Summary Minutes of the United States Environmental Protection Agency (U.S. EPA)
Science Advisory Board (SAB) Quality Review Teleconference
December 21, 2011

Teleconference of the Chartered SAB and SAB Liaisons[1]

Date and Time: December 21, 2011, 2:30 p.m. – 5:00 p.m. Eastern Time

Location: By Teleconference

Purpose: to conduct a quality review of a draft SAB report, a draft *Advisory on EPA's Draft Technical Document entitled Considerations Related to Post-14 Closure Monitoring of Uranium In-Situ Leach/In-Situ Recovery (ISL/ISR) Sites.*[2]

SAB Members and Liaison Participants:

SAB Members

Dr. Deborah Swackhamer, Chair
Dr. George Alexeeff
Dr. David Allen
Dr. Pedro Alvarez
Dr. Joseph Arvai
Dr. Terry Daniel
Dr. George Daston
Dr. Costel Denson
Dr. Otto Doering
Dr. Michael Dourson
Dr. T. Taylor Eighmy
Dr. Elaine Faustman
Dr. John Giesy
Dr. Barbara Harper
Dr. Kimberly L. Jones
Dr. Bernd Kahn
Dr. Agnes Kane
Dr. Cecil Lue-Hing
Dr. Eileen Murphy
Dr. James Opaluch
Dr. Duncan Patten
Dr. Stephen H. Roberts
Dr. Amanda Rodewald
Dr. James Sanders
Dr. Jerald Schnoor
Dr. Daniel Stram
Dr. Peter Thorne
Dr. John Vena
Dr. Robert Watts

SAB Liaison

Dr. James Johnson, Chair, National Advisory Council on Environmental Policy and Technology
Dr. Kenneth Portier, Chair, FIFRA Scientific Advisory Panel

SAB Staff Office Participants

Dr. Angela Nugent, Designated Federal Officer (DFO)
Dr. Vanessa Vu, Director
Dr. Jack Kooyoomjian, DFO for the SAB Radiation Advisory Committee Augmented for Uranium and Thorium In-Situ Leach Recovery and Post-Closure Stability Monitoring

Teleconference Summary:

The teleconference was announced in the Federal Register[3] and discussion generally followed the issues and timing as presented in the agenda.[4]

Convene the meeting

Dr. Angela Nugent, SAB DFO, convened the advisory teleconference and welcomed the group. She noted that the meeting had been announced in the Federal Register, which provided an opportunity for public to provide oral and written comments. She noted that four individuals had requested to provide oral public comments and that three sets of written comments had been received from Art Dohrmann[5] , Venice Scheurich of the Coastal Bend Sierra Club[6] and John Cash[7]. The DFO asked members of the public participating by teleconference to contact her so that their names could be listed in the minutes (Attachment A).

Purpose of meeting and review of the agenda

Dr. Deborah Swackhamer, the SAB Chair, welcomed SAB members to the teleconference. Dr. Swackhamer reviewed the purpose of the meeting, to conduct a quality review of a draft report entitled draft *Advisory on EPA's Draft Technical Document entitled Considerations Related to Post-14 Closure Monitoring of Uranium In-Situ Leach/In-Situ Recovery (ISL/ISR) Sites*. During quality reviews the chartered SAB deliberates to decide whether a draft report is ready to send to the EPA Administrator. She emphasized the importance of the quality review function of the chartered SAB and thanked members for their willingness to provide written comments and participate in the teleconference.

Quality review of draft report from the Radiation Advisory Committee Augmented for Uranium and Thorium In-Situ Leach Recovery and Post-Closure Stability Monitoring

Dr Deborah Swackhamer introduced the four members of the public providing oral comments.

Mr. Oscar Paulson, the licensee and owner-operator of the Sweet Water uranium project of the Kennecott Uranium Company, was the first public speaker. He commended the SAB draft report for acknowledging that a significant amount of monitoring data are available to guide regulatory decisions and noted that only a limited amount of data had been initially addressed in EPA's draft technical support that had been the subject of SAB review and comment.

He emphasized that the SAB report should clearly note the importance of variability in measured background levels, depending on the location of measurement, especially related to the migration of water. He asked for a consideration of naturally occurring radionuclides in the SAB document and EPA's technical document. It is Kennecott's view that *in situ* mining can be carefully managed to account for the variability of background levels of radiation. He also asked that the SAB document comment on the importance of analyzing baseline data regarding pre-existing flooded open pits that have different properties depending on their location and weather factors.

Location, weather and hydrogeologic conditions should figure into the baseline to characterize the "pre-existing situation" before in-situ mining occurs.

