

# A Range of Colorful Challenges

**F**or the past decade or so, one of the most important venues for nuclear waste management/facility cleanup information has been the biennial Spectrum conference. This year, the conference was held September 24–28 in Chattanooga, Tenn., putting the attendees close to the Oak Ridge site where so much cleanup work is under way. More than 300 meeting registrants gathered in the Tennessee Valley city to hear and discuss the latest in cleanup technologies and activities in both the government and commercial arenas.

## The Kickoff

After the usual welcomes, introductions, and thank-yous to the many volunteers who make such a conference possible, the Monday morning plenary session began with a presentation by U.S. Rep. Zack Wamp (R-Tenn.), who represents Tennessee's Third District, which encompasses both Oak Ridge and Chattanooga. Wamp began his talk with a brief discussion of the current energy picture in the United States. The prices of energy in the U.S. are inflated because of the demand we put on the supply, he said. "If you reduce demand 3 percent," he asserted, "you will see a 25 percent reduction in price."

In addition, he cautioned, we are "less than 10 years away from a crisis

in global energy supply." There are several solutions to the problem, he noted, including increased oil exploration and increased spending on research on clean-coal technology. But also, he stated, "this country needs to get real on the issue of nuclear power. . . . Going back to nuclear may not be popular, but it'll be a whole lot more popular than brown-outs."

On the subject of environmental cleanup, Wamp said that "not nearly enough is being done to clean up the [former defense] sites"—too much is being spent on "management" and not enough on actual cleanup. And, he asserted, Congress is going to have to see "real progress in cleanup" if it is to continue to fund the U.S. Department of Energy's Environmental Management (EM) Program at \$6 billion or \$7 billion per year. We have to begin to "take buildings down," not just "stir the pot," he challenged. We "don't need the military to take it over, but we do need a military-like plan," he suggested.

In the future, Wamp said, whether we find ourselves under President Bush or President Gore, we need to develop a five-point action plan:

- Ask the tough questions.
- Make sure science guides all our activities.
- Set realistic goals, and measure our progress.
- Clearly maximize the technologies available.

■ Have the courage to actually *do* it.

Wamp was followed by Johnny Moore, from the Technology Development Program at the DOE's Oak Ridge Operations Office (ORO). Moore noted the achievements the ORO has made at Oak Ridge, where it has demonstrated approximately 200 technologies at bench or larger scale, deployed about 80 of those technologies to date, and delivered more than 100 technologies with cost and performance data. A good example of these efforts, he said, is the development of the Houdini robot, used in the cleanout of the Gunit tanks at Oak Ridge—some 28 technologies were incorporated into this one device, which was developed to move tank sludge to areas where it could be extracted out of the tank.

Partnership development is one key to tackling the cleanup problem, said the next plenary speaker, Frank Harris, associate director of Oak Ridge National Laboratory (ORNL). Also, he noted, while the cleanups move along on an often legally mandated course, science moves on a different schedule. To help resolve this difference, Harris said, the cleanup programs should be able to draw on the resources of the entire DOE, not just the EM program. After all, he explained, these sites were contaminated in the process of doing work that benefited the entire country; therefore, their cleanup

should be a national priority, not just the responsibility of one program within the DOE.

### THE VISION THING

Carolyn Huntoon, assistant secretary for EM at the DOE, noted that the DOE faces a challenge to envision what its sites will look like in the future. This vision is limited somewhat by the money that is available and by how fast we can develop the technologies to do the job. In particular, she sees challenges in five major areas:

- High-level waste storage tanks.
- Subsurface contamination.
- Deactivation and decommissioning of 7000 contaminated facilities.
- Mixed, low-level, and transuranic waste.
- Long-term stewardship.

