

**Report of NABIR Subcommittee of BERAC
November 7-8, 2002, Belmont House, Baltimore, MD**

Uranium Mill Tailing Remedial Action Sites

The NABIR BERAC Subcommittee met on November 7-8, 2002 to review two aspects of the NABIR program: 1) projects at the Uranium Mill Tailing Remedial Action (UMTRA) sites and 2) projects in the Community Dynamics/Microbial Ecology Element.

This report details the subcommittee's response to its charge relating to the UMTRA sites. These sites were originally made available during the environmental review and approval process for the NABIR Field Research Center (FRC), and over the past four years, have served as research sites for a number of NABIR investigators. At its meeting, the subcommittee was provided an overview of these sites and briefed on a field research project at the Old Rifle Site. The subcommittee is impressed by the research opportunities offered by these sites, by the support extended to researchers by personnel associated with the UMTRA groundwater program, and by the quality and creativity of the site research, given the limited resources of this program. Each of the questions posed to the subcommittee are listed below, followed by the subcommittee's response.

Question 1: Are the UMTRA sites valuable to the program, and do they warrant continued or enhanced investment by NABIR? How can NABIR take better advantage of the availability of UMTRA sites for research?

The NABIR BERAC subcommittee believes that research at UMTRA sites can make substantial contributions to achieving the goals of the NABIR program. The importance of the 21 Title 1 UMTRA sites arises from their simplicity and relevance to other DOE subsurface sites with uranium contamination. These UMTRA sites are characterized by relatively simple hydrogeology and geochemical conditions. Uranium concentration levels are generally low, with the major contamination issue to remediate or manage the soluble plume. Their low contamination levels, in conjunction with the shallow depth to water table, make these sites extremely well-suited for low cost (and low risk) research and field demonstrations.

Despite the relative simplicity of the UMTRA sites, the microbial and geochemical processes occurring at these sites are of relevance to other, more complex and deeper, uranium contaminated sites in the West and other parts of the country. Thus, this combination of simplicity and relevance tends to facilitate the use of these sites for cost-effective, exploratory ("proof-of-principle") research that would be applicable to and enhance future research and remediation efforts at complex deeper sites.

To date, it appears that work at UMTRA sites has been 'boot-strapped' on a limited budget and has consequently involved only a small group of researchers. The subcommittee believes that an increased level of investment in research at these sites could provide a larger benefit to the NABIR program and accelerate the advancement of

remediation technologies. Increased investment would facilitate the participation of a larger group of NABIR researchers, better integrating these efforts with main-stream NABIR research and fostering more interdisciplinary collaboration. To promote better integration into the NABIR program, the subcommittee recommends that future studies at UMTRA sites be formally identified in the NABIR program plan.

Question 2: How could NABIR continue to make use of the UMTRA sites if a “western” FRC became operational in FY04? Should NABIR continue investing in UMTRA sites if a “western” FRC becomes operational?

The subcommittee is supportive of the western FRC concept. The investment in such a facility would provide a distinctly different biogeochemical environment for NABIR researcher investigations (in comparison to the existing FRC and UMTRA sites) and field studies at this site could be very valuable in moving the science forward. It is likely that, in contrast to the hydrogeologic setting found at most UMTRA sites, the geology at a western FRC would be characterized by a deep vadose zone and a highly heterogeneous, fractured rock environment. It is also likely that mixed wastes would be present at a western FRC, as well as in-place source areas. Although the hydrogeologic and biogeochemical complexities at a western FRC would offer many exciting opportunities for NABIR researchers, the construction and implementation of field experiments in this environment would likely be quite costly.

The subcommittee believes that continued investment in UMTRA site research would be warranted, beyond the timeframe in which a western FRC became operational. The subcommittee envisions that research at UMTRA sites could be integrated with a future western FRC site by facilitating the examination of a subset of problems/conditions, likely to be encountered at the FRC, that were also consistent with specific conditions at selected UMTRA sites. Use of UMTRA sites for field experimentation would permit proof-of-concept demonstration of technologies in a simpler setting. Based upon site conditions, it is likely that field experiments conducted at UMTRA sites would be substantially less costly and of shorter duration, and results would be more easily interpreted. Furthermore, because contamination levels at UMTRA sites are likely lower than those that would be encountered at a western FRC, the failure of a technology demonstration would also presumably pose less risk. If successful, a demonstrated technology could then be applied under the more complex conditions present at the FRC. This staged field investigation approach, linking UMTRA sites to an FRC, would promote the efficient use of resources and provide a logical means to address the more complex problems likely to be encountered at the selected western FRC.

Question 3: In light of UMTRA’s field site characteristics and the results from the ongoing Old Rifle field studies, what are the future research opportunities/uses for the UMTRA sites?

