

ANS ANNUAL MEETING

Nuclear arrives on Main Street

IF THE OPTIMISM displayed during the opening plenary session of the American Nuclear Society's Annual Meeting is any indication, the corner has been turned regarding the building of new nuclear plants in the United States—from *if* it will happen to *when*. The meeting, held June 8–12 at the Disneyland Hotel, in Anaheim, Calif., attracted more than 1500 attendees.

The theme of the meeting, “Nuclear Science and Technology: Now Arriving on Main Street,” was echoed by the opening plenary speakers, who agreed that nuclear power now seems to be an accepted part of American society. In his welcoming remarks, ANS President Don Hintz observed that the mainstream media no longer cover



Hintz

nuclear as a novelty. As an example he cited a recent edition of *Wired* magazine, which told its readers, “Face it, nukes are the most climate-friendly industrial-scale form of energy.” The magazine then went on to challenge its readers to

“embrace the atom,” Hintz said. Hintz also highlighted a recent event at a packed auditorium in Andrews County, Texas, where local citizens cheered as their state regulators approved a nuclear waste disposal site in their community. (The site, operated by Waste Control Specialists, was approved to accept radioactive by-product material.) Hintz quoted Rep. Mike Conaway (R., Tex.), in whose district the site is located: “In order to supply America’s electricity needs over the next 100 years, we’re going to have to overcome some irrational hesitation about the nuclear power industry.” Hintz reminded ANS members that they themselves are a “crucial element to overcoming irrational hesitation about nuclear technologies of all kinds.”

The plenary’s first scheduled speaker, former Louisiana Sen. J. Bennett Johnston, currently head of Johnston and Associates, LLC, said “The planets are finally coming into alignment for nuclear energy.” Johnston recalled that when he first became a member of the U.S. Senate in the 1970s, the United States was undergoing its first large nuclear

Meeting session coverage:

- ◆ *The momentum for nuclear power expansion*
- ◆ *New reactor planning in the U.S.*
- ◆ *Spent fuel transportation issues*
- ◆ *License renewal beyond 60 years*
- ◆ *Workforce development initiatives*

build. “Remember,” he said, “we’d just had the Arab oil embargo, and President Nixon declared ‘Project Independence,’ which meant that by 1985 we were going to be free of oil imports.”

The circumstances of the era helped to promote the ongoing nuclear program, he noted, and the United States was on its way to getting 20 percent of its electricity from nuclear. Within a few years, American leadership in nuclear technology was unparalleled and unchallenged. “It was a heady time in the nuclear industry,” he said. “We had 1 million workers during the 1970s either directly or indirectly employed in the United States in nuclear energy.”

But something happened on the way to energy independence, and nuclear energy got derailed. The main causes, he said, were cheap natural gas, the accident at Three Mile Island, and the environmental community’s assuring the public that nuclear energy was not necessary for clean air. For three decades afterward, the nuclear industry atrophied. “We went from 1 million employees down to the current estimate of about 100 000,” he said.

Johnston then elaborated on how he sees the planets aligning. The first “planet,” he



Keith Arntsen

Johnston

said, is global warming and the need to deal with the vast accumulations of carbon dioxide in the atmosphere. The second planet is the rising cost of other fuels to produce energy, making nuclear more competitive. The third planet, which still needs to come into alignment, is the capital that is needed to build new plants, each of which is priced at billions of dollars. For utility executives to decide in favor of building one, he said, means “betting the company.”

Johnston said that utility executives have a high degree of confidence in the new reactor designs, but there is uncertainty about the regulatory process, the construction times, and the inflation costs, which is why the Department of Energy’s proposed loan guarantee program is needed. That program would serve as “a bridge between now and the time we build our first three or four reactors,” he said, adding that if three or four new reactors are built, the costs would be proven and “the rest of them will follow along without any difficulty.”

In conclusion, Johnston said, “We cannot solve our CO₂ problems without massive amounts of nuclear power. Now, that represents an unparalleled opportunity to the American nuclear industry. If America fails to make the necessary decisions to implement that policy, then I am virtually certain we are going to have big electricity shortages in this country. That represents a great danger to the American way of life.”

A buoyant attitude

Peter Lyons, a commissioner on the Nuclear Regulatory Commission, remarked that the meeting's theme—"Now Arriving on Main Street"—conveyed a buoyant attitude that is evident throughout the nuclear industry, both in the United States and internationally.



Lyons

The meeting's location at the Disneyland Hotel prompted him to think about the people who built neighboring Disneyland, "and about how committed those designers and engineers were to creating something that the public not only would value, but would feel extremely safe in using."

Lyons compared Disneyland to the nuclear energy enterprise in that for both, their

success and their existence is dependent on an unwavering commitment to safety. "Such a commitment, resulting in an excellent performance record on safety, is what generates public trust," he said. "Optimism in the arrival of a new generation of nuclear science and technology comes with the continued promise of safety that we must never forget and must always achieve."

Lyons listed challenges facing the industry in the lead-up to building new plants, and how those challenges will best be addressed. He noted the following:

- Ensure that applications submitted to the NRC for design certification and licenses for new plants are fully complete and of high quality. "This should also help bring regulatory predictability to our technical review schedules," he said.

- Standardization of new plants in design, licensing, construction, and operation will bring improved regulatory consistency and effectiveness, as well as life-cycle efficien-

cies, for the NRC and its licensees. "This will be particularly true in the more technically complex areas such as digital I&C and safety systems," he said.

- The necessary quality workforce and the educational infrastructure must be built up to maintain the new plants and the existing fleet.

- Research will continue to be needed to benchmark the validity of computer simulation codes that are used to demonstrate that the NRC's safety requirements are met.

- Licensees will have to ensure oversight of their contractors and of supply-chain components and parts for new construction. Contractors who do not understand the requirements of quality nuclear materials could be a problem in nuclear's successful comeback, he said.

Taking the risk

The plenary's third speaker, Charles "Chip" Pardee, agreed with Senator Johnston's comment about "betting the company." Pardee, senior vice president and chief nuclear officer of Exelon Nuclear, said that



Pardee

Johnston was "absolutely right about the risk that companies such as Exelon are taking in the pursuit of nuclear power." As an example, the book value of Exelon—"which is by many measures the largest integrated utility in the United States"—is about \$17 billion. The company is currently pursuing a combined construction and operating license (COL) for a new two-unit plant in Texas that has a price tag of \$12 billion to \$13 billion, which is a moving target. "Simple math will tell you that [saying] 'betting the company' is not being melodramatic," Pardee said. These are very serious propositions for the companies such as mine that are contemplating nuclear."

Pardee noted that by his count, there are 32 possible new reactors that are in the proposal stage, have letters of intent, or have COL applications being reviewed by the NRC. "As you can well imagine, these represent a significant challenge to the industry—to all of us—if we are going to be successful," he said. "It is imperative that however big the first wave is, we do this correctly."

He noted that the industry is coordinated on standardized plant designs for the new reactors, "right down to the water cooler in the control room," the only exceptions being those things that are tailored specifically to a site, such as heat sinks. The benefits of standardized designs have already been proven by the U.S. military and by foreign countries that have built new plants, he said.

Continued

Smyth Award to Diaz: "We're the good guys!"