Mr. John Cash, Ur-Energy USA Inc., was the second public speaker. He referred SAB members to his written public comments and expressed appreciation for the key role the SAB plays in reviewing science related to SAB regulations. He provided comment on the SAB draft report in four areas: 1) the report should encourage more coordination across federal and state agencies regarding regulatory activities affecting *in situ* leach mining; 2) the report should provide more detail regarding compliance and restoration for exempted aquifers, i.e., the locations where *in situ* mining occurs; 3) the report should look for opportunities to characterize relative risks of different options; and 4) the report should check references, especially the Sass 2011 reference, for appropriateness.

Ms. Katie Sweeney, General Counsel for the National Mining Association, was the third public speaker. She emphasized that the draft SAB report should provide additional information regarding exempted aquifers and the purpose of the aquifer exemption. Maximum contaminant levels play a role in protecting aquifers that haven't been exempted if they are adjacent to an exempted aquifer. She expressed praise for the SAB's open review process.

While SAB members waited for the fourth public speaker to join the call they asked several clarifying questions. One member asked Mr. Cash to expand his comment on coordination across federal and state agencies. Mr. Cash noted that it will be important for the U.S. EPA, Nuclear Regulatory Commission and the states to be consistent on the aquifer exemption. Another member asked about the status and location of existing data described by Mr. Paulson. Mr. Paulson noted that data generated by private mining companies and "operational groups" generally are submitted to state and federal regulatory agencies. This information is public and generally constitutes "most of the data" possessed by companies and operational groups. In response to a question, Mr. Cash explained how it can be acceptable for an exempt aquifer to be adjacent to a non-exempt aquifer in a relatively small landscape. The hydrogeology allows for horizontal confinement of uranium. Horizontal flow is very slow, only a few inches or perhaps a few feet per year. Most ions related to *in situ* mining (e.g., uranium and radium) are immobile; they are highly reactive and absorbed to clays. Existing regulations set out criteria for exempting aquifers. Another SAB member observed that it is important to take "vertical and horizontal profiles" to understand the movement of radioactive materials. Mr. Cash responded that companies typically monitor *in situ* mining in several key ways. They monitor above and below the underlying aquifer and establish a surrounding monitoring ring, usually 35-acres in size. In response to another question, Mr. Cash clarified that he did not intend to indicate that the SAB report had many errors. His written comments provide comments and suggestions and one correction.

Ms. Venice Scheurich, the fourth public speaker and Chair of the Coastal Bend Sierra Club, joined the call. She expressed gratitude for the SAB draft report's emphasis on understanding pre-operational groundwater quality as a step to help set post-restoration standards. She referenced written comments that discussed the quality of industry data used in permit application. Recent studies questioned the quality and representativeness of industry data on

which hydrogeological models would be based. How will decision makers determine a baseline if there is no way to judge if data sets are representative? Only a few situations have independent monitoring mandated by a legal proceeding; such mandates allow for independent checking of industry data. Ordinarily such data are not available because state regulations do not require it. Ms. Scheurich asked that the SAB modify language on page 7 of the draft to identify an effective way of addressing this concern.

An SAB member asked if Ms. Scheurich had a specific recommendation regarding gathering independent data. She responded that EPA should look beyond what industry initially presents. She did not have any other specific suggestions.

Dr. Swackhamer then thanked the four public speakers for providing comments. She introduced the panel chair, Dr. Bernd Kahn, and asked him to provide some background on the draft report.

Dr. Kahn thanked chartered SAB members for their useful comments[8]. *In situ* leach mining involves pumping a leaching solution called a lixiviant into an injection well near an extraction well, instead of extraction and milling procedures used in traditional mining. An *in situ* mine may have 50 or 100 injection wells. Uranium is removed from the leachate solution by ion exchange or some other mechanism. When mining is terminated, the lixiviant is replaced by water until the uranium content is minor. Ideally, the aquifer would return to its pre-mining situation and there would be no contamination. In practice, there is some contamination. The goal is to return to the original status or reach some acceptable level of concentration

Until recently, U.S. mining for uranium was quiescent. Currently, there are 32 sites identified by industry where the *in situ* leach mining procedure could be used. An advantage of this technology is avoidance of major rock movement, milling and tailing ponds. However, *in situ* leach mining can affect aquifers and therefore regulatory requirements are important. The current regulatory framework, responding to the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978, identified three federal agencies that share regulatory responsibility. The EPA sets environmental and health standards. The Nuclear Regulatory Commission licenses mine operations and the Department of Energy controls licensing of mills (a topic outside the scope of the draft report being quality reviewed). Currently, *in situ* leach mining is not explicitly addressed by the regulations. EPA is considering establishing health and environmental protection standards for *in situ* leach mining. Licensing documents are quite different for *in situ* leach mining, compared to uranium surface, underground mills and conventional hard-rock mining.

