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# NRC order and related documents on NFS near-miss accident released

Five months after it quietly issued a confirmatory order to Nuclear Fuel Services for a March 2006 near-miss criticality accident at NFS' fuel fabrication facility in Erwin, Tennessee, the NRC is making the document public. The February 21 confirmatory order, which was released July 19, formalizes commitments that NFS made during mediation sessions with agency officials last year to make safety culture and other improvements.

The agency said in a July 19 statement that it also was releasing other related documents, including a transcript of a closed May 30 meeting involving the NRC commissioners and staff and NFS officials discussing the fuel facility's safety record and a December 2006 performance review of the facility.

NRC has been under pressure from lawmakers to release information about the accident and to revise an internal policy that classified many documents relating to NFS as "official use only" and withheld them from the public.

House Energy and Commerce Committee Chairman John Dingell, a Michigan Democrat who criticized the extent of NFS documents swept under the OUO policy, told NRC in a July 3 letter that it was mere "luck" that a criticality accident hadn't occurred (INRC, 9 July, 3). Michigan Democrat Bart Stupak, chairman of the House Energy and Commerce Subcommittee on Oversight and Investigations, also signed the letter to NRC.

More recently, Republican Senators James Inhofe, the ranking Republican on the Senate Environment and Public Works Committee, and George Voinovich, chairman of the Senate

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# Big shocks in Japan quake raise issues of seismic rule adequacy

The July 16 earthquake 10 kilometers from Tokyo Electric Power Co.'s Kashiwazaki-Kariwa station produced peak ground acceleration measured nearby at nearly three times the PGA standard for the plant's design, forcing Japanese regulators to reconsider national earthquake design standards that were tightened and formally reissued only this year.

Monitors inside the seven-BWR plant showed PGA at more than double the standard, according to Tepco. "That's not supposed to happen," said one German safety expert. Nonetheless, all four units operating when the quake hit scrammed to safe shutdown, and no damage has been reported in nuclear safety systems at any unit, leading a Japanese expert to say the quake appeared to demonstrate that Kashiwazaki-Kariwa "may be more robust than the existing DBE [design-basis earthquake] would suggest."

The event is providing substantial new data for seismological modeling and has European regulators seeking data to restudy their rules (see related stories). In the US, the event may raise questions about whether there will be implications for reviews of new plant licensing applications, expected to begin being filed in the next three months, or for existing units.

NRC and the Nuclear Energy Institute both said last week that US reactors are designed to withstand the strongest earthquakes in the areas

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# FirstEnergy makes new pledges to NRC

FirstEnergy has made additional commitments to the NRC in response to the agency's questions at a meeting last month on the company's handling of a report it had commissioned on the degradation of the Davis-Besse reactor vessel head.

The report was prepared by the consulting firm Exponent Failure Analysis Associates as part of a FirstEnergy insurance claim dealing with the degradation, which was discovered at Davis-Besse in 2002. Some of the report's conclusions conflicted with FirstEnergy's earlier explanation of the development of the degradation. In particular, the Exponent report said the cracking of the reactor vessel head penetration nozzles started later and then developed more quickly than Fenoc

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had estimated.

That conflict, and FirstEnergy's delay in forwarding the report to NRC, led to a "demand for information" from the agency. A DFI is a possible prelude to NRC enforcement action.

In its June 13 written response to the DFI and at a June 27 meeting with senior NRC officials, FirstEnergy distanced itself from the Exponent report (INRC, 9 July, 16). The company also made five commitments to the NRC, largely dealing with its internal coordination and its communication with NRC.

In its explanations to NRC last month, Fenoc said one cause of the problems in the handling of the Exponent report was poor coordination between FirstEnergy Nuclear Operating Co. — the subsidiary that operates Davis-Besse, as well as Perry and Beaver Valley — and FirstEnergy's corporate offices. Because the Exponent report was part of a commercial matter, the company's communications with NRC were not handled as they normally would have been, FirstEnergy said.

One of the new commitments is that FirstEnergy will conduct "regulatory sensitivity training for selected non-Fenoc FirstEnergy employees." The second new pledge is to conduct follow-up "effectiveness reviews" to determine "if an appropriate level of regulatory sensitivity is evident."

In the July 16 submittal, FirstEnergy also provided further detail on the five earlier commitments and elaborated on some of its answers from the June 27 meeting.