At the end of the opening plenary session, Marvin Fertel, executive vice president and chief nuclear officer of the Nuclear Energy Institute, presented the Henry



Diaz

DeWolf Smyth Nuclear Statesman Award to Nils Diaz, former NRC commissioner and chairman. The award, jointly established in 1972 by ANS and NEI's predecessor organization, the Atomic Industrial Forum, recognizes statesmanlike contributions to the many aspects of nuclear science and technology. The 2008 award cited Diaz for his exemplary leadership, which was instrumental in reducing the uncertainty surrounding nuclear power plant licensing and helped the industry as it approached and passed many important milestones, including license renewal for existing plants, the implementation of 10CFR52, and new plant licensing under 10CFR52. The depth of respect for Diaz worldwide was duly noted.

Diaz, an ANS Fellow and member since 1969, served on the NRC from 1996 to 2006, and was appointed chairman in 2003. Prior to his appointment to the NRC, he was a professor of nuclear engineering sciences at the University of Florida, director of the Innovative Nuclear Space Power Institute (a national consortium of industries, universities, and national laboratories), and president and principal engineer of Florida Nuclear Associates, Inc.

Diaz gave those in attendance at the session their shot of inspiration for the day—or maybe even for the week—with his acceptance speech. He said that he felt privileged, honored, and humbled to be the recipient of the award, which, he noted, is particularly important because it is from his colleagues and peers. He dedicated the award to his wife, Zeña, who, he said, "has always been with me, who has cheered me on. She is the wind beneath my wings."

This is "an important time in the history of the world," he continued. "What is going to happen to us?" he asked, regarding energy supply and quality of life. "Others want our quality of life—and they deserve it!" he declared, noting that abundant supplies of electricity are required to achieve that quality of life.

It is "time to take a different tack," Diaz proclaimed. "We need to be more aggressive; we need people to need nuclear. We're the good guys," he continued, emphasizing that this is something those in the industry have to believe. "It's time to put passion and emotion in what we have to do," he added. "I see the problems, and nothing out there tells me we can't do this."

By making the case for nuclear, Diaz concluded, "we will make a better world for us and our children."—*R.M. and B.T.*

Turning to politics, Pardee said that the pending change in the U.S. administration should not be the hindrance to the nuclear industry that some expect it to be. But, he said, “it still introduces a number of potentials that could slow down or in some other means impede timely development of new nuclear generating stations.”

Regarding the cost of fuel, Pardee said that nuclear has a clear and sustained production advantage over fossil fuels. “The cost of uranium enrichment is simply not that great a percentage of nuclear plant operations,” he said. If the cost of uranium doubles, production costs for nuclear plants would go up by less than 10 percent. By comparison, the cost of electricity from a natural gas-fired plant would double if the cost of gas doubled. “So, not only do we

Selby, director of nondestructive examination for the Electric Power Research Institute (EPRI). Part of a recent report issued by the Department of Energy’s Energy Information Administration, the forecasts show that electricity consumption in the United States will increase



Selby

by 30 percent by 2030. “That is huge,” Selby said. “That is several large states’ worth of current consumption added to our consuming right now.”

The EIA report also predicts that CO₂ emissions in the United States will increase by 16 percent by 2030, which is why EPRI performed its “Prism” analysis. Prism, according to Selby, is an effort to assess which technologies will be required to slow, stop, and reverse the increase in CO₂ emissions forecast by the EIA. The Prism analysis shows “what *can* be done, not what *will* be done,” he said.

The technologies addressed in Prism are energy efficiency (demand reduction), renewables, nuclear, advanced coal, carbon capture and sequestration, plug-in hybrid electric vehicles, and distributed energy resources. For example, for renewables, the goal is to have 100 GWe by 2030; for nuclear, 64 GWe by 2030; and for plug-in vehicles, 10 percent of new light-duty vehicle sales is the target for 2017, and 33 percent by 2030.

Selby said that many factors affect a utility’s decision to build new nuclear plants, among them the skyrocketing cost of commodities. Steel prices have risen 60 percent since 2003, copper by 300 percent between 2003 and 2006, and cement by 30 percent between 2003 and 2006. There is also the fact that nuclear steam supply system vendors are “rusty,” he said, and that there is now increased global competition for supply chain items such as forgings, infrastructure needs, and skilled labor. Still, he said, there are powerful drivers propelling decisions for new units, including their sustained high outputs and low operating costs, the probable carbon tax on fossil-fuel units, and government incentives.

Selby said that the initial deployment of advanced light-water reactors (ALWR) should happen in the United States right after 2015, and a prototype high-temperature gas reactor (HTGR) should be operational in the 2020 time frame. About 24 GWe of

new ALWRs should be on line in 2020, HTGRs should be commercially available in about 2025, and about 64 GWe of new ALWRs should be operating by 2030. In addition to building new plants, he said that the existing nuclear fleet should run for at least 80-year lifetimes.

Getting the word out

In keeping with the “Main Street” theme of the meeting, the President’s Special Session: Getting the Word Out, was conducted as a town hall–style meeting. ANS President Don Hintz noted the desire to keep the session informal, with members of the audience invited to step up to the microphones to ask questions and make comments. Sitting on the panel were incoming 2008–2009 ANS president Bill Burchill, newly elected ANS vice president/president-elect Thomas Sanders, past ANS president Harold McFarlane (2006–2007), and ANS treasurer Eric Loewen.

Burchill, then vice president of ANS, said that the session was “kind of an experiment.” He provided an overview of his activities over the past year as vice president/president-elect, including visiting local sections, presenting charters to two new student sections, attending and speaking at the 2008 student conference, making two visits to ANS headquarters, and making appointments to standing committees.

Early comments from the audience centered on ANS policy statements. The first commenter noted that ANS has not issued a statement on global warming. Burchill concurred that this was correct, and said that there is a statement on the environmental attributes of nuclear, but not one specifically on global warming. Larry Foulke, chairman of the Public Policy Committee, ANS past president (2003–2004),



Foulke

and adjunct professor in the Department of Mechanical Engineering and Materials Science at the University of Pittsburgh, said that because ANS is not an authority on meteorological conditions, it should not issue a statement on global warming, but will be better served to continue to tout its environmental benignity.

Jim Tulenko, another ANS past president (2004–2005) and a professor in the Department of Nuclear and Radiological Engineering at the University of Florida, urged

A labor crisis does not yet exist, but it could develop as the nuclear industry competes with the oil and gas industries for skilled workers.

have a production cost advantage with nuclear, but we tend to be a stabilizing factor in how much the ratepayers will have to pay for that electricity. And that is a major factor these days,” he said.

An area of concern highlighted by Pardee is the nuclear labor force, which he said would continue to be a challenge. For young people, working in the trades, even the skilled trades, “is not a popular job or career opportunity these days,” he said. A labor crisis does not yet exist, but it could develop as the nuclear industry competes with the oil and gas industries for skilled workers. And while a source of these workers is being pursued aggressively by the industry and educational institutions, it is not yet assured, he said.

Pardee also endorsed comments made by Johnston about whether the United States is moving fast enough to address energy problems before they become a crisis. The crisis could result not only in skyrocketing electric bills, but also in more serious consequences such as brownouts and deficient investment in new generating capacity, driven by a lack of confidence that the electrical infrastructure would be able to support the new capacity. The challenge, he said, is whether these issues can be dealt with in a timely fashion to be able to avoid a crisis.

Looking into the future

The possibility of a pending crisis was supported by forecasts presented by Greg

the backing of spent-fuel reprocessing, a topic about which “Congress is confused,” he said. He suggested that ANS members use the term “recycling” instead. Foulke, in his role as Public Policy Committee chair,



Tulegenko

about nuclear.