The most challenging task involves the HLW currently stored in tanks at various DOE sites. But, she proudly noted, efforts at Oak Ridge, for example, have resulted in an accelerated schedule for cleanup and reduced costs. In the area of subsurface contamination, she pointed out the vast legacy of contaminated soil and groundwater (most notably chlorinated solvents) at former defense sites. Yet more than 50 new technologies have "revolutionized activities" in this area, she said, citing in particular oil-field technologies adapted to DOE sites. This problem is not unique to the DOE, she added, and other industries and international governments are involved in the continuing search for new technologies and methods.

In the decontamination and decommissioning (D&D) area, Huntoon noted that the government is adapting many technologies from the commercial nuclear power industry; the impact of these new technologies is significant at Rocky Flats and in the "cocooning" of the Hanford Site's C Reactor.

In the waste area, Huntoon pointed with pride to the Waste Isolation Pilot Plant as an example of the DOE's abil-

ity to get a facility opened and operating. And as far as long-term stewardship is concerned, she said, "this is a technology issue as well." To help tackle this problem, she has created a new office of Long-Term Stewardship under the Science and Technology Program.

Looking ahead, Huntoon noted several new initiatives the DOE is implementing to help speed the cleanup effort, including improving integration of science and technology with field operations, improving contracting and procurement, and introducing incentive systems to reward employees for good ideas.

### A BEACON TO FOCUS ON

The views of the private sector were the subject of the presentation by Ambrose Schwallie, president of Washington Group International. Since companies in the private sector generally are doing the actual cleanup work, Schwallie discussed some of the intricacies of creating partnerships and blending together companies with differing cultures and methodologies to achieve a single goal. Focusing on what he termed the "softer science" of managing people, Schwallie suggested: "Give the employees a beacon to focus on."

As a case in point, he told about the difficulty in blending together several companies to begin the work on the cleanup at the Savannah River Site after the end of the Cold War. Many of the employees faced a "profound change" in the work environment, with the new business realities radically different from the previous history of 40 years of doing business. To ease the transition, the companies developed what he termed the "five initiatives" to integrate the workers:

- Safety—This gave a focus for employee attention and actively engaged them in the work at hand.

- Disciplined operations—This brought more formality to the workplace, as it reminded workers that it was not enough just to work safely, but that you had to *prove* that you were working safely.

- Cost-effectiveness—The end of the Cold War brought a change in the way of doing business, with a new sense of urgency to reduce costs.

- Teamwork—This encouraged greater cooperation along operations and budgetary lines. It was also a good place to promote other initiatives such as tolerance and diversity.

- Continuous improvement—Schwallie said the companies first tried a "total quality" program but had only limited success with it. The "continuous improvement" program was easier for workers to understand.

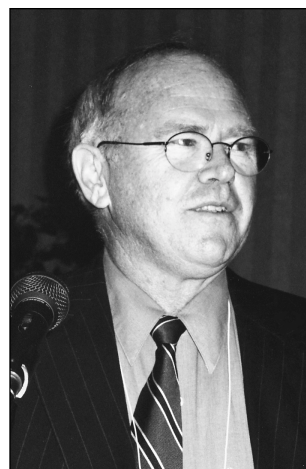
Once there was buy-in by the employees on these five imperatives, it was easier to introduce new initiatives, as long as they could be tied to the imperatives, Schwallie said.



Carolyn Huntoon, assistant secretary for EM at the DOE



Ambrose Schwallie, president of Washington Group International



Terry Hawkins, director of nonproliferation and international security at LANL

### LANL COMEBACK TRAIL

Concluding the plenary session was a presentation by Terry Hawkins, director of nonproliferation and international security at Los Alamos National Laboratory (LANL), who focused on a different type of environment: "the environment in which we do business."

LANL has been undergoing some tough times, Hawkins said. The difficulties began shortly after the end of the Cold War, which brought an "interesting peace," with some new realities and new instabilities, to the na-

tion. (In time, he suggested, we may look back fondly on the Cold War era as a time of stability, if for no other reason than that we at least knew who and where the enemy was.) At LANL, this brought about a reengineering of the institution, with attendant lay-offs and reductions-in-force (RIFs) (although later new programs enabled the lab to rehire many of those RIFed employees).