Meanwhile, attorney Billie Garde sharply criticized NRC for not recording and transcribing the June 27 meeting. Without a transcript, NRC cannot hold FirstEnergy accountable for statements at the meeting that were inconsistent with earlier ones, Garde said in a July 16 letter. NRC is preparing a summary of the meeting, but Garde questioned "the evidentiary value of a summary of what was said for the purposes of an enforcement proceeding."

Garde is an attorney for Andrew Siemaszko, a former Davis-Besse engineer who prohibited by NRC for five years from working on NRC-licensed activities for his alleged role in Fenoc's handling of the Davis-Besse head degradation.

David Lochbaum, the director of the Union of Concerned Scientists' nuclear safety project, supported Garde. In a July 17 letter, he said FirstEnergy's remarks at the meeting "have substantially less weight than the formal written statements provided to the NRC under oath or affirmation in its response to the DFI."

But NRC spokesman Scott Burnell said the additional information and commitments from the meeting were formally conveyed in the July 16 letter, which was under the oath and affirmation of Anthony Alexander, the CEO of Fenoc and president/CEO of FirstEnergy. The original June 13 response to the DFI was under the oath and affirmation of Fenoc President/Chief Nuclear Officer Joseph Hagan.

"Given that Fenoc has provided all this in writing, under the signatures of two of its most senior officials, what's left

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to transcribe?" Burnell questioned.

*—Daniel Horner, Washington*

# PRA quality issues must be addressed in 2008 RI-ISI

NRC staff and industry have begun to develop criteria for the application of probabilistic risk assessment quality standards to licensee requests for reapproval of their risk-informed in-service inspection programs. But industry representatives said at a meeting last week that some licensees may face time pressure in preparing their requests if criteria are not promptly agreed upon.

More than 85 units have received NRC approval to implement risk-informed in-service inspection programs, known as RI-ISI, Biff Bradley, risk assessment director at the Nuclear Energy Institute, said at the July 17 public meeting at NRC headquarters. The objective of these programs is to identify degraded conditions that are precursors to pipe failures at power reactors, and NRC's regulatory requirements for agency review and approval of such programs are specified in 10 CFR 50.55(a).

RI-ISI "has been one of the most successful risk-informed initiatives, and, as of May 2005,) "99 of 104 operating US power reactors are expected to implement such programs, Mike Tschiltz of NRC's Office of Nuclear Reactor Regulation, or NRR, said in slides accompanying a presentation at a May 2005 public meeting. The RI-ISI process divides plant systems into piping segments, evaluates consequences of segment failures, determines failure potential of each segment, categorizes risk significance of each segment, selects welds and elements for inspection, and assesses impact on core damage frequency and large early release fraction in conformance with Regulatory Guide 1.174, the NRC's regulatory guide for risk-informed decision-making at nuclear plants, Tschiltz said in that presentation.

Specific guidance for RI-ISI programs is provided in RG 1.178, last updated in September 2003. NRC has approved two topical reports detailing "well defined generic methodologies" for licensee implementation of RI-ISI programs, one from Westinghouse in 1998 and one from the Electric Power Research Institute in 1999, Tschiltz said in 2005.

Power reactor licensees must periodically re-submit their RI-ISI programs for NRC approval, and approximately 13 units are scheduled to make such submittals in 2008, Bradley said at the July 17 meeting. Those units were not specified at the meeting, and industry representatives did not provide a list of the units by press time last week.

Revision 1 of RG 1.200, issued in January, provides an approach for determining the technical adequacy of probabilistic risk assessment, or PRA, results for risk-informed activities (INRC, 5 Feb., 1), and NRC and industry must now determine how to apply that regulatory guide's quality standards to RI-ISI applications. NRC said in a March 2007 regulatory issue summary, RIS-2007-06, that agency staff will use RG 1.200 to assess PRA technical adequacy for all risk-informed applications received after December 2007. Industry has generally been supportive of PRA quality standards, but has expressed concern about the ability of some licensees to upgrade their PRAs to meet RG 1.200 criteria by the end of the year.

## Various options reviewed

Licensees have reviewed their PRAs to identify "gaps" that must be addressed to meet RG 1.200 PRA quality criteria, and NRC staff and industry must now "identify the pertinent subset" of these gaps which are relevant to RI-ISI applications and "identify a process" for agency review and approval of those applications, Bradley said at last week's meeting.

Industry representatives and agency staff agreed at the meeting that there is not enough time before the end of the year either to revise RG 1.178 or to submit and review a pilot plant application. One possible approach discussed at the meeting would be a joint NRC-industry working group, perhaps modeled after a group convened to review PRA issues related to the mitigating systems performance index of the agency's reactor oversight process (INRC, 2 May '05, 3). Bradley said this might be "the most efficient way" to address the issues, although it would be difficult to "pull a group together rapidly," given that industry's PRA community is already "saturated" with other tasks.