Lon Paulson, of GE-Hitachi Nuclear Energy, suggested that ANS could deliver a powerful message to the public and to Congress if it could say that each baseload nuclear plant offsets oil imports “by X amount.” If ANS could get the message across, he said, the momentum of the nuclear renaissance would continue. Related to this message, Foulke said that a policy statement specifically on reducing oil imports was to go before the ANS Board of Directors at its meeting that week.

Following up on a comment from the floor that the term “emission-free” should be used regularly as a prefix to “nuclear power,” Hintz said that in his speaking appearances, he does point out that nuclear is emission-free and that he also supports renewable sources of energy. The public, he added, is misled into thinking that the “niche” sources can do the big job of fulfilling large electricity demand, and don’t realize that nuclear *can* do it.

Ruth Weiner, of Sandia National Laboratories, noted the importance of educating and informing the policymakers. “People believe what they want to believe,” she said. It’s important for members to get out to nuclear-related meetings. The anti-nuclear people are there, she pointed out, and the pronuclear people are not.



Weiner

She said that she has seen representatives of state and national antinuclear groups, “one after another,” proclaim the evils of whatever nuclear process or activity is being discussed. Getting up and providing the other, positive side “is not comfortable,” she said, but is needed. Burchill added that op-ed pieces are a good way to reach out with a positive message, too, and Hintz noted that individuals can provide credibility, perhaps more than an organization or utility can with their vested interest in the positive message.

Another commenter from the floor observed that a change in tactics is needed, and that “the way we do business” needs to be revised. He asked where the pronukes are on Capitol Hill. ANS Washington Representative Craig Piercy responded by

pointing out that ANS’s biggest value is in its members, and they need to explain that nuclear science and technology have the ability to solve some of our biggest problems. He encouraged ANS members to join and participate in the Nuclear Advocacy Network, a grassroots advocacy program designed to enable individuals to voice their support of issues important to the nuclear renaissance. “The power lies with you,” he said.

Adding to the discussion of getting the word to legislators, Andy Kadak, ANS past president (1999–2000) and professor of the practice in nuclear engineering at the Massachusetts Institute of Technology, urged



Kadak

members to visit their congressional representatives and to “find a better way to deliver the message” about nuclear. Another participant added that “we have to get the wording right.”

Lisa Stiles, project manager of strategic staffing and knowledge management at Dominion Nuclear, noted the problem that ANS members—particularly younger members—who work for utilities have in getting their employers to fund their attendance at ANS meetings. Related to this, she asked about ANS’s consideration of having just one large national meeting a year so that more young people could attend.



Stiles

Burchill noted that this subject has been deliberated “nearly every year,” and the decision always is to continue to hold two meetings. “It’s a fair question,” he said, “and will be looked at again.”

John McGaha, chairman of the Special Committee on ANS/Utility Integration and president of planning, development, and oversight for Entergy Nuclear, addressed the issue of utility funding of employees’ attendance at ANS meetings. One of the

problems, he noted, is competition with attendance at other organizations’ meetings. It all comes down to a few simple questions, he said: What is the value to them of attending ANS meetings? Are the meetings relevant to them? What can they get out of

The public is misled into thinking that the “niche” sources can do the big job of fulfilling large electricity demand, and don’t realize that nuclear can do it.

the meetings? This subject has been among the committee’s focus areas, he added.

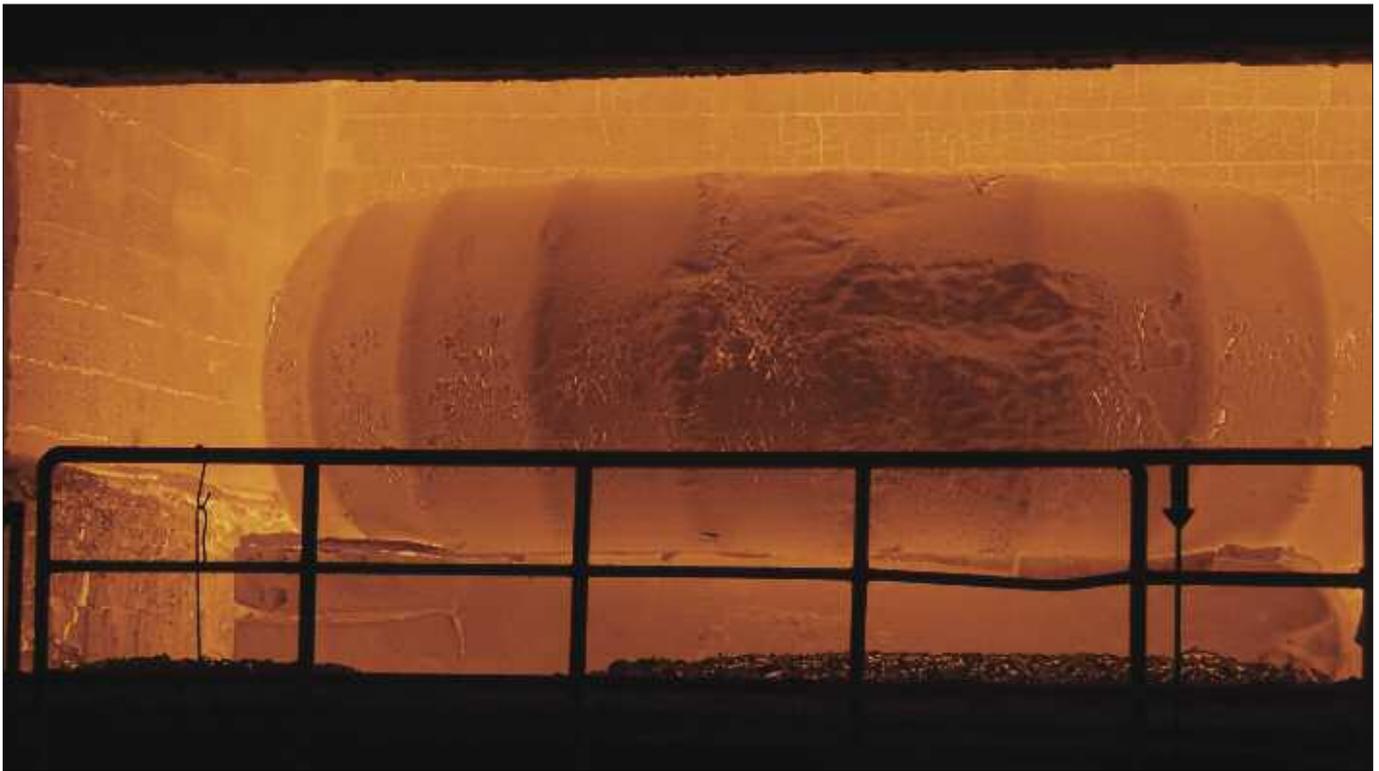
As the discussion wound down, Foulke made the point that in speaking to the public, care should be taken regarding *how* “emission-free” is described as it relates to nuclear power, because the fuel cycle has emissions. Otherwise, he said, “this will come back to bite us.”

Hintz also encouraged attendees to be more active, and to be accurate, but added, “We’re *so* careful about the message we put out, we get out *no* message.”

Committee on New Construction

The ANS Operations and Power Division’s Committee on New Construction held what has become a fixture at ANS national meetings—a panel discussion built around progress reports on new reactor projects. ANS Past President Ted Quinn (1998–1999), chairing the session as he has in the past, reminded the audience that new reactor projects can stir enthusiasm at the beginning but lead to disillusionment as real-world work builds up, by showing a slide with Adm. Hyman Rickover’s famous comparison of a “paper reactor” (one that has never actually been built) with a real reactor. In this sardonic view, the paper reactor always looks better because it hasn’t yet gone through the design modifications, compromises, delays, and cost hikes that are associated with real reactors.

