CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: Princeton Groundwater Remediation Course (20.06002.01.011.019)

DATE/PLACE: October 4–8, 2004; Orlando, Florida

AUTHORS: S. Painter

DISTRIBUTION:

CNWRA	NRC	SwRI
W. Patrick	B. Meehan	Record Copy B
CNWRA Directors	D. DeMarco	
CNWRA Element Managers	E. Whitt	
D. Farrell	J. Guttmann	
L. Gutierrez	H. Arlt	
	J. Pohle	
	J. Bradbury	
	W. Ford	

ENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: Princeton Groundwater Remediation Course (20.06002.01.011.019)

DATE/PLACE: October 4–8, 2004; Orlando, Florida

AUTHOR: S. Painter

PERSONS PRESENT:

S. Painter attended Princeton Groundwater's Remediation Course. The course was attended by about 100 environmental professionals, mostly from engineering and consulting companies.

BACKGROUND AND PURPOSE OF TRIP:

This trip was a professional development activity. The purpose of the trip was to attend the Remediation Course taught by Princeton Groundwater, Inc.

SUMMARY OF PERTINENT POINTS AND ACTIVITIES:

Princeton Groundwater's Remediation Course provides an extensive overview of contemporary approaches for remediating contaminated groundwater. The lectures address fundamental processes involved in groundwater remediation and practical field experience with various remediation systems.

The presenters for the Orlando course were R. Cleary (Princeton Grounwater, Inc.), B. Kueper (Queen's University, Canada), G. Rorech (Progressive Engineering & Construction, Inc.), Richard Brownell (Malcolm Pirnie, Inc.), and M. Einarson (Einarson & Associates).

Nearly two days of lectures were devoted to a review of relevant geohydrology processes and analysis methods. These lectures were taught by R. Cleary and included "Fundamental and Advanced Concepts of Remediation Hydrogeology", "Fundamental and Advanced Concepts of Fate and Transport of Dissolved Contaminants", and "Field Methods to Determine Remediation Design Hydraulic Parameters". Dr. Cleary also provided a useful and extensive list of references, and devoted an entire lecture to discussing how to find additional information.

On the first day, R. Brownell gave an overview of soil and groundwater remediation that emphasized strategies for cost effective solutions. In this lecture, he discussed the Environmental Protection Agency's regulations and other drivers for remediation, and summarized industry experience with remediation. In addition, Dr. Brownell discussed possible future policy directions.

Fluid flushing technology ("pump and treat") was the subject of another lecture by Dr. Brownell. He noted that fluid flushing is generally not effective for removing contaminants, but it is effective at containing a migrating contaminant plume. The low capital costs associated with such a containment strategy are offset by the costs associated with the long operating period.

Fluid flushing is the more cost effective approach in some situations. Dr. Brownell also presented a lecture on ex-situ treatment technologies that complemented the lectures on fluid flushing.

Dr. Brownell also presented a lecture on reactive walls. Reactive walls include permeable reactive barriers and reactive zones that are created by altering geochemistry ahead of the migrating plume. The goal in both approaches is to remove contaminants by inducing precipitation or sorption reactions in the reactive wall. A large number of shallow permeable barriers have been built and have met with some success. An advanced example a reactive wall is the removal of hexavalent chromium by in-situ redox manipulation at Hanford. Research needs in this area include longevity of the barrier or zone, loss of permeability due to precipitation, and long-term monitoring data.

M. Einarson presented the following key points on environmental site characterization.

- Cost effective remediation is generally not possibie without careful site characterization.
- Rigid site characterization plans are not effective and should be abandoned in favor of adaptive iterative strategies.
- Innovative characterization technologies, such as direct-push technology, are reducing characterization costs, at least for shallow contamination.
- Multi-level sampling is necessary to get an adequate picture of the plume.

Mr. Einarson also discussed methods for verifying the effectiveness of remediation. He is advocating a flux-based decision framework that uses contaminant flux at a monitoring boundary to quantify effectiveness of remediation instead of concentration-based criteria.

Several lectures dealt with remediation of non-aqueous phase liquids, including the processes involved and experience with various remediation schemes. Dense non-aqueous phase liquids are extremely difficult to remove from the subsurface and successful remediation programs are rare. Locating the source of dense non-aqueous phase liquids is key to successful remediation. Once the dense non-aqueous phase liquid source has been identified, techniques such as chemical oxidation or in-situ heating can be applied.

One evening and one-half day were spent on computer exercises with computer tools for remediation design. Two exercises used the screening tools BIOSCREEN and Princeton Model 5, which implement analytical mass transport models. The third exercise used the Visual MODFLOW software.

PROBLEMS ENCOUNTERED:

None.

PENDING ACTIONS:

None.

RECOMMENDATIONS:

None.

SIGNATURES:

Scott Painter
Principal Scientist

12-10-04
Date

CONCURRENCE:

Gordon Wittmeyer
Manager, Hydrology

12/10/2004
Date

Budhi Sagar
Technical Director

12/10/04
Date