Nonetheless, the issue must be addressed, because NRC staff cannot just consider "high level requirements" for PRA quality when reviewing RI-ISI applications, Gareth Parry of the division of risk assessment at NRR said at the meeting. Deepak Rao of Entergy agreed that there is "no way to get around" reviewing and "binning" licensees' outstanding PRA quality issues to determine which are relevant to RI-ISI.

Bradley said at the meeting that NEI, by early September, will put together and send to NRC a list of potential industry members for a working group, as well as a list of "supporting requirements" in the American Society of Mechanical Engineers PRA quality standard that may have relevance to the review of RI-ISI applications. If the working group approach is agreed to, its conclusions could potentially be implemented in an update to relevant industry guidance, a regulatory issue summary, or both, meeting participants suggested.

Also still to be determined is how rapidly licensees would need to close relevant identified gaps in their PRAs in order for an RI-ISI application to be approved. "That's something we haven't really come to grips with," but "there is no transition period" specified in RG 1.200, said Mark Rubin of the probabilistic risk assessment branch at NRR. If all relevant PRA gaps are not closed by the time NRC staff completes its review of such an application, the agency could potentially keep its safety evaluation "open" or specify license conditions in its approval, Rubin said.

Stephen Dinsmore of NRR said at the meeting that, regardless of the specific review approach used, licensees submitting RI-ISI applications will either need to tell NRC staff how any deficiencies identified in their PRAs "don't affect" risk-informed in-service inspections or how they have "fixed" those deficiencies.

Bradley said that industry and NRC staff have the same objective, and the question is how best to identify and address relevant PRA quality gaps "in a structured manner."—*Steven Dolley, Washington*

## NRC expects to complete tests on fuel clad embrittlement in August

NRC's final embrittlement tests on Zirlo and M5 fuel cladding should be completed in August and an information letter on the results issued a month later, putting NRC a step closer to deciding whether to broaden its embrittlement criteria to cover a range of cladding materials, according to the agency.

In a July 11 letter responding to earlier recommendations by the Advisory Committee on Reactor Safeguards, the NRC staff said it agreed with the ACRS recommendation that it should develop performance-based requirements that are not based on any specific fuel type or cladding material.

Sometime after receiving the information letter from NRC's Office of Nuclear Regulatory Research in September, the Office of Reactor Regulation will determine whether the agency should move forward with a rulemaking on generic, performance-based embrittlement criteria.

Existing criteria in 10 CFR 50.46, written in 1973, apply only to zircaloy and Zirlo cladding materials. NRC has to grant exemptions, on a case-by-case basis, for advanced cladding materials such as M5 and so-called optimized Zirlo cladding now being used by utilities. The new criteria also can accommodate higher burnups, an average peak burnup of 62 gigawatt days per metric ton uranium, than what was envisioned in the 1973 criteria.

In addition, the existing 17% oxidation limit isn't applicable to all zirconium-based fuel, NRC's Ralph Meyer said July 18. Embrittlement tests under way at Argonne National Laboratory, using irradiated fuel supplied by industry, are trying to determine appropriate limits for different alloys, he said.

"The requirements would be aimed at ensuring that fuel maintains adequate structural integrity during a LOCA [loss of coolant accident] so that coolable geometry and long-term cooling capability are maintained and accident conditions do not challenge containment integrity," NRC's letter said of generic, performance-based criteria.

The letter added that staff also agreed that in order to support a performance-based rulemaking, NRC must develop "detailed regulatory guidance on acceptable methodologies for evaluating different types of fuel and cladding behavior to demonstrate compliance with requirements."

If staff is unable to develop an enforceable performance-based regulation independent of fuel type, it should at least develop flexible performance requirements for specific fuel types, the letter stated.

Odelli Ozer of the Electric Power Research Institute told the ACRS in February that industry supports NRC's overall objective of developing performance-based criteria, eliminating the need for exemptions and making the licensing process for new cladding material smoother. However, Ozer said that industry believes data have not shown "the presence of any public safety issues" arising from continued use of the existing criteria.

A change in the criteria could require industry to reanalyze the cladding material it uses and could reduce the industry's flexibility in the use of some heavily corroded assemblies, one source said.

