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Comments on August 12, 1999 RPM Meeting Issues

Julie Roth
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Dear Julie:

There were several issues raised at the last UCDDOELEHR national Superfund site RPM meeting on which I wish to provide comments.

Violation of the IRA Polluted Groundwater ReInjection Permit Conditions

It has now been confirmed that UCD's groundwater experimental interim removal action (IRA) is violating the Central Valley Regional Water Quality Control Board's permit conditions for reinjection of the partially treated polluted groundwaters that UCD is pumping from one of the HSU plumes at the LEHR site. The violations are occurring in the total dissolved solids (TDS) and nitrate concentrations in which the concentrations of these two parameters have increased above the CVRWQCB limit. While there is no data to support this because of the inadequate groundwater monitoring program being conducted by UCD at LEHR, it is likely that there are violations of other parameters in the reinjected groundwater as well.

This situation points to the experimental nature of the IRA. The RPMs and DSCSOC supported this limited scope IRA for the purpose of gaining information about the characteristics of the aquifer system. While UCD attempts to portray this IRA as a final removal action, neither the RPMs and especially DSCSOC have considered it a final removal action. As discussed in my comments when I recommended to DSCSOC that this IRA be approved as an experimental program, the highly limited approach that UCD is following in only removing some of the VOCs from the pumped polluted groundwater limits the utility and usefulness of this removal action.

One of the issues that needs to be addressed is the violation of the permit conditions. It appears that this could be an annual event, where during part of the year the TDS and nitrate concentrations increase above the CVRWQCB reinjection limits. I feel that DSCSOC should recommend that UCD be required to comply with the reinjection permit conditions. Either UCD must shut down the IRA during the time that it would be reinjecting waters that are in violation of these conditions, or UCD must provide treatment of the reinjected waters to meet permit conditions. Since ultimately, as part of any final removal action that involves reinjection, UCD will have to treat the polluted groundwaters by more than just VOC stripping, this would be an excellent opportunity for UCD to do what it should have done initially, namely to investigate methods of removal of bulk parameters such as TDS, as well as known pollutants such as nitrate.

From my perspective, I recommend that no more than one more year of IRA operations where violations of the current CVRWQCB permit would be allowed for TDS and nitrate. This recommendation is based on gathering additional information on the characteristics of the aquifer. It is clear that the aquifer system underlying the LEHR site is still very poorly understood. Considerable additional experimental studies are going to be needed before any effective comprehensive groundwater cleanup program is implemented.

With respect to the violations of the current permit conditions, it is recommended that UCD be required to obtain a one-year variance from the current permit, where TDS and nitrate can exceed permit conditions by a limited amount over a limited period of time. It should be required in the permit that this variance cannot be renewed past one year. Further, this variance should only be granted if UCD starts an aggressive program of exploring additional treatment of the polluted groundwaters so that when a remedial action is finally initiated, that the violations of the permit conditions for TDS and nitrate limits will not be an issue and a treatment/management program will be in place to prevent these violations from occurring in the reinjected water.

One of the issues of concern was the situation mentioned by you with regard to the neighbors' wells' TDS and nitrate not showing the seasonal patterns that UCD is finding in this experimental IRA of seasonal increases in TDS and nitrate. UCD representatives suggested that this seasonal pattern being seen at the LEHR site of increasing nitrate and TDS are due to background. However, I understand that your well, which is certainly influenced by regional as well as local ag fertilizer application, is not showing these patterns. This issue should be explored further to confirm your observations. If they are correct then it appears that the seasonal increases in TDS and nitrate may be a LEHR site characteristic arising from former waste disposal practices and waste stored in the vadose zone.

Fouling of Reinjecting Partially Treated Polluted Groundwater

It was brought out at the RPM meeting that the reinjection pressures for the IRA have continued to increase, indicating that the reinjection/aquifer characteristics are being polluted by the reinjected groundwater. As I pointed out when the IRA was first proposed, UCD/Dames and Moore have not

followed the normal technically valid approach of properly assessing the potential for plugging of the well screens/packing and aquifer by the reinjected partially treated groundwater. It was obvious then, as it is now, that air stripping of LEHR site groundwater will raise the pH and lead to calcium carbonate supersaturation and precipitation. I recommended several years ago that a recarbonation (CO₂ addition) be practiced to adjust the pH so that this precipitation does not lead to plugging of the reinjection system. My recommendations were ignored, with the result that UCD is now having to go into an experimental program to try to remove the constituents that are plugging the reinjection system. This is another of the 1960s level science/engineering that prevails at the LEHR site, where UCD/Dames and Moore and, for that matter with respect to other issues, DOE fails to use the science/engineering that has been available for many years in characterizing the groundwaters and surface waters to anticipate and proactively address problems of this type.

The plugging of well screens, gravel pack and aquifers by waters that are saturated with respect to calcium carbonate following air stripping to remove the equilibrium CO₂ is a well known characteristic problem of reinjection systems. I have written several papers that discuss these types of issues. I am presenting a paper at the National Groundwater Association Conference that will be held in San Francisco later this year discussing this and related topics. Further, I am part of an American Society of Civil Engineers Groundwater Recharge Committee that is just completing a multi-year effort to develop a guidance manual on groundwater recharge in which these issues are discussed.