Carter “Buzz” Savage, deputy director of technology for the Global Nuclear Energy Partnership at the Department of Energy, filling in for the DOE’s Tom Miller, delivered the latter’s presentation on the agency’s Nuclear Power 2010 program. The NP2010 work these days follows on the applications already submitted for combined COLs for Bellefonte and North Anna, and the ongoing design certification work for Westinghouse’s AP1000 pressurized water reactor and GE-Hitachi’s ESBWR. Savage clarified that although the NuStart consortium is receiving



The forging for the bottom of an ESBWR reactor vessel, intended for North Anna-3

NP2010 cost-sharing support for the Bellefonte COL application for two AP1000s, the DOE is not supporting NuStart's application for an ESBWR at Grand Gulf. Dominion's application for North Anna-3 is the only ESBWR COL application on which the DOE is sharing costs.

Regarding design certification, Savage said that Revision 5 of the ESBWR design control document (DCD)—intended to make the design conform to the COL applications—was submitted to the NRC on June 1. Revision 16 of the AP1000 DCD, which was submitted last year, was also developed to conform with COL applications and has prompted a substantial review effort by the NRC of a design that had already been certified. Savage noted that Westinghouse will submit Revision 17 late this year, adding that it would include only "small changes."

Savage also said that the South Korean firm Doosan has received contracts from Westinghouse to fabricate major components for the four AP1000s to be built in China, and also for the four covered under the EPC contracts signed for the Vogtle and Summer projects in the United States. Despite the EPC contracts, he said, there would not be a firm commitment to build Vogtle or Summer until sometime next year at the earliest.

David Matthews, director of the division of new reactor licensing in the NRC's Office of New Reactors, presented an update on the progress of licensing and design certification as of early June. He showed a slide indicating that FPL Energy planned to use the AP1000 as the reactor model for

Turkey Point-6 and -7, and he later said in response to a question from *NN* that this has been stated to the agency by FPL (which plans to apply for a COL in 2009). At the time of Matthews' presentation, however, neither FPL nor Westinghouse had announced a reactor choice (*NN*, July 2008, p. 67). Matthews has done this before; at the committee's session at the ANS Annual Meeting in Boston, in June 2007, he revealed that PPL Susquehanna would join with UniStar Nuclear to apply for a COL for a U.S. EPR at the Susquehanna site in Pennsylvania, in advance of official announcements by PPL or UniStar.

Matthews, as he and other NRC officials have done before, said that ideally, under 10 CFR Part 52, a COL applicant would already have an early site permit (ESP) and would refer to a certified reactor design. This is not the case with any of the applicants, however, especially because none of the referenced reactor models has been completely certified. He noted that COL applications are undergoing technical reviews at the NRC at the same time as reviews of the designs. He said that for the first time, however, some agency officials are seeing from experience to date that the concurrent design and COL reviews "may prove to be an efficiency," but that whether this is really true is not yet clear. He also restated the agency's earlier position that applications



Matthews

received after September 30, the end of fiscal year 2008, may be processed more slowly than those received before then because of expected NRC resource limits in FY 2009. For all applications, he said, pending issues such as digital instrumentation and controls are having "schedule implications," but there will be no further changes to 10 CFR Part 52. Also lingering as issues in several applications are sump strainers and site hydrology and geology.

One COL applicant that does have an ESP is Dominion, for North Anna-3. Dominion's vice president of nuclear development, Eugene Grecheck, reported that the ESP process had revealed to the company the need for cooling towers to be built for the new reactor at the site.



Grecheck

The COL application has now been opened to requests for a hearing, and Grecheck said he believes that several of the contentions filed by a petitioner, the Blue Ridge Environmental Defense League, will be rendered moot by the points already established in the ESP. He said that a key date will be the issuance of the draft environmental impact statement (EIS) for the COL, scheduled for this December. Beyond that, he projected that Dominion could begin site separation (closing the Unit 3 property off from the two operating reactors) next year, begin site preparation in 2010, receive the COL in 2011, begin safety-related con-

struction in 2012, and start up the reactor in 2016 or 2017. Before committing to build, however, Dominion would need to see the completion of engineering work, an agreement on commercial terms, financing put in place, approval by Virginia regulators, and approval by the company's board of directors.

Grecheck stressed the importance of the completion of first-of-a-kind engineering, which is being cost-shared for North Anna-3 under NP2010. Only about half of the necessary expenditures have been made, and so the pace of the project depends on the extent of federal funding for NP2010 in the next few years. Despite the uncertainties, and the limits Dominion has placed on its current commitment to the project, Grecheck showed a slide indicating how far the project has already come: a photo from Japan Steel Works of the forging in progress for the bottom of the reactor vessel of what could one day be North Anna-3.

Greg Gibson, manager of regulatory affairs for STP Nuclear Operating Company (STPNOC) and, like Grecheck and Matthews, a frequent participant in the various installments of this session, reported

Despite about \$2.5 billion already having been spent on new-build activities, the renaissance will not go ahead if there are not the people to carry it through.

on his company's plans to build two ABWRs at the South Texas Project site. He said that he still believes that STPNOC's will be the first new reactors to be built and operated in the United States, despite the decision to use a Toshiba-designed ABWR, which differs from the GE-Hitachi model that holds the NRC design certification. STPNOC will resubmit the COL application during the third quarter to reflect the Toshiba model. According to Gibson, the NRC's requests for additional information on the EIS reviews that are still under way should be resolved by the end of the second quarter. Even so, he said, STPNOC does not have access to an unlimited number of hydrologists and design engineers, and so both STPNOC and the NRC are facing constraints on their resources.

The final presentation was made by José Reyes, chief technical officer of NuScale Power Inc., on the company's proposed 45-MWe "grid-appropriate" light-water reactor based on technology transferred from Oregon State University (with which Reyes

has been affiliated) and developed in partnership with Kiewit Construction. Reyes noted, among other things, that this reactor could be manufactured without ultra-heavy forgings, and therefore without competition for the long-range availability of Japan Steel Works. He said that the company would meet with the NRC in July for planning prior to submitting an application for design certification. (Separately, NRC officials have questioned the need for grid-appropriate reactors in the United States, in the absence of customers' expressing an interest in them.)



Reyes

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The employment pipeline

Introducing the panel session, Developments in Nuclear Talent Pipeline and Workforce Planning, John Wheeler, manager of workforce planning at Entergy Nuclear, said the question of where the new workforce will come from is of concern to all sectors of the industry. The panel members discussed how the challenge is being met, describing their experience in attracting, training, and retaining new talent, and providing some fresh ideas and insights picked up along the way.

Adrian Heymer, senior director of new plant deployment at the Nuclear Energy Institute, called the workforce one of the key pieces of the nuclear industry's infrastructure—along with the supply chain, transmission and distribution, and the regulatory framework—that must be in place for the renaissance to occur. Despite about \$2.5 billion already having been spent on new-build activities, the renaissance will not go ahead if there are not the people to carry it through,



Heymer

Heymer said, reminding the audience that 35 percent of the current industry workforce will be eligible for retirement in the next five years. Furthermore, as the latest workforce survey showed, only 13 percent of engineers working in the industry are under 33 years of age. But that is good, he said, when compared with maintenance and craft workers

and those in radiological protection.