NRC's July 11 letter to ACRS adds that "other effects of fuel behavior under LOCA conditions, such as balloon size and fuel particle relocation, will be addressed under the second phase of the research plan." NRC added that completion of that research is contingent on it receiving an adequate supply of irradiated fuel from the industry and that the staff is working with industry to obtain the samples. It said that these other effects of LOCA conditions "do not affect the zirconium cladding embrittlement criteria needed for development of the rulemaking."

—*Elaine Hiruo, Washington*

## Industry presses for easing burnup credit, NRC predicts progress soon

Industry representatives pressed their case for relaxing NRC staff guidance on analyzing spent fuel burnup for transportation casks before an agency advisory committee last week, arguing that methods used to take credit for burnup under 10 CFR Part 71 should be aligned with the less conservative methods used to analyze in-pool storage of the fuel under 10 CFR Part 50.

Burnup credit has long been at the top of a list of issues that NRC staff and the Nuclear Energy Institute have identified as requiring collaborative effort to resolve. NRC's Advisory Committee on Nuclear Waste and Materials has taken an interest in those issues over the past several months. Utilities have been loading high-burnup fuel into high capacity canisters that have been certified for both transport and storage, but under current NRC guidance on burnup, 130 of those canisters cannot be qualified for transport and that number continues to grow, according to NEI's Everett Redmond. He told the committee July 18 that only changes to staff's guidance, not regulatory changes, are required to allow transport of these canisters. Otherwise, he said, the canisters will need to be reopened at the utility site and repackaged prior to offsite transport.

William Brach, director of NRC's division of spent fuel storage and transportation, or SFST, told the committee July 17 he expects to see considerable progress on burnup credit over the next one to two years. Industry and NRC staff are planning to meet this fall to further discuss these issues. Edwin Hackett, SFST deputy director for technical review, said after the meeting he would like to see NRC's and industry's technical experts sit down at a workshop and make real progress beyond the posturing that has characterized such exchanges in the past. He said he believes NRC "needs to move down the path of better risk informing this

area," while recognizing progress will be incremental and will take time.

The regulations for spent fuel transport under 10 CFR Part 71 state that a package must be designed so that the contents will remain subcritical if water were to leak into the containment system. Because of uncertainties in the radionuclide composition of fuel that has been irradiated, NRC historically required cask vendors to use fresh fuel in their criticality control analyses. NRC's interim staff guidance 8, Rev. 2, "Burnup Credit in the Criticality Safety Analyses of PWR Spent Fuel in Transport and Storage Casks," allows credit for the decrease in reactivity in irradiated fuel, but only credits actinides, not fission products. That guidance, issued in September 2002, relaxed some of the assumptions in previous guidance but requires the user to measure burnup to confirm reactor records. Industry argues that the measurement requirement is redundant, burdensome and has no safety benefit.

Redmond told the committee that industry believes NRC staff should consider giving more credit for burnup, noting the probability of a criticality accident during transport is extremely low: between $10^{-18}$ and $10^{-17}$. He suggested NRC staff could permit criticality analyses performed under Parts 71 and 72 requirements for spent fuel transport and storage, respectively, to use the burnup credit analysis methods that are acceptable under Part 50 reactor operating requirements. Alternatively, he said, the staff could offer credit for canisters for which it can be demonstrated that no water could leak in during an accident, also known as moderator exclusion. NRC staff has prepared a paper that is expected to go to the commission by next month seeking guidance on a possible rulemaking to allow moderator exclusion on a more widespread basis than is currently allowed under the regulations.

Albert Machiels of the Electric Power Research Institute, or EPRI, told the committee that staff's requirement for fuel burnup measurement is "a highly sensitive issue for utilities" because it poses "a significant operation burden" that has no safety justification. Burnup is already measured in the core during reactor operations, he said, and those measurements are of higher quality than in-pool measurements. Furthermore, he said, there is "no known instance of a safety concern related to the use of burnup data."

Machiels also presented data from an EPRI study of the impact of misloading fresh and underburned fuel assemblies. Eight assemblies with 5% initial U-235 enrichment burned to 25 gigawatt-days/metric ton uranium would need to be loaded into a canister intended for fuel burned to 45 gwd/mtU before the reactivity potential reaches 0.95, still leaving a 0.05 margin before criticality would be achieved, he said. While only two fresh fuel assemblies would need to be misloaded into the same spent fuel canister for the reactivity level to approach 1.0, he said, spent fuel loading campaigns generally are conducted in the middle of the cycle when no fresh fuel would be present in the pool.

