Comments on

UCD Groundwater Modeling Work Plan
Laboratory for Energy-related Health Research/South Campus Disposal Site
University of California, Davis

Dated June 25, 2009

Comments submitted by
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June 27, 2009

In May 2009, the US EPA requested that UCD develop a groundwater modeling plan for the LEHR Superfund site. In response, UCD submitted a letter stating, "*The University of California, Davis (UC Davis) is developing a Site-specific hydrogeologic model to support the preparation of a feasibility study that will evaluate alternatives to remediate contaminants in Site groundwater.*" and describing that study. UCD described the objective of the study to be: "*The objective of the study is to develop a numerical model to simulate the long-term fate of Site contaminants in groundwater in hydrostratigraphic unit (HSU)-1 and HSU-2 under various pumping and non-pumping scenarios. The model's results will support the effectiveness and cost evaluation of remedial alternatives in the feasibility study that include groundwater extraction and natural attenuation*."

Presented herein are some of the issues that need to be addressed in developing a groundwater model for the LEHR Superfund site to develop better, more reliable remediation of the waste disposal units and existing groundwater pollution, and to prevent further groundwater pollution by identified and yet-to-be-identified pollutants in the LEHR site waste disposal units and soils.

Overall Adequacy of Understanding of Sources of Groundwater Pollutant Sources and the Pollution of Site Groundwaters at LEHR Site

The groundwater monitoring well array that exists at the LEHR Superfund site is inadequate to allow reliable definition of the specific contributions of pollutants from each waste disposal unit (landfills, trenches) and soils to the groundwater under the LEHR site. As DSCSOC has noted in the past comments to the LEHR RPMs, there has been, and continues to be, need to develop a comprehensive groundwater hydrology model for the LEHR site to allow reliable evaluation of

- the releases of pollutants from the various waste disposal sources at the LEHR site to the groundwater that passes under the waste management unit, and
- the fate (dilution and transformation) of each of the COCs, yet-to-be-identified pollutants through worst case assumptions, and other constituents including organic carbon, oxygen-demanding constituents, and EC/salts, in the groundwater down-groundwater-gradient from the waste management unit.

These concerns have been raised and discussed repeatedly in comments provided by DSCSOC to the RPMs. These comments are available in the documents section of the DSCSOC website

[website: http://www.gfredlee.com/DSCSOC/DSCSOC.htm]
[document section of website: http://www.gfredlee.com/dscsoc/doc.htm]

The groundwater monitoring well array in place at the LEHR site is a hodgepodge of monitoring wells; that array was not laid out in a manner that enables the development of an understanding of the potential for each waste disposal units to cause groundwater pollution immediately down-groundwater-gradient from the waste disposal unit. As a result, the current contribution of each waste disposal unit to pollution of LEHR site groundwater is not known. Without proper data from an appropriately designed and sampled monitoring well array, it is not possible to define, much less evaluate, remediation activities needed for each waste disposal unit as part of developing a ROD for the remediation of the pollutant sources at the LEHR site. Groundwater models based on insufficient and unreliable monitoring data, cannot be expected to yield reliable information or projections.

An issue that has not been considered, but has bearing on remediation measures needed for the site, is the waste disposal practice of placing different types/composition of wastes in various areas of a waste disposal site such as a landfill/trench. That practice can have resulted in the generation of several pollutant plumes from various locations in a landfill/waste disposal unit that at this time have not been defined.

A key issue that needs to be understood is the amount of lateral spread of a pollutant plume that originates from a waste disposal unit. There is growing understanding that in many aquifer settings the lateral spread of a pollutant plume can be very limited; this results in long, narrow plumes that can be readily missed by typical monitoring wells. Since the typical monitoring well samples water from a zone of capture of a foot or so about the well, it is unlikely that a limited-width pollutant plume from a waste disposal unit would be intercepted by a monitoring well array of the type that can exists at LEHR. Dr. John Cherry of the University of Waterloo was the first to point out that the typical groundwater monitoring well array, with monitoring wells located hundreds of feet apart and oriented perpendicular to the down-groundwater-gradient direction of groundwater pollution migration, has a limited ability to detect groundwater pollution plumes near sources of pollutants. In a study of the lateral dispersion of pollutant plumes, Smyth (1991) of the Waterloo Centre for Groundwater Research, University of Waterloo, reported that a 0.6-m (2-ft)-wide point-source tracer spread laterally to a width of only about 2 m (6 ft) after traveling 65 m (213 ft) in a sand aquifer system. The groundwater model that is being developed should take those findings into consideration and be able to define how well a certain monitoring well array downgradient from each waste management unit can detect releases from the unit.

Smyth, D., Personal Communication, Waterloo Centre for Groundwater Research, University of Waterloo, Waterloo, Ontario, Canada (1991).

Issues of concern regarding the potential capping of the LEHR site landfills with a low-permeability cap have been discussed in previous DSCSOC comments. Leakage of the cap that allows rainwater to enter the landfill will lead to narrow groundwater pollution plumes down-groundwater-gradient from the landfill. Such leachate plumes can readily be missed by the current monitoring well array.

The LEHR groundwater model should be used to delineate a monitoring well array that will reliably define whether each of the waste management units, especially the landfills, is still releasing chemicals such as TOC, DOC, and EC to the groundwater system. Of particular importance is the release of organics from the landfills that leads to the release of chromium from the natural occurring minerals in the HSU-1 in the groundwater system.

Qualification of Commenter

Over the past 14 years, Dr. G. Fred Lee, technical advisor to DSCSOC, has been involved in evaluating:

- the reliable definition of the sources of pollutants that cause groundwater pollution that impairs the beneficial uses of groundwaters for domestic and other purposes at many hazardous chemical sites,
- the adequacy of an existing or proposed groundwater pollution monitoring program for detecting groundwater pollution from particular sources, and
- the adequacy of proposed source control and groundwater remediation programs to protect public health and the environment.

Dr. Lee for several years served as a member of the editorial board of the Journal Groundwater with responsibility for reviewing groundwater articles. He has published extensively on these issues; many of his publications are available on his and Dr. Anne Jones-Lee website, www.gfredlee.com. These include their March 2009 report discussing the inappropriateness of allowing UCD to only measure so-called dissolved constituents in the groundwater samples:

Lee, G. F., and Jones-Lee, A., "Sampling of Groundwater at the UCD/DOE LEHR Superfund Site," Report to DSCSOC by G. Fred Lee & Associates, El Macero, CA, March (2009). [http://www.gfredlee.com/dscsoc/doc.htm].