Since the workforce challenge was identified in the 2001–2002 time frame, he said, little progress has been seen, but a lot is happening. In 2003, NEI formed a workforce working group to develop appropriate policies and strategies and a task force to identify the challenges and propose solutions. NEI and its members are now reaching out to local, state, and federal agencies, working with other energy and construction industries, and forming partnerships with labor unions, community colleges and universities, and high schools. There have even been talks with officials about bringing shop and craft classes back into schools, Heymer said, "so the foundation is being laid."

This is a big job, he continued, and the nuclear industry must leverage the resources of the entire energy sector rather than try to do everything itself. For example, the Southern Governors' Association, aware of the growing energy demands in the expanding southeastern United States, is engaged in building up the needed skilled craft workforce. Heymer said there are now 14 state-based workforce development activities moving forward. The Department of Labor is another resource to cultivate, he said. It has issued over \$47 million for community-based activities associated with workforce development over the past five years, but only \$5.5 million has gone to nuclear-related initiatives.

Among the most positive developments Heymer mentioned were the 35 community college programs of relevance to nuclear workforce needs. He focused on community colleges because they prepare young people in skilled crafts, which is where the chronic shortages are. What really works well, he said, are partnerships between companies, community colleges, and universities. For example, Central Virginia Community College put together a two-year associate's degree course, working with the University of Virginia, which allows the credits earned to be transferred to the university. In this case, with support from Areva, university professors are giving lectures at the community college.

To further promote opportunities in the industry, the message that there will be many well-paid jobs with good benefits for some time to come is now getting out to high school teachers and the media, which are now very interested in employment issues. The industry is also finally learning how to use the new media, he said, developing Web sites that can attract young people. Heymer described a new interactive Web site, <www.getintoenergy.com>, where students can learn about careers in energy, watch videos, take skills tests, and obtain information on job locations and specific employers. The site was developed by the Center for Energy Workforce Develop-

ment (<www.cewd.org>), a consortium of electric, natural gas, and nuclear energy companies and their associations, formed in 2006 to build the alliances, processes, and tools needed to develop the energy workforce.

found that his opinion was respected and his ideas were taken into consideration. Based on his experience, he put forward the following ideas on how to make the experience even more rewarding for interns, how to increase their productivity, and how to

neers become competent.

Among the goals set for legacy selection, Bradish noted, are hiring in peer groups and hiring locally, with the aim of developing a close-knit group of people with good working relationships at the plant and good social relationships outside the plant, which will help in another important goal: staff retention. This does not happen when hiring in ones or twos, he said, also mentioning that the first two engineers he hired left after completing the program to take jobs close to home.

Bradish said that he has also developed a summer intern program for about 20 engineering students with the hope that it will eventually provide about 50 percent of legacy engineers. The interns and legacy engineers both started the program on June 10, which happened to be the day before this session was held. "It is a marvelous sight to see 40 brand new young engineering students and graduates, hanging out in the lunch room, getting together," Bradish said.

The legacy engineers go through an accredited engineering course for which they must pass qualification requirements in five areas: plant engineering; nuclear fuel; design engineering; oversight (including quality assurance); and probabilistic risk assessment. The program includes a Final Safety Analysis Report familiarization component, as well as operations training, for which they are attached to an operations crew for six weeks.

At the end of the program, he explained, all of the engineering managers come together to assign the legacy engineers to a plant organization. At the meeting, managers have to make their case for why a particular engineer should be assigned to them. The legacy program is now expanding beyond the engineering departments as others, including operations, chemistry, and health physics, want staff who go through the program.

Education and training

The final speaker, Clarence Fenner, workforce development coordinator at the South Texas Project (STP), started his talk by conveying some hard-won lessons:

■ Workforce issues cannot be resolved alone. Relationships have to be developed, and those relationships have to be given time and energy. Be prepared, he said, to mend fences and "even send flowers."

■ Look for win-win situations. When seeking support from politicians, school district councils, and local colleges, there has to be something in it for them as well. For example, for politicians, leverage what you have that they want, which is typically jobs, economic growth, and infrastructure development.

■ Have a vision and put all your energy toward it. The workforce challenge has many components to it, and efforts may not bear

Workforce issues cannot be resolved alone. Relationships have to be developed, and those relationships have to be given time and energy.

Life as an intern

Matthew Fallacara, who recently graduated from Georgia Tech with a degree in mechanical engineering, provided a firsthand account of life as an intern at a nuclear power station. He spent two summers at Entergy's Pilgrim plant, in Massachusetts, an experience that he said he found very valuable. And although he did not accept an offer to work for Entergy, having decided he wanted to focus on his engineering major, he did choose to work in nuclear power, with Proto-Power Corporation. He said he could see himself working at a nuclear plant in the future, particularly a new one.

Fallacara said that upon his arrival at the plant to begin his internship, he found that the plant was not fully prepared, as it took two weeks for him to get computer access. This left him time to read manuals, an activity that was useful but not very satisfying. The plant environment was very friendly, he said, and he was made to feel part of the team quite quickly. There were good team-building activities, particularly those involving other interns, along with their mentors and supervisors. Particularly noteworthy was a trip to a Boston Red Sox baseball game.

Fallacara said that he was given interesting work. He started out in the preventive maintenance optimization group, which was updating the preventive maintenance program at the plant and integrating the changes into the computer system. He also worked on an equipment reliability report, which required that he read condition reports on equipment failures to identify particular weaknesses. He said that this work gave him a broad view of what it would be like to work at a nuclear plant. Shadowing his mentor afforded him contact with a variety of engineering disciplines and was also a great learning experience, as were the occasions when he had to present his work to colleagues. He said that he received good feedback throughout his projects.

Working at a nuclear plant was "pretty cool," Fallacara said, and in general, the plant did a fantastic job at selling itself. He

help keep them in the nuclear industry once their internship is completed:

■ Ensure that they get off on the right foot by having everything ready for them.

■ Make them feel comfortable in the new setting and involved in the work.

■ Give them enough and varied work that allows them to learn, especially work related to their major, if possible.

■ Let them know what is expected of them to be productive. Communication is key.

■ Get them involved with younger employees.

Building the workforce

Tom Bradish, engineering section leader at Arizona Public Service Company's Palo Verde nuclear generating station, described an unusual two-prong strategy for building the future engineering workforce at the plant. The key element is his two-year "legacy program," which takes in about 20 engineers, almost all new graduates, each year. A vital aspect of the program is that "legacy engineers" are not part of the company's head count and cannot be called on by any desperate manager needing help to sort out some problem. The number and type of engineers recruited for the program is based on the losses in each discipline two years ahead as forecast by retirement eligibility data, plus an expected rate of attrition. Bradish said the idea was to look at the disciplines being lost, not the individuals leaving.

The second element involves hiring particular "talent" to fill certain critical jobs. These relate to those "experts" or "masters" in their field, whose expertise is needed at the plant and cannot be easily contracted out. While many plants are often afraid to lose their long-serving experts, he said, the reality is that there is probably someone there who can do the work of that expert/master—perhaps not at the same level, but at a competent level—who can then develop to expert level. Bradish said that very few cases have been encountered where this was not feasible.

One of the ideas behind the legacy program is that the legacy engineers will reach that competency level within a few years. Bradish said that he expects that by 2010, the critical job element of the hiring strategy can be phased out as the legacy engi-

fruit for some time. It is easy to lose your way.