With respect to calcium carbonate saturation, several years ago I suggested that calculations of calcium carbonate saturation be conducted. These calculations are trivial to do based on the information provided in Standard Methods for the Examination of Water and Wastewater. Failure to do them is another indication that UCD/Dames and Moore still are trying to operate an expensive complex program without having anyone on their staff who is involved in the project with an elementary understanding of aquatic chemistry issues. This problem has come up time after time over the past three years.

At the RPM meeting there were suggestions that this plugging might be due to something other than calcium carbonate. Comments were made about how the air stripping adds oxygen, which would lead to increased biological growth. There is no evidence for a deficiency in oxygen in the groundwater system at LEHR. In fact, the evidence is strongly contrary to low dissolved oxygen problems in LEHR site groundwater except possibly just downstream of waste management units that have high organic content. So far the indications are that DO is present throughout the aquifer, as well as in the chloroform plume arising from Landfill 2. If it were not present, then there would be a good chance that the chloroform would be dehalogenated.

I have repeatedly suggested that down borehole DO measurements be made. Thus far UCD has refused to make such measurements. This would eliminate any ambiguity about low dissolved oxygen issues. It is unlikely that low dissolved oxygen is a factor that is contributing to the fouling of the reinjection of the partially treated groundwater as part of the IRA.

Another statement that was made at the RPM meeting about the possible cause of fouling was that it was due to biological growth from the nutrients added. Again, there is no evidence that there is any significant addition of nutrients. The two nutrients of concern are nitrogen and phosphorus. Certainly there is no shortage of nitrate in these systems and the reinjection of the groundwater would not be expected to be adding any significant increase in phosphorus. The system may be phosphorus starved because of the characteristics of the aquifer where available forms of phosphate would not be expected to be present in the aquifer. The UCD's IRA treatment approach, and the groundwaters which are being pumped as part of this program, do not, to my knowledge, have elevated phosphorus.

Translocation of Hazardous Chemicals From Waste Through Plant Roots to the Environment

As you know, I have repeatedly cautioned UCD, DOE and the RPMs about the need to be certain that the vegetation that occurs at the LEHR site is not a mechanism for pumping waste-derived constituents from the wastes and contaminated soils to the environment through uptake in the plant roots and release in plant leaves and flowers/fruit. It is only with the potential for having to dispose of the pine trees that were removed as part of the waste burial hole remediation that this issue surfaced to the point where it was given attention. Finally, after three years of suggestions, UCD did do some of the measurements that should have been done years ago to determine whether this mode of transport is occurring. Based on the last RPM meeting, when they examined the pine tree needles and bark they found greatly elevated concentrations of tritium.

This situation points to the superficiality of the risk assessment that DOE/Weiss Associates have conducted at the LEHR site, where they have not included the translocation pathway in the risk assessment. This is a well known, documented pathway that has to be considered in any credible risk assessment, where hazardous constituents in soils are transferred to the environment through plants. Once in the environment they can be adverse to public health, either directly or through stormwater runoff to Putah Creek where they can bioaccumulate to excessive levels in fish. Even if there is no hazard to humans, there can be a significant hazard to wildlife that must be evaluated and managed.

As I discussed at the RPM meeting, the UCD studies of the pine tree should have been reviewed with the RPMs before they were undertaken. If they had been they would have included the pine cones as part of the study. Again, this situation points to the lack of using elementary science in the approach that UCD/Dames and Moore use in the LEHR site investigations. It is well known that the fruit of trees and shrubs tends to accumulate higher concentrations of some constituents than the leaves.

Another lack of science issue at the LEHR site is one that I have mentioned over the past three years regarding the form of tritium that is present at the LEHR site. Again, at the last RPM meeting, it is being assumed that it is tritiated water. Tritium is used as an isotope tracer in many organics. Several years ago I suggested an experimental approach that could define whether the tritium that is being found at elevated concentrations in groundwater, soils and now trees is tritiated water or some other form of tritium. It is important to understand the form of the tritium in order to properly evaluate its hazard in the

environment. It should be understood that the form of tritium may change at a particular location since a variety of forms were likely used on campus at different times. Also metabolism of organics could change the form of the host compound for the tritium.

The situation that has occurred with the tritium and the pine trees raises again the issue that I have discussed a number of times, namely is translocation an important pathway for radioactive and other hazardous constituents in the LEHR site wastes. As I understand, UCD only looked for radioactive constituents in the pine trees. There could readily be other constituents which are present in the wastes in contaminated soils which are also translocated.. A comprehensive work plan to address this issue site-wide and on an ongoing basis is needed. I have raised this issue repeatedly over the past three years. This is another example of where it has taken an excessively long time for the PRPs to address obvious public health and environmental hazards that should have been addressed at least half a dozen years ago as part of the initial site investigation.

Please contact me if you have questions on these comments.

G. Fred Lee, PhD, DEE