The parties each said progress was made when they met last October to discuss burnup credit in detail (NuclearFuel, 23 Oct. '06, 11). Redmond said the issue does not have the highest priority because widespread transport of US spent fuel is still years away. But another industry official noted last week that "opening seal-welded canisters is a big problem. That's what makes this urgent now."

*—Maureen Conley, Washington*

# NRC, industry revising guidelines for treatment of PRA uncertainties

NRC staff and industry are developing and revising their guidance on the identification and treatment of uncertainties in power reactor licensee probabilistic risk assessments, but much work remains to be done by the end of the year, when new NRC guidelines for assessing PRA quality take effect.

Beginning in January 2008, NRC staff will use Revision 1 of Regulatory Guide 1.200, issued in January 2007, to determine the technical adequacy of licensee PRAs used to support licensing applications submitted to the agency. Industry has expressed concern about the NRC staff's approach to uncertainties in licensee PRAs and the models that calculate those PRAs. At a June 14 public meeting of NRC's PRA leadership team, Biff Bradley, risk assessment director at the Nuclear Energy Institute, said that industry is "uncertain what we need to do now" about PRA uncertainties, "and the clock is ticking." Ken Canavan, program manager for risk and asset management programs at the Electric Power Research Institute, said at that meeting that industry does not currently know what its peer review teams should look for when reviewing potential sources of uncertainty in licensee PRAs.

At a July 10 public meeting at NEI, Mary Drouin of the probabilistic risk assessment branch at NRC's Office of Nuclear Regulatory Research said the agency will issue for public comment in late August a draft regulatory document, Nureg-1855, on the treatment of uncertainties in risk-informed decision making. Nureg-1855 will "provide guidance on how to treat uncertainties in PRA in risk-informed decision making," and will address "parameter, model, and completeness uncertainties," Drouin said in slides accompanying her presentation. The Nureg "identifies and describes the different classes of sources of uncertainty" and how they should be addressed by licensees, she said.

The three-month public comment period for the Nureg may be extended to December, and public meetings will be scheduled in September, October, and January to discuss the Nureg and public comments, Drouin said. Nureg-1855 will be issued for use in March 2008, and will be referenced in Revision 2 of RG 1.200 when that revision is issued in December 2008, she said.

## RG 1.200 clarification

NRC staff is also finalizing a "clarification" of criteria in Revision 1 of RG 1.200 for handling PRA uncertainties, Drouin said. That clarification, which she said will "provide additional explanation ... regarding the staff's regulatory position with respect to the treatment of sources of uncer-

tainty," will be published as a Federal Register notice as early as the week of July 23. The clarification is being issued partly because the American Society of Mechanical Engineers (ASME) PRA standard "is too subjective" on how to address uncertainties, "and consequently, it is difficult to demonstrate compliance," she said.

Drouin outlined some staff concerns about the ASME standard, such as "the scope of sources of uncertainty is not limited" with appropriate definitions. Thus, "even a very minor change could be categorized as an impact on the PRA results" and "every source and assumption could be considered 'key'," she said. Staff's position is that there need to be "numerical criteria appropriate to an application rather than ambiguous qualitative words," Drouin said.

"The sources of uncertainty and assumptions in the base PRA only need to be identified and characterized," and "the impact of sources of uncertainty and assumptions only need to be evaluated in the context of an application so that when the PRA is used to support an application, their impact on the PRA results used to support the application are understood," Drouin said in her presentation.

At the meeting, NRC staff and industry representatives reviewed the draft Federal Register notice and agreed upon a number of wording changes. However, Drouin declined a request by an industry representative to review the draft notice again before it is published.

### EPRI guidance

An appendix in Nureg-1855 will provide NRC staff positions on PRA uncertainty guidance that was developed for industry by EPRI, Drouin said. The staff position on these documents is "still being formulated," and NRC is "working with EPRI to address staff concerns," she said. Staff would like to work out its technical differences with industry on the EPRI guidance before August, which should be feasible given that there are no policy disagreements, she said. Drouin had said at a June 19 meeting of NRC's PRA steering committee that "80% to 90%" of NRC staff's technical problems with the EPRI guidance had been resolved.

However, NRC staff still has concerns about current industry guidance on PRA uncertainty, as provided in an EPRI December 2004 technical basis document and October 2004 applications guide, in three areas: "identification and characterization of uncertainty and assumptions, assessment of modeling uncertainties and assumptions, [and] assessment of parameter uncertainties," staff said in presentation slides from the meeting. For example, it is "not clear there is guidance to identify unique sources [of uncertainty] associated with the plant model of the PRA," staff said. Also, staff said, "guidance for choosing sensitivity studies is too general" and "guidance for interpretation of results is insufficient."