In 2006, when the plan to add two nuclear units at the South Texas Project site was announced, STP moved from a period of retrenchment to one of growth, requiring about 1400 new workers by 2015. In addition to engineering staff, he said, there are big requirements for people with what he called the “two-year college degree technical skills” to work in craft areas such as maintenance, electrical, mechanical, instrumentation and control, and health physics.

STP realized that it could not meet this challenge alone and formed a partnership with two other utilities working in Texas, Exelon and Luminant. Together they hammered out the Texas Nuclear Workforce Development Initiative, which consists of 10 key strategic elements, including degree programs—Nuclear Power Technology Associate (NPTA), Radiation Protection Technology, and Digital Instrumentation and Control Associate—and other supporting activities.

To provide program coordination and oversight of these initiatives, STP lined up Texas A&M University, which provides assistance in areas such as curriculum development, marketing, outreach, and recruiting. Fenner said that this has been particularly useful in bringing in other sources of support, including other academic establishments, industry organizations, and the state. Each initiative has a lead institution, usually a community college.

The NPTA degree program, Fenner noted, was developed in partnership with Texas A&M, with the goal of developing a two-year program that would be closely aligned to the needs of the utilities. The graduates, he said, will form the feedstock for the technical disciplines. This program has been developed and approved by the state’s education authority and will be implemented in three local colleges this fall.

Another initiative that Fenner noted as particularly valuable is the certificate program in Nuclear Power Systems and Operations. This is a four-year program that allows young people with a technical qualification in a related skill to continue to work in their own discipline. By adding the nuclear certificate, he said, they can reach the same level as the NPTA degree.

To assist in promoting the degree programs, there is also a nuclear student recruiting program, Fenner explained. The university’s own students are invaluable in this area because they know how to attract other young people. Another initiative, online nuclear engineering technology courses, was also devised to reach out to young people.

During the discussion following his presentation, Fenner described examples of the types of help received from other people and organizations. For example, with the

assistance of the local city council, an abandoned Wal-Mart building in a blighted area was taken over and recreated into a college satellite campus. Starting this fall, technology degrees and certificates will be offered at this campus. Already, 60 candidates have been selected. STP has also taken over part of the building for development purposes.

There was also discussion about recruiting from minority groups and various “underrepresented” populations. The considerable efforts made to market the course, Fenner said, did not reach these groups. “We had to find a way to go to them,” he said, which has been difficult. He noted that some progress has been made by engaging people who know how to reach out to these groups. For particularly disadvantaged families, extra resources may be needed to allow young people to take part in the program, he said.

License re-renewal?

A panel on aging management for power reactors addressed the possibility that license renewal, which has already cleared the way for some reactors to operate for up to 60 years, might be able to stretch the limit to 80 years or more. Speakers at the session noted that even as there was never any technical reason for limiting a reactor operating license to 40 years, there is likewise no policy reason limiting it to 60 years. Even now, no power reactor in the United States has actually begun its first renewal period, but there has been enough interest in the topic of further renewal to spur studies of what would be necessary to keep a reactor safe and productive past the 60-year mark.

Garry Young, manager of license renewal for Entergy Nuclear, stated that the federal regulation for license renewal, 10 CFR Part 54, was written to allow continued renewals as long as it is demonstrated that the reactor can be operated safely. He

said he believes that the integrated plant assessment and other aging-management review processes would be simplified in a second round of renewal, but the second round might have to include a “gap” analysis to cover issues of aging regarding structures, systems, and components that may not have been covered in the first round. Buried piping and cables might need closer looks, especially because some cables might not be environmentally qualified to work as long as 80 years. Young said that research is needed on neutron embrittlement (not yet projected beyond 60 years), metal fatigue, and the accumulation of heat-

up/cool-down cycles.

Ronaldo Szilard, director of nuclear science and engineering at Idaho National Laboratory, made the familiar case for keeping existing reactors in operation for as long as is reasonable (because, among other reasons, of the low cost of the electricity produced by reactors already in service). He noted the report that INL recently wrote in collaboration with EPRI, urging research and development support for light-water reactors. Work is needed in materials aging and degradation, advanced fuels, risk-informed safety margin characterization, and advanced instrumentation and controls, he said, adding that by the end of fiscal year 2009, some cost-shared R&D will have started.

Jim Reilly, vice president for engineering and technical services at Southern California Edison Company, spoke from the perspective of a plant (San Onofre) that has not yet applied for license renewal and is approaching aging management as much for its relevance to current operation (the two reactors were licensed 26 years ago) as for a future renewal application. Reilly noted that obsolescence has included vendor decline, with the reactor vendor, Combustion Engineering, no longer in existence. With the manufacturing capability lost, some spare parts acquired from other vendors have failed. He added that even with equipment modifications made along the way, he believes that some obsolete technology will still be present at the plant, citing analog controls on heater drain tanks as an example. One technology that does change—in-

Even as there was never any technical reason for limiting a reactor operating license to 40 years, there is likewise no policy reason limiting it to 60 years.

formation technology—has to carry with it all earlier plant documentation when it is switched, and has to cover all structures, systems, and components, not just those that are safety-related.

There were questions from the audience after each presentation and also to the speakers gathered as a panel. Young was asked if it has yet been contemplated that plant modifications could extend to the replacement of the reactor vessel and core. Young noted experience in Europe with the annealing of vessels, and the need to uphold the current licensing basis, because if it cannot be maintained the licensee would have

to consider closing the plant. He did not specifically address the actual replacement of the vessel and core, but because the subject had been raised, the panel was later asked by *NN* whether the replacement of items as fundamental as the vessel and core would be permissible under a reactor's license. Session chair Gene Carpenter, of the NRC's Office of Nuclear Regulatory Research, said that the opinion of the NRC is that as long as the current licensing basis is intact and upheld, any of the physical objects at a nuclear power plant could be replaced and the license would still be valid. Asked whether this has been tested in a court challenge, he said that it has not.

Spent fuel transport

The panel session on the safety of spent nuclear fuel transport was concerned with the transportation of spent fuel to the proposed repository at Yucca Mountain, in Nevada. The panel brought together professionals representing a wide range of interests, including the Department of Energy, the transportation industry, a waste management consultant, and state authorities, including a representative of Nevada.

The first speaker was Alex Thrower, who is with the Yucca Mountain Project Office, part of the DOE's Office of Civilian Radioactive Waste Management, which has the responsibility for constructing, licensing, and operating a repository for spent nuclear fuel and high-level waste at the Yucca Mountain site. Thrower focused on the development of a routing strategy.

While a repository at Yucca Mountain will not begin operation for at least 10 years, he said, routing issues will keep the DOE busy until then. In 2006, the National Research Council of the National Academies issued a comprehensive study, *Going the Distance? Safe Transport of Spent Nuclear Fuel/HLW in the United States*, which advised the DOE to identify routes as early as possible to adequately plan these shipments and also to give communities along the routes time to prepare. The DOE, Thrower said, is responsible for providing technical assistance and funding to allow states and tribes to understand what the activity involves, to present their views, and to meet their responsibilities for public safety. This will require what he called a "planning basis understanding" of the expected routes so that funding can be apportioned fairly.

He noted that many issues need to be assessed, such as environmental impact, security, and stakeholder concerns. A suite of representative routes has already been developed to allow a routing analysis, as required under the National Environmental Policy Act process. Furthermore, the situation is not static, and the DOE will have to be able to adapt. Over the past year, for example, rail freight operations have changed

dramatically, primarily because of the increased price of diesel fuel.