The UMTRA sites are characterized by relatively simple hydrogeology (alluvial deposits and shallow water tables) and geochemical conditions (neutral pH, low organic carbon, simple waste plumes). Furthermore, substantial characterization and hydrologic modeling work has apparently been undertaken at most sites in support of the development of a management plan (long term stewardship). The sites are also relatively small in geographic extent and the source of contamination is generally well-understood. Because the continuing source has been removed at most sites, uranium concentration levels are generally low and the major contamination issue involves management of a soluble plume. As noted above, these sites seem extremely well-suited for field-testing of *in situ* biostabilization methods. The risk associated with failure is not great, costs to implement tests are low, and design is relatively straightforward.

In addition to their potential use in remediation technology demonstrations, these sites would also appear to offer exciting possibilities for research into other issues that will eventually be an important part of the full-scale implementation of these technologies at DOE sites. For example, the sites would appear to offer opportunities to investigate the suitability and efficacy of alternative mixing strategies in amendment addition, to develop and field validate numerical simulators for remedial design, to develop and compare alternative monitoring strategies (metals), to develop and validate methods for quantifying mass fluxes, to explore manipulating geochemistry and its influence on stability of reduced uranium, to test new microbial characterization tools (designed to examine community structure), to compare efficacy of alternative amendments, and to explore terminal electron acceptor availability.

The UMTRA sites also offer unique opportunities for the BASIC program. Some attributes of these sites are similar to, and others significantly different from, those of other DOE sites, offering many opportunities for informative case-specific or comparative studies. Attributes of UMTRA sites that may offer particularly fertile avenues for research include: their historical and current social and economic context; their incentive structures for cleanup; and their varied stages in the cleanup process. Examples of UMTRA context variables that provide opportunities for comparison and contrast with other DOE sites include: (1) DOE and its predecessor agencies were not the original polluters; (2) DOE already has cleaned up visible and contentious pollution problems; (3) DOE has relatively little economic influence on local communities; and (4) the presence of cultural groups like Native Americans. Liability and incentive structures associated with formal cleanup agreements could also serve as a focus of study. Of particular interest is the degree to which a state's contribution to cleanup costs (under certain circumstances) influences the willingness of the state and other stakeholders to support cleanup options that involve some form of attenuation rather than active remediation. Because compliance strategies have been approved at some sites and are under development at other locations, UMTRA sites offer the potential for both retrospective and prospective studies. These studies could investigate, as single cases or comparatively, site decision-making processes and issues. In particular, such studies could explore how NABIR-related management options, such as long-term stewardship, immobilization/containment, and bioremediation, manifest themselves across UMTRA sites.

Question 4: Is coordination among UMTRA investigators adequate for integration of data? How can this be improved?

UMTRA sites appear to be providing useful sediment samples to NABIR PIs. Coordination among current UMTRA investigators appears to occur formally, through PI meeting presentations, workshops, and conference calls, as well as through informal communication. These efforts are useful and conducive to data integration.

Overall, however, the subcommittee believes that coordination efforts have been limited by the opportunistic and ad hoc approach that has been taken to UMTRA research. The data being collected and integrated may not be the best data to collect and integrate to achieve NABIR programmatic goals. Like other NABIR research, UMTRA field activities should be aligned with clearly identified goals. These goals would orient research activities toward key programmatic objectives. They would also provide a framework for selecting among proposed research projects and for deciding which have a higher priority.

UMTRA researchers are interdisciplinary and represent a diverse set of institutions. Review of the research activities, however, suggests that there may be too heavy an emphasis on microbiology and too little emphasis on other relevant disciplines. This imbalance limits what data are integrated and inhibits effective interdisciplinary project development. The joining of the EMSP and NABIR programs appears to offer excellent opportunities for research partnering at UMTRA sites.

Question 5: Is UMTRA well-integrated into the overall NABIR program and, if not, what can be done to enhance integration?

The subcommittee believes that UMTRA is not very well-integrated into the overall NABIR program. There have been no calls for proposals targeted to UMTRA sites and it is not clear how or why researchers should choose to conduct research at UMTRA sites under the NABIR umbrella.

The subcommittee's primary recommendations for enhancing integration are to develop strategic plans for UMTRA research and to incorporate UMTRA explicitly in calls for proposals, targeted to these strategic goals. The subcommittee suggests that NABIR develop a Field Research Program Element that incorporates the Oak Ridge FRC, selected UMTRA sites, the western FRC, if it is developed, and other sites that can be used to achieve programmatic goals. A strategic plan that clearly delineates objectives should be written for this new program element. The plan would guide and focus researchers' efforts. Explicitly incorporating UMTRA sites into calls for proposals likely would promote research at those sites. The subcommittee emphasizes that UMTRA sites can be a cost-effective test bed for varied research, guided by strategic goals.

Signed for the Committee

Linda M. Abriola, Chair, November 27, 2002

Members and guest members present:

Tamar Barkay

Margaret Cavanaugh

Linda Chrisey

Stephen Lien

Mary Voytek

Lew Semprini

Barth Smets

Amy Wolfe