The EPRI guidance documents will be revised to account for NRC staff issues and concerns, Don Vanover of ERIN Engineering said at the meeting. In the revised guidance, the list of sources of model uncertainty will be "enhanced," criteria for both base PRA models and use of PRA in specific applications revised, and additional clarification and corrections made, including some related to the development and use of sensitivity studies, Vanover said in his presentation.

Canavan said at the July 10 meeting that EPRI has already begun revising its guidance documents, but will "need to scope out the whole job again" after hearing staff's concerns. EPRI would like to have a meeting with NRC staff "as early as the beginning of August" for technical discussion of these issues, Canavan said. EPRI plans to issue the revised guidance by the end of the year, and will make the documents available to NRC staff six weeks prior to issuance so they can be reviewed for endorsement in Revision 2 of RG 1.200, Canavan said.

Drouin praised industry for its hard work and "tremendous progress" on revising its PRA uncertainty guidance. She said she could "see a convergence on an agreement" between agency staff and industry "on all these technical issues."—*Steven Dolley, Washington*

## ACRS approves guidance on post-fire operator manual actions

A draft nuclear regulatory document on assessing operator manual actions for post-fire safe shutdown, which has raised objections from industry, should be published for use, the NRC's Advisory Committee on Reactor Safeguards said in a letter released last week.

ACRS Chairman William Shack said in a July 13 letter to NRC Executive Director for Operations Luis Reyes that revisions made by agency staff to draft Nureg-1852, which was discussed at the committee's July 11 meeting, "have addressed our concerns satisfactorily," and the revised Nureg "should be issued as final."

In a June 18 letter to Reyes, Shack said the ACRS had several suggested revisions to the draft Nureg, including the addition of discussion of "the potential use" of "methods from risk assessments and human reliability analyses that can be adopted to help structure this judgment" of the feasibility and reliability of operator manual actions. The Nureg should also specify that "a detailed evaluation using the criteria in Nureg-1852 will not be required" in the "many cases" where "ample time for action will be available." The Nureg should also provide advice regarding the skills required by industry teams that would determine the time margin required for specific operator manual actions to be implemented, Shack said.

In her presentation at the July 11 meeting, Erasmia Lois of NRC's Office of Nuclear Regulatory Research said that the staff had added text to the draft Nureg-1852 stating that "risk assessment and particularly human reliability techniques may be useful for identifying the range of fire scenarios and related contexts and the possible operator manual actions that might be used," but "the use of such risk-informed techniques is not required."

Language was also added stating that "it is expected that for many cases, where extra time is clearly available and the actions are relatively simple, evaluating the criteria will be straightforward, requiring only simple justification and

analysis," and that "not all of the criteria will usually require significant analysis or even be applicable," Lois said in her presentation. A section was also added to Appendix B "summarizing the characteristics and types of expertise that would be appropriate for a panel" estimating required time margins for operator manual actions, Lois said.

Industry had objected to an earlier draft of Nureg-1852 as unworkable, saying it represented an NRC staff effort to resurrect review criteria for operator manual actions that the commission had rejected when it terminated a related proposed rulemaking in January 2006 (INRC, 5 March, 6). Industry representatives did not give a presentation or make public comments at the July 11 ACRS meeting.

Paul Gunter, formerly head of the Reactor Watchdog Project at the Nuclear Information and Resource Service and now representing a new anti-nuclear group called Beyond Nuclear, told the ACRS at the July 11 meeting that he is concerned that operator manual actions are "being proposed to supplant physical fire protection measures" required by NRC regulations at power reactors, which "constitutes a significant diminishing in defense in depth." Gunter also criticized what he called "a retreat" by NRC staff from a conservative time margin criterion it had proposed in an earlier draft of Nureg-1852 (INRC, 11 June, 13), and characterized the Nureg's proposed criteria as "a U-turn" from current fire protection regulations specified in Appendix R of 10 CFR 50.48.

Gunter said that "action is being taken before bounding the scope of the problem" because NRC staff does not even know how many operator manual actions currently exist in licensee fire protection procedures.