Regarding security, Thrower noted that the Federal Railroad Administration has issued a rule requiring that railroad operators do routing assessments of safety and security issues. The assessments must take into account many different factors, including items such as toxic materials, chlorine, some types of explosives, and spent nuclear fuel. The results of these assessments may have an impact on spent fuel shipments, he said.

One important action the DOE has taken is to establish a routing topic group, which has brought together people with various perspectives to sort through the issues. One goal of this group is to come up with a national suite of preferred rail and highway routes. This will be a collaborative process, Thrower said, that will take time to get right. The DOE will be expected to have open and cooperative discussions with all stakeholders on these matters.

Providing the facts

The second speaker was David Blee, executive director of the U.S. Transportation Council, an organization formed in 2002 during the Yucca Mountain ratification debate to provide factual information on transport experience and safety. Because the main opposition to a repository at Yucca Mountain comes from the state of Nevada, Blee said that his first order of business was to correct some of the false statements being issued by Nevada, in particular those posted on Sen. Harry Reid's Web site. He noted, for example, the claim that there is not going to be a full public process to review the transport of spent fuel—not by the NRC, not by the DOE, not even by the Department of Transportation—and that this is a massive and dangerous shipping campaign that the NRC refuses to scrutinize.

Blee called these attacks a "desperate fourth-quarter response" to what is indeed a new day for the Yucca Mountain program. The DOE's submittal of the licensing application to the NRC in June was a watershed, he said, and now that the issue is in the NRC's hands, it matters only what the experts there think, not what he or anybody else thinks. If the NRC does not docket the application, he added, then it is not of sufficient quality. In any case, he said, the decision won't be up to Senator Reid, or Sen. Pete Domenici, or Energy Secretary

Samuel Bodman. It is now in a neutral setting, he noted, and that's a huge accomplishment.

In terms of safety, Blee said, the track record of spent fuel transportation was thoroughly aired during the ratification debate. The ratification passed by an overwhelming vote in Congress, and so, he said, he does not think that transportation safety will be an issue that opponents will get much leverage from now, as there is so much experience. Ultimately, the spent fuel will have to be moved, and it must be done safely.

Blee also referred to the National Academies' report (*Going the Distance?*), which

The DOE is responsible for providing technical assistance and funding to allow states and tribes to understand what the activity involves, to present their views, and to meet their responsibilities for public safety.

says that there are "no fundamental technical barriers to the safe transport of spent fuel and high-level radioactive waste" in the United States, that "the radiological health and safety risks associated with transportation . . . are well understood and are generally low," and that "transportation route selection processes are reasonable." The report also notes that the DOE route selection procedures are "risk-informed" and take "into account security, preferences of state and tribal governments, and information from states and tribes on local transport conditions."

There are two things the DOE has to do now, Blee said: defend its license application, and move the program forward (which, he noted, is where Senator Reid will be likely to use his influence to try to block). Among the priorities for the program, he said, are to launch the Yucca Mountain rail corridor and to license and deploy the new TAD (transport-aging-disposal) canister system at utility sites. He noted that he would also like to see a demonstration of transportation utilizing fuel at a shutdown nuclear plant, something that the National Academies' report called for.

Not in Nevada's backyard

Robert Halstead, transportation advisor at Nevada's Nuclear Waste Project Office, made it clear that Nevada wants the DOE to abandon its current plans for Yucca

Mountain. In the meantime, he said, there are a number of actions that the DOE should take, as follows:

- Undertake full-scale shipping/storage cask testing—regulatory and extraregulatory—of each new cask design, including a three-hour regulatory fire test, to benchmark the codes used in the certification process.

- Abandon rail routes through Las Vegas and other highly populated/security-sensitive locations.

- Apply full NRC regulations. While the NRC regulates utility fuel shipments, the DOE self-regulates in many areas of spent fuel handling. It will be a big job, Halstead said, to convince Nevada and other stakeholders that the DOE's self-regulation will be equivalent to the NRC's regulation, particularly on security matters, and it would be much easier to apply fully the NRC regulations.

- Develop contingency plans regarding rail access to the repository. He said that he thought it was strange that the DOE does not have a contingency plan were it to fail to get a new rail link to Yucca Mountain. As now defined, Halstead said, the proposed route is very complicated from a regulatory standpoint, and from a right-of-way acquisition standpoint.

Halstead voiced his opinion that the likelihood of the Yucca Mountain Project's going forward is less than 50 percent. The license application is a first of a kind, he said, and the licensing process will be very challenging, with a heavy burden of proof. "I don't think the NRC would rubber stamp it," he said.

Yucca Mountain is a very political issue, Halstead said, going back to the way the site was chosen in 1987. It is his belief that the other sites on the shortlist were "let off the hook" because they had more powerful representation in Congress. This in itself, he said, is a major reason for the strong opposition in Nevada.

Some other observations he made included the following:

- At least double the amount of spent fuel that Yucca Mountain can accommodate will likely need to be disposed of. Congressional action will be required if the additional spent fuel is allowed to go to the repository.

- The volumes of spent fuel to be sent to Yucca Mountain by rail will be much lower than the DOE plans, which will mean many thousands more truck shipments than it is figuring.

- The cost of spent fuel transport to Yucca Mountain will be much higher than the DOE's "lowball numbers."

- The public opposition to transportation will grow because of the large number of states, congressional districts, major metropolitan areas, and tribal lands affected.

- The routing process requires much more

consultation. The DOE should reread the National Academies' report, taking more account of the warnings given in it.

Doing it right

Jim Hardeman, of Georgia's Environmental Radiation program in the Department of Natural Resources, presented a good example of how nuclear transportation is administered by a state. He noted Georgia's experience with the transport of spent fuel and fuel waste that is trucked through the state on the way to and away from the Savannah River Site (SRS), in South Carolina. The



Hardeman

cargoes going to SRS mostly involve research reactor fuel, he said. Fifteen shipments were made between 2003 and 2007, and about half that number have been made so far this year. Since the September 11, 2001, terrorist attacks, these shipments have been escorted by armed, uniformed law enforcement officers border-to-border. Also, about 100 shipments a year from SRS pass through the state bound for the Waste Isolation Pilot Plant (WIPP), in New Mexico. These shipments are not escorted.

Hardeman noted on a map of the Atlanta area that most of the shipments going to SRS travel a road through the "rich" suburbs, and so there is not an environmental justice issue. Interestingly, he said, the shipments from SRS to WIPP go around the other side of the city.

Three other Georgia state agencies also have a role in dealing with radioactive material shipments: the Georgia Department of Public Safety, which deals with hazardous material permits and provides escorts; the Georgia Emergency Management Agency, which is responsible for tracking systems that cover spent fuel and acts as the overall coordinating agency for incident response; and the Georgia Department of Transportation, which is responsible for routing decisions and road closures.

The Georgia Department of Natural Resources, in which Hardeman works, is the primary state responder to radiation incidents. To have a robust emergency preparedness and response capability, he said, requires that several elements be in place, including plans and procedures, personnel, equipment, and trained local responders

along the route. To put all this together for spent fuel transport to Yucca Mountain will require funding, he said, and for that he is banking on federal funding based on the provisions included in Section 180(c) of the Nuclear Waste Policy Act.

Questioning study results

The final speaker was Marvin Resnikoff, of Radioactive Waste Management Associates, which provides consultancy services



Resnikoff

to clients, including the state of Nevada. He said that his experience goes back to working for the New York State Attorney General in 1975, when the state had concerns about the safety of containers used for transporting plutonium by air. The NRC had to be forced to act, he said, before containers were finally designed to survive an air crash.