Then came the allegations of espionage, which resulted in adverse publicity, cuts in the travel budget, a moratorium on foreign visits and exchanges, cuts in research and development funding, loss of morale, and difficulties in recruitment. Ironically, he noted, subsequent investigations have demonstrated that there was never any espionage at LANL.

As if that were not enough, there was this spring's "controlled burn" by the U.S. Park Service, which led to uncontrollable consequences for the lab. Some 43 000 acres of lab land ultimately burned, and 420 homes in the town of Los Alamos were lost. And as a consequence of the burn, with fires so hot they vitrified the soil, with the summer rains came the danger of flooding.

Finally, there was the case of the lost hard drives, which generated still more negative publicity for the lab. The result of the investigation,

Hawkins said, was that LANL was found to be in compliance with all DOE regulations regarding security, although this finding did not generate the headlines and publicity that the lost hard drives did.

But now the lab is "on the comeback trail," with eight principles guiding its effort:

- Treat employees as the most important asset.
- Restore public trust.
- Ensure a safe and secure workplace.
- Emphasize excellence in science and engineering.
- Draw strength from the lab's heritage (that is, from the academic freedom it has always enjoyed as a mem-

ber of the University of California system).

- Focus on intellectual integrity.
- Expect performance discipline; that is, deliver what is promised, when it was promised, at or under the promised cost.
- Appreciate and protect the environment.

## New Technologies

### WEBSITES

You know you have entered the Internet Age when a paper consists of nothing more than a presentation of various websites where information on new DOE D&D technologies can be found. Steve Bossart, from the DOE's National Energy Technology Center, gave such a presentation Monday afternoon at a session on new D&D technologies. To be fair, it was a very informative presentation, with slides showing home pages while Bossart talked about site content.

The fact that such a vast compendium of information is available at the click of a mouse rather than through hours of tedious library research demonstrates just what a wonderful tool the Internet can be for the cleanup community.

### ENTOMBMENT RECONSIDERED

Donald Vernon, from the Idaho National Engineering and Environmental Laboratory (INEEL), gave two papers in the same session on the con-

cept of entombment as a D&D alternative. It is time, he said, to reconsider entombment as a D&D option. Decades ago, three reactors—the Hallam Nuclear Power Facility, the Piqua Nuclear Power Facility, and the Boiling Nuclear Superheater Power Station—were entombed, and 30 years of monitoring has proven that entombment can successfully contain radionuclide releases.

This past July, the U.S. Nuclear Regulatory Commission directed its staff to proceed with a rulemaking on the entombment option for commercial reactors, and the DOE is actively considering entombment as an option at Hanford for dealing with the canyons and perhaps some of the

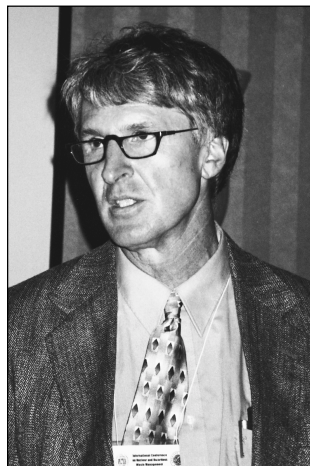
old reactors. It is also considering entombment for three INEEL reactors, Vernon said. To that end, the DOE is conducting further research into the technology to help it make a better informed decision. Key questions, Vernon said, include how to ensure long-term waste containment, how to ensure worker safety and cost savings, and how to ensure public acceptance. Also, he noted, entombment would have to be demonstrated as a superior option—if a technology is only as good as the baseline, it's not going to be accepted or used very much, he explained.

If entombment is eventually adopted as an option for INEEL, Vernon said, such work would not begin for at least five years—it would take two years to remove the fuel and three more for other activities before entombment work could begin.