The EPA has two types of responsibilities related to *in situ* leach mining. Before an operator applies for a mining license, that person must receive an exemption if activities affect the water supply near the mine. EPA also must make a regulatory determination as to whether the mining (i.e., adding the lixiviant to the aquifer) interfere with water used elsewhere. EPA regulates the water that can be returned for use after mining. A mine must monitor groundwater operations to ensure that the lixiviant s not present. EPA asked SAB to consider a draft technical report that described groundwater monitoring at *in situ* leach mining sites to compare post and pre-

operational groundwater quality and the presence or absence of the lixiviant beyond the production zones.

EPA's charge to the SAB was designed to seek advice on the scientific and technical issues associated with EPA's regulatory role for *in situ* leach mining. The first charge question is the most significant, i.e., EPA seeks comment on "The technical areas described in the report and their relative importance for designing and implementing a monitoring network. Identify any technical considerations that have been omitted or mischaracterized." The other questions (regarding characterizing the pre-mining phase; monitoring in the post-mining/restoration phase for determining when groundwater chemistry has reached a "stable" level; and statistical techniques to be used) seek more detail related to supporting the first charge question.

The draft SAB report contains an extensive set of recommendations, which Dr. Kahn briefly highlighted. The EPA should acquire a thorough knowledge of aquifer lipid-solid interactions based on site results, as compared with other mines. The report recommends that EPA devote significant attention to applying statistics and statistical principles to the design of the monitoring network and to then collection of data, not just focus on statistical techniques for analyzing the results from the monitoring networks. EPA's draft technical report discusses statistics in detail in terms of results, but if the data gathered or modeled do not adequately define the aquifer, statistical analysis of that data will not be meaningful. The key question should be: once you have the data can you make comparisons pre- and post- *in situ* mining operations and demonstrate they are identical. EPA will need to understand the technical details of the *in situ* mining process as implemented in specific kinds of situations to set standards for human and environmental protection. It will be complex to understand the hydrogeochemical interactions at mining sites to set appropriately protective standards, whether that entails returning a mine to its pre-mining conditions or some other standard.

Dr. Swackhamer asked the lead reviewers to provide comments. The first lead reviewer, Dr. Taylor Eighmy, focused on one major point. The SAB draft report and EPA's draft technical document should more clearly identify the need to establish baseline hydro geological and geochemical conditions at *in situ* mining sites. The SAB report could be strengthened by emphasizing the importance of better characterizing baseline information about how water moves into and out of the ore body. It is likely that much of this information exists in industry and state files. To successfully use models, one must carefully sample all the analytes and redox pairs that are important and use surface spectroscopy.

Dr. Swackhamer summarized the written comments provided by the second lead reviewer, Dr. James Mihelcic, who was unable to participate in the teleconference. He noted that the fourth charge question was not adequately addressed and requested additional advice on statistical techniques to fully address the charge question. He called for additional wording changes concerning the use of the following terms: lifecycle, seasonality, and extreme weather events. He suggested that the letter to the Administrator provide more detailed information.

Dr. Horace Keith Moo-Young was the third lead reviewer. Because he did not join the call, Dr. Swackhamer briefly summarized his written comments. He called for the draft report to include

more information about monitoring and clarify the discussions of natural attenuation and retention ponds.

Dr. Jerry Schnoor, the fourth lead reviewer, emphasized one major point. The SAB draft report should include more discussion of hydrogeological and geochemical conditions and issues related to *in situ* mining. The charge questions should be more clearly identified in the draft report for easy access by the reader.

Dr. Kahn then responded to the lead reviewers' comments. He agreed that the draft report must correct its description of natural attenuation, as noted by the lead reviewer. He is working with Dr. Daniel Stram on the Radiation Advisory Committee and Dr. Jack Kooyoomjian, the DFO for the committee, to closely analyze comments received and determine how they can be addressed. The response to charge question 4 regarding statistical methods will be revised and strengthened. The report will strengthen its discussions of hydrogeology and geochemistry. The SAB Office will work to see if the charge questions could be more clearly identified in the table of contents. He also noted that the draft report will be revised to call on the agency to identify the lixiviant being used. He emphasized the importance of EPA working closely with staff from the Nuclear Regulatory Commission. These scientists work closely with mine operators and permittees on a daily basis. Such collaboration is necessary to develop regulations that are both protective and realistic.

In response to a question from the SAB Chair, Drs. Eighmy and Schnoor indicated that their comments and questions had been addressed.

Other SAB members then provided additional comments and questions. In response to a question about the need to enhance the working relationship between EPA and the Nuclear Regulatory Commission, Dr. Kahn explained that there may be some public concern that EPA might implement some "unrealistic requirements" because EPA does not have day-to-day interactions with mining operations as personnel from the Nuclear Regulatory Commission do. He was confident that the administrative inter-relationship between technical staff in both agencies "will work itself out." An SAB member suggested that the need for inter-agency collaboration should be highlighted in the letter to the Administrator because it is administratively important. Another member asked whether the draft report should include some mention of sustainability, in addition to the risk paradigm. Dr. Kahn responded that it would be appropriate to discuss sustainability, because sustainability concerns are part of the determination of post-mining standards. Most likely, he noted, that when a mine is closed it will not be likely that "the water looks exactly like before or better." In many cases a regulatory agency will have to determine the level of acceptable lixiviants, where it is impossible to return groundwater to its original condition. There will be a need to make sustainability possible, not an impossible goal of returning the groundwater exactly to its pre-mining condition.

