cell (iron/sawdust) and microbial denitrification will also likely continue in the iron treatment cell because of the transport of dissolved organic carbon from the first cell. This will further reduce the nitrate concentrations. As stated in the response to the previous comment regarding performance monitoring, influent and effluent concentrations for the treatment system will be measured.

Comment: A 3D map showing the movement of groundwater contamination both horizontally and vertically has not been produced. The Draft Decision Document indicates that preparation of these maps is too costly to undertake. We urge the DOE to provide funding for the 3D mapping of the groundwater. It would be very beneficial to our community to have information on anticipated groundwater movement for the future. Preparation of the map would also aid the DOE and the community in determining appropriate remediation to protect offsite areas from future potential migration of contaminated groundwater.

Response: The SPP in its present configuration is not a good candidate for illustration using 3D mapping techniques because the plume is too shallow. Modeling tools used in the analysis of alternatives incorporated a 2D analytical horizontal plane plume model and a 2D numerical vertical plane flow and transport model. Please note that responses to comments received from the CAB indicated that one of the reasons a 3D map has not been generated is because of the cost associated with production. The Decision Document does not contain this statement. However, a 3D map illustrating the plume has not been produced because it is felt that the project resources are better spent moving towards remediation.

Comment: We would urge the DOE to include a provision in the final Record of Decision for replacement of the barrier in the event that it fails. Given the fact that the remediation for the solar pond groundwater plume is expected to take greater than thirty years there needs to be a commitment from the Department to upgrade or completely replace the barrier with current technology at some point in the future.

Response: The Decision Document serves as a major modification to the Final Proposed Interim Measures/Interim Remedial Action Decision Document for the Solar Evaporation Ponds, Operable Unit 4, 1992. The need for continued treatment or system shutdown be addressed in the Site CAD/ROD. As presented above, Section 5.5 of the Decision Document, provides guidance with respect these decisions.

Comment: Thank you for the opportunity to comment on this document. As you are aware, the City of Westminster is very concerned about offsite migration of plutonium and other contaminants into the Westminster community from Walnut Creek. Remediation activities that would serve to further contaminate Walnut Creek flows are not supported.

Response: We appreciate the City of Westminster's interest in the SPP project. The SPP remediation will not further contaminate Walnut Creek.

References

Final Draft Solar Pond Plume Decision Document, RF/RMRS-98-286.UN, April, 1999.

Cantrell et al. 1995. Cantrell, K.J., Kaplan, D.I., and Weitsma, T.W., 1995, Zero-valent iron for the in situ remediation of metals in groundwater, Journal of Hazardous Materials, 42/2 (Jul 95), pp. 201-212.

Morrison and Spangler, 1992. Morrison, S.J. and Spangler, R.R., 1992, Extraction of uranium and molybdenum from aqueous solutions: A survey of industrial materials for use in chemical barriers for uranium mill tailings remediation, Environmental. Science Technology, Vol. 26., No. 10, pp. 1922-1931.

Morrison and Spangler, 1995. Morrison, S.J. and Spangler, R.R., 1995, Adsorption of uranium (VI) on amorphous ferric oxyhydroxide at high concentrations of dissolved carbon (IV) and sulfur (VI), Journal of Contaminant Hydrology, Vol. 17, pp. 333-346.

Solar Ponds Plume Remediation and Interceptor Trench System Water Treatment Study, RF/RMRS-97-093.UN, September, 1997.

Final Proposed Interim Measures/Interim Remedial Action Decision Document for the Solar Evaporation Ponds, Operable Unit 4, 1992.