### VOLUME REDUCTION

Jerry Christian, a scientific fellow at INEEL, discussed a concept being developed at INEEL to volume-reduce greater-than-Class-C (GTCC) contaminated stainless steel. The commercial nuclear industry currently has some 2000 cubic meters of GTCC stainless steel waste, which the industry plans to handle with the spent fuel, although there is no absolute certainty that the proposed Yucca Mountain spent-fuel repository will accept such material. In addition, the DOE has some 8000 m<sup>3</sup> of GTCC stainless steel waste, and the Navy has an unknown inventory of this material. For these latter two groups of steel, there is currently no disposal plan.

The INEEL process, which Christian could not describe in technical detail because of proprietary concerns, would reduce the volume of GTCC steel by a factor of 12 (the process is limited to the factor of 12 because one-twelfth of the volume of stainless steel is nickel). The process would dissolve the steel in a suitable solvent (the identity of which was not revealed). One cubic meter of steel would result in 0.09 m<sup>3</sup> of GTCC metal (nickel) and 1.6 m<sup>3</sup> of Class B or A low-level waste. Thus, he said, disposition costs could be decreased by at least \$1 million/m<sup>3</sup> of stainless steel. And, he continued, if the recovered nickel could be used to fabricate advanced alloy spent-fuel disposal containers, GTCC would be eliminated entirely.



Donald Vernon, INEEL

The current DOE and commercial inventory could support four processing plants, each processing 500 tons/year of activated steel, for the next 40 years, Christian concluded. In response to a question on getting the GTCC from its point of origin to the processing plant and the costs associated with that, Christian noted that such issues have not yet been considered.

#### *DUO<sub>2</sub> IN SPENT-FUEL WASTE PACKAGES*

At a Tuesday morning session, Charles Forsberg, from ORNL, discussed the use of depleted uranium dioxide (DUO<sub>2</sub>) in repository spent-fuel waste packages. The DUO<sub>2</sub> can be used in a granular form as fill material, filling up to 65 percent of the void space in a spent-fuel package, and as a structural component, if it is combined with steel to form a cermet composite.

Using depleted uranium in this way has the following effects:

- Reduces potential for long-term criticality.
- Reduces radionuclide release rate from the spent-fuel package.
- Provides waste package shielding.
- Disposes of excess depleted uranium.

Forsberg estimated that using DUO<sub>2</sub> strictly as fill material would consume about 3.5 tons of DU per ton of spent nuclear fuel, while using the DUO<sub>2</sub> as both fill and as a structural material (in, perhaps, the cask basket and as an additional inner layer in the cask) would use about 5 tons of DU per ton of spent fuel. The upper limit of fill and cermet use, Forsberg estimated, would be about 7 tons of DU per ton of spent fuel, because the resulting waste package would weigh some 125 tons, about the upper limit of

what anyone would want to handle.

In the end, he concluded, there are multiple benefits to using the DUO<sub>2</sub> in the spent-fuel package, but the proposal needs much more study, since it changes the performance of the waste package, thus affecting repository performance and licensing bases.

### **Around the World**

#### *THE WIPP INTERNATIONAL PROGRAM*

In a session on international programs and activities, Mark Matthews, from the DOE Carlsbad Area Office, outlined the efforts the DOE is making to develop international programs centered on the WIPP repository, the first deep geologic repository to operate in the world.

Matthews noted that the DOE is currently focusing its efforts on identifying and pursuing foreign-based collaborations and partnerships, identifying and pursuing Carlsbad-based collaborations and partnerships, and developing an international outreach program. Obstacles to these efforts, he said, come from the "limited knowledge" of the know-how and expertise that exist at WIPP and on the fact that very few countries are

pursuing rock salt as a disposal medium (most countries are looking at igneous or crystalline rock or clay).

However, Matthews stated, the processes that the DOE has gone through in developing and opening the WIPP facility are the same processes that must be gone through for any repository, in any medium. These include site selection, characterization, developing the

safety case, working with regulators, and actually opening the facility. Also, he continued, the scientific phenomena (flow rates, etc.) are the same as well.