Resnikoff then showed a Russian video demonstrating the latest antitank missile. The outer shell penetrates the tank, and then an inner missile shell is fired, destroying the tank. He used this to show one of the weaknesses he found in published work from Sandia Labs on the consequences of a terrorist attack on spent fuel containers. Oth-

The [Yucca Mountain] license application is the first of a kind, and the licensing process will be very challenging, with a heavy burden of proof.

er weaknesses he pointed out in the Sandia study included the following:

- The casks used in the study were not pressurized as the latest designs now are. This, he said, is important as far as how much material might be released.

- The study focuses on particle release, not semi-volatiles such as cesium. Resnikoff said that new data indicate that considerably more cesium in the fuel pellet-cladding gap would be released than the Sandia study assumes.

- The cask damage does not include an exit hole. Resnikoff said that he believes that in case of a double missile hit, an exit hole would be produced, allowing fuel material to escape.

He said that although his latest assessments are not yet completed, a rough esti-

mate of the consequences of a “successful” sabotage event in Las Vegas, based on his previous work, is >500 latent cancer fatalities.

In the discussion period following the presentations, an NRC staff member countered some of the criticisms leveled by Halstead and Resnikoff. Although not familiar with Resnikoff’s work, he said that he appreciated the limitations of the Sandia study. More recent studies, however, which unfor-

year. “We are the gatekeepers,” Phillippi said in explaining his role as a story analyst. “We are the ones who read the scripts first and say if they have potential for some reason or another.”

Every film company is looking for different things, Phillippi said, such as the one that he worked for recently that was searching for films for males in the 13 to 24 age range, which is considered the core moviegoing audience. “Anything that didn’t appeal to younger males—in other words, anything with a female lead or that didn’t have a lot of action or fighting in it—they didn’t want to hear about,” he said. In addition, the company had a budget of about \$20 million per film, which is not a lot of money when it comes to

it is because people don’t understand nuclear technology. “A scriptwriter,” he explained, “is looking at something that we’ve been told can be made into a bomb and is so lethal that if it’s sitting in a room and you walk in, it can kill you. The scriptwriter looks at that in terms of drama and thinks, ‘Wow, this is the greatest weapon in the world!’”

Even with that perception existing in the public eye, Phillippi said that over the past five years he has seen the number of movie scripts dwindle regarding the dangers of nuclear technology. “I haven’t seen a lot of scripts recently about that sort of thing,” he said, “and I’ve read about 10 000 in my career.”

Phillippi said there seems to be an understanding, in Hollywood and in the general public, that it is time to move away from saying “be afraid!” of nuclear technology. It’s possible, he concluded, that in the past five years, because of rising gas prices and with more going on in the world to worry about, people are starting to perceive nuclear as a friend instead of a foe.

Carol Cole, public involvement manager at the Idaho-based environmental remediation company North Wind, Inc., recounted the pop culture symbols that indeed have portrayed nuclear as less than trustworthy. There was the movie *The China Syndrome*, about the valiant nuclear plant worker who is killed while trying to warn of the plant’s pending meltdown; the animated TV com-

The most important thing to keep in mind about nuclear in the movies is that reality takes a backseat to what is dramatically acceptable in a script.

tunately are classified, consider the type of damage that Resnikoff described, as well as other conditions, such as high burnup fuel with brittle cladding and excess cesium, as well as many others. These studies also looked at other extreme scenarios, he said, such as terrorists’ throwing explosives directly inside the cask, and in all cases, the results show very little material dispersal.

Also, to counter some of the issues about Yucca Mountain raised by Halstead, he described the thoroughness of the NRC’s safety review process. In response, Halstead stressed that he mainly wants the DOE to be regulated under the same NRC procedures as the utilities. He would particularly like the casks that are to be used in the repository to be subjected to the same full-scale test program as were the casks used at WIPP. He said that he thinks that such tests would go a long way toward convincing the public of their safety.

Thrower said that Congress is the place where decisions are made, and until there is a change, the DOE will go ahead with the program, sorting out the issues, such as transportation. “We are making progress,” he said.

Nuclear as cinema villain

Hollywood has come to its senses, finally realizing that there is little to be feared from nuclear technology. So implied script reader Guy Phillippi during the panel session, Focus on Communication I: Nuclear Pop Culture.

Phillippi has been a script reader for 20 years, laboring through mounds of treatises for major movie companies such as Disney and Warner Brothers. Each of these companies receives about 2000 scripts in a year and makes only about 20 movies a

moviemaking. “So, most of the stuff was just pass, pass, pass, whether it was a good script or not,” he admitted.

Looking specifically at the nuclear industry, he said he has seen a transition over the past two decades that he has been reading scripts, from the early days of anti-everything nuclear to the present time, when nuclear seems to have lost its pizzazz as a movie villain.

He recalled the late 1980s, when many scripts contained attacks on nuclear reactors by bad guys who wanted uranium so that they could do bad things. And when the Soviet Union fell, suddenly scriptwriters were depicting rogue Soviet generals armed with nuclear weapons. Phillippi said he would sit back and think, “I’ve never heard about this one in the news.” And yet, judging by what he was reading in movie scripts, it seemed to be “a terrible world problem,” he said.

Then, after the terrorist attacks of September 11, 2001, the threats in movie scripts were dirty bombs, and people wandering around with a suitcase full of nuclear weapons. Again, he remembered thinking, “I don’t really know if these [types of incidents] are possible. I’ve never heard of them happening.”

Phillippi noted that the most important thing to keep in mind about nuclear in the movies is that reality takes a backseat to what is dramatically acceptable in a script. He has wondered why this is so, and thinks

It’s possible that because of rising gas prices, and with more going on in the world to worry about, people are starting to perceive nuclear as a friend instead of a foe.

edy *The Simpsons*, which depicts a nuclear plant as an unsafe place run by buffoons;



Cole

bumper stickers that proclaimed “Nuclear power is not healthy for children and other living things”; and the well-known “sunshine logo” from Sweden that included an antinuclear message.

Cole said that the public’s mistrust and lack of understanding of science and technology are “pretty basic,” and that people began to associate nuclear technology with atomic weapons after World War II. But

things are changing, she said, noting that now, for example, half of all Swedes support nuclear power, and well-known envi-

ronmentalists such as Patrick Moore, who cofounded Greenpeace, have come out in support of nuclear power.

tors, we recycle, and that's a green technology. So," she said, "we have a big advantage in that respect."

Cole said that antinuclear groups offer a lesson to be learned in that they know how to call their troops together to rally against a nuclear project. But rallying also can be done on the pronuclear side, she said. An example of that happened recently in Idaho when the community got together in support of a uranium enrichment plant proposed by Areva. The company had been considering a handful of sites across the United States as a possible home for the plant, but it picked Idaho Falls because of the support put on display there. The community coming together was enough, Cole said, "to show that the whole state was in favor of nuclear."—*E. Michael Blake, Dick Kovan, Rick Michal, and Betsy Tompkins* **IN**

Antinuclear groups offer a lesson to be learned in that they know how to call their troops together to rally against a nuclear project. But rallying also can be done on the pronuclear side.

Why is the change happening? The answer is in the demographics, she said. Young people who have grown up with computers and iPods are much more comfortable with technology than their predecessors. "They don't even remember Chernobyl. They never heard of Three Mile Island. Nuclear power is 'recycling.' If we go to fast reac-