One SAB member noted that the executive summary was unusually short. Dr. Kahn agreed to add some additional text to the summary and the letter to the Administrator. Several members concluded the discussion by commending the committee for its extensive work and for the well-written report

After discussion had concluded, Dr. Swackhamer asked for a motion to dispose of the report. She reminded members that the purpose of the quality review is to determine if the report is ready to transmit to the Administrator as an SAB report and under what conditions. Dr. Michael Dourson moved that the report be revised and that lead reviewers to review the changes before the Chair conducts her final review prior to transmittal to the Administrator. Dr. Terry Daniel seconded the motion. The Chair asked that the motion be modified to call for a select number of SAB members to review the revised report and that the DFO would constitute the group providing the initial review. Dr. Dourson accepted this modification. The motion was approved unanimously with no opposition. Dr. Swackhamer concluded by thanking the committee chair, and the SAB members for their contributions to the quality review.

The DFO adjourned the teleconference at 4:03 p.m.

Respectfully Submitted:	Certified as True:
___*/Signed/*_____	___*/Signed/*_____
Dr. Angela Nugent	Dr. Deborah L. Swackhamer
SAB DFO	SAB Chair

NOTE AND DISCLAIMER: The minutes of this public meeting reflect diverse ideas and suggestions offered by committee members during the course of deliberations within the meeting. Such ideas, suggestions, and deliberations do not necessarily reflect definitive consensus advice from the panel members. The reader is cautioned to not rely on the minutes represent final, approved, consensus advice and recommendations offered to the Agency. Such advice and recommendations may be found in the final advisories, commentaries, letters, or reports prepared and transmitted to the EPA Administrator following the public meetings.

Attachment A: Members of the Public Who Indicated Participation on the December 6, 2011 Teleconference

Richard Blubaugh, Powertech (USA) Inc.

Richard Bush, Department of Energy

Michael Widdop, S. M. Stoller Corporation

John Cash, Ur-Energy USA Inc.

Andrea Cherepy

Mary E. Clark, U.S. EPA

Casey Dietrich, CQ Transcriptions

Phil Egidi, U.S. EPA

June Fabryka-Martin, Los Alamos National Laboratory

Kevin Frederick, Wyoming Department of Environmental Quality

Michael Widdop, S. M. Stoller Corporation

Dan W Jackson, U.S. EPA

Bill Kearney, Uranium One Americas

Charles Kelsey, UR-Energy,USA

Katharine Kurtz, Navy and Marine Corps Public Health Center

Muthu Kuchanur, Wyoming Department of Environmental Quality,

Tom Lancaster, U.S. Nuclear Regulatory Commission

Lisa Ledwidge, Institute for Energy and Environmental Research

Ray Leissner, U.S. EPA

Josh Leftwich, Radiation Safety & Licensing

Arjun Makhijani, Institute for Energy and Environmental Research

Mike Neumann, Neutron Energy Inc.

Oscar Paulson, Kennecott Uranium Company

Tom Peake, U.S. EPA

Zach Rogers,

John Saxton, U.S. Nuclear Regulatory Commission

Venice Scheurich, Coastal Bend Sierra Club

Elise A. Striz, U.S. Nuclear Regulatory Commission

Katie Sweeney, National Mining Association

Mike Thomas, Uranerz Energy Corporation

Michael Widdop, S. M. Stoller Corporation

Materials Cited

The following meeting materials are available on the SAB Web site, http://www.epa.gov/sab, at the following address: http://yosemite.epa.gov/sab/sabproduct.nsf/a84bfee16cc358ad85256ccd006b0b4b/21eb8659c72b64698525794400717edb!OpenDocument&Date=2011-12-21

[1] Roster, Chartered SAB Members and Liaisons
[2] Draft *Advisory on EPA's Draft Technical Document entitled Considerations Related to Post-14 Closure Monitoring of Uranium In-Situ Leach/In-Situ Recovery (ISL/ISR) Sites* (11/22/11 draft)
[3] Federal Register Notice announcing the meeting
[4] Agenda
[5] Comments from Art Dohrmann, 12/13/11.
[6] Comments from Venice Scheurich of the Coastal Bend Sierra Club
[7] In-line comments from John Cash, Ur-Energy USA Inc., received 12/20/11
[8] Preliminary Comments from Members of the Chartered SAB as of 12/19/11