To help develop the WIPP international program, the DOE is conducting cooperative programs with other national organizations (currently working with organizations in Switzerland, Sweden, Germany, Spain, Canada, and Japan), as well as with international organizations (the International Atomic Energy Agency; the European Union; the Organization for Economic Cooperation and Development/Nuclear Energy Agency; the United Nations Educational, Scientific, and Cultural Organization; etc.). Areas of scientific research being conducted include waste characterization, upscaling data and models, and dual porosity flow, among others.

Also, Matthews said, there are lessons learned to share. "We made some mistakes," and the DOE hopes that other organizations can learn from these mistakes.

#### *EFFORTS IN JAPAN*

Kuniaki Takahashi, from the Japan Nuclear Cycle Development Institute (JNC), discussed the efforts JNC is making to develop a waste management program for handling its LLW, the majority of which is contaminated with transuranics or uranium. Because Japan currently has no strategy for disposing of these wastes, JNC, which operates fuel cycle facilities as well as a pair of experimental reactors, has been using volume reduction and interim storage to handle them. Currently, there are some 154 000 drums of such LLW accumulated in JNC stores.

Studies on a waste disposal strategy began in 1999, looking at such issues as disposal options, costs, and environmental impacts. A final disposal mechanism is scheduled to be proposed at the end of March 1991. After that, the proposal will be modified as needed and eventually implemented, Takahashi stated.

### **D&D&D**

Several sessions covered progress in various deactivation, decontamination, and decommissioning (D&D&D) projects.

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#### IOWA STATE

Mark Granus, of Duke Engineering & Services, described the decommissioning and demolition of the research reactor at Iowa State University. The reactor, a 10-kW Argonaut-type unit built in 1959, was located in a building constructed in the 1930s as an agronomy laboratory, which had done a lot of pesticide work.

The contract for the reactor D&D was awarded in July 1998, the D&D plan was submitted in January 1999, and the plan was accepted in May 2000. D&D began June 12 and was completed August 4.

According to Granus, the characterization had revealed that the reactor was relatively clean (because it was small and "well run" while it was operating, he noted), with a maximum dose rate of about 8 mR/hr. There was some asbestos on the reactor coolant pipes, and there was lead paint as well. In fact, he said, they missed some of the lead paint in the characterization, a lesson learned.

One surprise was the activity of the graphite. As it was removed, it was segregated according to activity, since the contractor planned to free-release some. But in the end, about half of the graphite had to be shipped out as LLW.

Another surprise was the compression strength of the concrete in the bioshield. The actual compression strength was much greater than the blueprints had indicated, and the tools were "just bouncing off the walls," Granus said. Workers had to retool and try again. In addition, they used expansive grout poured down boreholes, which caused cracking and enabled them to cut up the concrete. In the end, the bioshield yielded some 600 cubic feet of concrete, or 45 000 pounds.

One other finding was europium-152-contaminated dirt found in a small subgrade area under the reactor. But the good news was that there

was no pesticide contamination in the area.

In the end, the operation was completed 18 days ahead of schedule and within the approximately \$1 million budget.

#### GEORGIA TECH

Similar surprises were found during the D&D of the 5-MW Georgia Tech Research Reactor, reported Steve Markse, from CH2M Hill, at a Wednesday session. Among the lessons learned listed, Markse stressed one point: "Characterize, characterize, characterize." As at the Iowa reactor, activation in the graphite was more extensive than expected (europium and cobalt contamination), as was activation in the concrete. Also, again as at Iowa, the concrete (this time an iron-aggregate concrete) was much denser than expected. Much of this could have been learned through more extensive characterization, Markse said. Instead, these factors have delayed project completion by several months. The concrete alone resulted in a 14-week schedule slip.

Other lessons learned from the project, Markse reported, included the fact that containment tents, while preventing the spread of contamination, also cause ventilation and heating problems; that any accumulated water can be a haven for tritium; that drawings often will not accurately reflect the as-built condition of the plant; and that lump sum fixed-price contracts will not work where characterization is not complete.