Alex Klein of the fire protection branch at NRC's Office of Nuclear Reactor Regulation disagreed with Gunter, saying at the meeting that the staff is not proposing changes to the Appendix R rule. Rather, Klein said, Nureg-1852 "will put in place a consistent set of criteria for the staff to use to evaluate operator manual actions." Phil Qualls of NRC's fire protection branch said that the staff has never claimed that operator manual actions are "equivalent" to physical fire barriers required by Appendix R. "There were some pretty bad examples" of operator manual actions found during NRC inspections, Qualls said, and "we need some standard" to assess such action.—*Steven Dolley, Washington*

## TN critiques TAD specifications, calls for additional spec changes

A spent fuel cask vendor last week gave DOE high marks overall for managing the development of the transportation, aging, and disposal canister, a concept known as TAD, but suggested additional changes are necessary to make the TAD more widely deployable at utility sites.

Robert Grubb, senior engineering vice president for Transnuclear Inc., briefed NRC's Advisory Committee on Nuclear Waste and Materials, or ACNW&M, July 18, offering a cask vendor's view of the DOE final performance specification issued June 19. DOE issued a request for proposals, RFP, from cask vendors July 11, with responses due August 24. The department said it expects to award up to four firm fixed-price contracts and wants the canisters to be available for commercial use as early as 2011. DOE expects that up to 90% of commercial spent fuel could be placed into about 7,500 TAD canisters.

From the beginning of the program, cask vendors have been calling on DOE to increase the capacity of the TAD, currently specified at 21 PWR assemblies or 44 BWR assemblies. DOE has said that the capacities could increase over time through future amendments; the industry standard is now 32 PWR assemblies and about 68 BWR assemblies. Grubb said higher capacities would make the system more economical for utilities, reduce total dose, reduce the number of shipments, allow for smaller footprints in the storage and aging facilities, reduce the number of transfers to the repository, and reduce the space required in the repository.

In addition, Grubb said, operations and systems costs could be reduced if DOE allowed higher dose rates at the vents of the aging overpacks that will be used at the repository site. That would allow fuel with higher heat loads and shorter cooling times to be shipped to the aging facility and allow more economical aging overpack designs, he said. Grubb also called on DOE to allow horizontal storage at the aging facility. TN owns the certificate of compliance for the horizontal Nuhoms storage system, which Grubb argued offers considerable benefits over vertical casks certified by other vendors.

Other concerns include DOE's insistence on using borated stainless steel as the neutron poison. Grubb pointed out that a code case would be needed to allow structural credit for the material. Industry officials say borated stainless steel has only been used in dry storage casks on a limited basis in the US, and has never been given structural credit. While it is used throughout Europe, according to officials from Holtec International, it is manufactured there using a different process that is considerably cheaper than the powdered metallurgy process DOE has specified for the TAD canister. One official said borated stainless steel is a factor of three to eight times more expensive than regular stainless steel.

Grubb also pointed to issues with the 1 million-year earthquake that the TAD canister and the aging overpack must be designed to withstand without tipping over and without anchorage. The 1 million-year earthquake requires vendors to demonstrate the system can withstand 3 g, compared to the 1.5 to 2 g accelerations NRC has seen in certified storage systems, he said. Therefore, vendors may need to use methodologies that NRC has not yet seen or approved, he said. Given those requirements, Grubb said, vendors will need to either "tie down" the casks or be prepared to "get out of the way" if such a large magnitude earthquake were to occur. He said the apparent solution is to add 50,000 to 100,000 pounds to the aging overpack and increase the thickness of the basemat, adding to the cost of each.

Further, Grubb said, the DOE spec requires vendors to demonstrate that the TAD canister can withstand a 1,720 degree F fire, while NRC's 10 CFR Part 71 regulations require applicants to show their systems can withstand a 1,425

degree F fire — again necessitating NRC review of analyses and methods that may not have been previously reviewed and approved. He also called on DOE to increase the repository's thermal load in order to allow for increased capacity in the TAD canisters.

DOE's specification will require a great deal of final design work in a short period of time, Grubb said, as vendors are expected to deliver preliminary safety analysis reports for transportation and onsite storage to DOE by January 31, 2008, with final reports due by August 15, 2008. Those documents are to be submitted to NRC by September 30, 2008, according to the RFP, and vendors must obtain NRC certification of the systems by December 31, 2010. The more vendors can use previously approved methods in their submittals, the faster NRC will be able to complete TAD reviews, he said.