The project is expected to be completed by the end of this year, Markse said, and the report to the NRC will be submitted in January 2001. The total cost will come in at around \$6.7 million, about \$1 million over the original cost estimate.

#### BIG ROCK

Scott Dam, from BNFL Inc., re-

ported on the large-component removal project at Big Rock Point. So far, he said, they have conducted core borings of the primary bioshield to determine activation and have removed the 18 reactor upper grid bars (the GTCC component of the reactor vessel), which have been placed in nine canisters for eventual storage in a dry storage container (identical to a spent-fuel container). They are currently creating a new construction opening in the reactor sphere.

The reactor vessel is scheduled to be shipped to Barnwell in the fall of 2002. The container being designed for the vessel is just slightly more than 13 ft in diameter, so it should be able to be shipped by rail. With the GTCC components removed, the rest of the internals will remain in the vessel when it is shipped to Barnwell.

## Stakeholder Involvement

The value of stakeholder involvement—and of advisory committees or advisory boards—was the topic of a Wednesday morning session, which also covered long-term stewardship issues.

#### IN "SLEEPY HOLLOW"

Mike Cavanaugh, communications manager at Connecticut Yankee (CY),



*Hugh Curley, Community Decommissioning Advisory Committee*

noted that the company has "done a lot of things differently as a result of interaction" with the plant's Community Decommissioning Advisory Committee (CDAC). Hugh Curley, a member of that committee, joined Cavanaugh in a team presentation on the history and activities of the CDAC. It's ironic, Curley noted, that the community around CY was "empowered only when the plant was depowered."

One issue that has especially "stressed out" the community (which Cavanaugh described as "Sleepy Hollow," with roads featuring "mailbox, mailbox, mailbox, nuclear power plant, mailbox") has been that of dry cask storage. Even though the proposed site for the storage pad is in the center of the CY property, hid-

den from view, just the idea of change has been stressing the neighbors, Cavanaugh said. This issue is just one of the challenges for the CDAC.

The 15-member CDAC meets monthly. Its mission, Curley said, is communications, not control. They work to ensure that complete information about the CY decommissioning activities is made available to all community residents. For example, the committee was instrumental in getting CY to open an Internet web page and to put its newsletter on that page.

The committee costs some \$20 000/year to support, Cavanaugh stated, which covers some travel, paperwork, cookies for meetings, etc. "Don't underestimate the value of cookies," Cavanaugh quipped.

#### *A MATTER OF TIMING*

Getting the timing right for stakeholder involvement to actually do some good was the subject of another team presentation, this by Joseph Haymore, of Bechtel Jacobs, and Barbara Brower, of the DOE. To aid in this project, the DOE developed what Haymore and Brower called a "bubble chart," which integrated major events, reporting

deadlines, regulator relationships, and budget cycle events (putting each of these factors into a "bubble" on a chart), and then they looked for appropriate times for stakeholder input. As a result, the DOE was able to reduce the number of stakeholder meetings it held, allowing interested parties more time to respond to proposals and provide input to plans. It was a win-win situation for everyone.

#### *A WISH LIST*

At the Oak Ridge site in Tennessee (as at several other of its major cleanup sites), the DOE does not expect to be able to clean up the entire site to free-release levels. Therefore, some level of long-term stewardship is going to be required.

Lorene Sigal, from the Oak Ridge Site Specific Advisory Board (SSAB), noted work the board has done in this area, including developing a mini-curriculum on stewardship for high schools to get young people involved in the issue. "This will be their legacy, after all, and we want to get them involved early," she stated.



*Lorene Sigal, Oak Ridge Site Specific Advisory Board*

The stakeholders also want stewardship requirements written into the Records of Decisions (RODs), since unless these requirements are specifically spelled out in the RODs, they are not enforceable. In addition, Sigal expressed concern that the people running the stewardship office at DOE headquarters are all political appointees. Consequently, on the SSAB wish list is a national DOE policy on stewardship, assured funding for stewardship, and a DOE Headquarters infrastructure to support stewardship activities.—*Nancy J. Zacha, Editor* ■