Grubb suggested the focus on certifying TAD systems could slow down NRC review of other critical storage and transport applications. By his count, Grubb said NRC cask licensing staff is currently reviewing 13 storage applications or amendments and five transport applications or amendments. TN alone could add three additional storage and four additional transport submittals, he said, including its TAD submittals. "TAD operation by 2012 is possible but will be difficult considering the current state" of the industry's and NRC's work load, he said.—*Maureen Conley, Washington*

# DOE, NRC sign memorandum spelling out agencies' GNEP roles

NRC and DOE reached an agreement this month for work on the Global Nuclear Energy Partnership, specifying the kinds of cooperation the two agencies are to undertake in connection with DOE's effort under GNEP to develop new types of reprocessing plants and fast reactors.

A memorandum of understanding was signed July 13 by NRC Executive Director for Operations Luis Reyes and Paul Lisowski, DOE's deputy assistant secretary for fuel cycle management.

DOE and NRC have not specified NRC's role in regulating the department's work on the reprocessing plant and fast reactor demonstration facilities. DOE has not yet settled on key parts of its plans for those facilities, including their size and the role of private industry in developing them.

GNEP also includes an advanced fuel cycle facility, or AFCF, a research center for developing the fuel the fast reactors ultimately would use and for improving fuel-cycle technology. According to the MOU, the AFCF would be a DOE-controlled and -operated facility that is not subject to NRC licensing.

Under the MOU, DOE will give NRC "information on advanced recycling technologies, permitting NRC to evaluate [their] licensability." According to the July 17 DOE press release announcing the MOU, the information will help NRC develop licensing criteria for GNEP facilities.

NRC will also participate in and observe DOE tests, simulations and demonstrations; review and provide feedback to DOE on GNEP reports and engineering studies; make facility tours; and provide annual reports to DOE on work performed under the MOU, the document said.

According to a June 1 NRC internal memo — which was released along with the MOU July 17 — a separate interagency agreement and statement of work will developed for particular activities under the MOU and will be funded under a "reimbursable agreement" with DOE.

NRC officials have emphasized that, by law, the agency cannot collect money from DOE for activities directly related to NRC's regulation of DOE facilities. Technical exchanges and the other work covered under the MOU are not considered to fall into that category.

The MOU says that DOE "will provide NRC with current information on prospective options for the GNEP facility design and technology (including, as appropriate, engineering, safety, safeguards and security analyses and data), as well as the technology development programs and plans, and schedules that support those options."

According to the MOU, one of NRC's responsibilities is to think about the ways in which it would need to adapt or develop its licensing requirements for GNEP facilities. Last month, the commission directed the staff to start that evaluation, but in a very limited way (INRC, 9 July, 1). The MOU also says that NRC also is responsible for developing preliminary estimates for resources that "may be needed in the future for GNEP."

In July 17 comments to a panel of the National Academy of Sciences, NRC Chairman Dale Klein said the agency has to "move in parallel" with DOE. After briefing the NAS panel, he told reporters there is "so much uncertainty" about the level of funding DOE is going to receive for GNEP and about what technologies DOE would choose for the program, if it is funded.

NRC had requested fiscal 2008 funds for GNEP work, but the White House Office of Management and Budget removed that item from the final version of the budget request, according to an NRC staff paper (INRC, 11 June, 1).

Klein said he was "surprised" at OMB's argument that NRC's GNEP work should be funded by industry. At this point, there is enough uncertainty about the program that it would have to be government-funded, he said.

## Licensing questions

According to the MOU, the NRC-DOE cooperation "will lay the basis for developing and quickly implementing a regulatory structure, should NRC be responsible for licensing and regulating any GNEP facility."

One unresolved question that may affect NRC's regulatory involvement is the size of the GNEP facilities that DOE plans to build. When the department originally unveiled GNEP in February 2006, the program was presented as a research and development program to be carried out primarily at DOE's national laboratories and involving demonstration facilities before moving to commercial scale. But in August, DOE revised its approach, aiming to bring in the private sector at an earlier point and to go directly to commercial-scale facilities.

The request for expressions of interest that DOE issued at the time referred to a facility with a nominal capacity of 2,000 to 3,000 metrics tons of spent fuel, although the department emphasized that the parameters could change in response to industry input. Current commercial reprocessing facilities in France and Japan have throughputs of about 800 mt/yr.

Recently, DOE has indicated more strongly that it might not jump immediately to such a large-scale facility. At a July 18 meeting of the Advisory Committee on Nuclear Waste and Materials, DOE's Daniel Stout emphasized that the department has not said it will build a 3,000 mt/yr plant. An alternative, he said, is to follow a strategy of "deploy small and grow."

But after the meeting, Stout, who is DOE's director of light water reactor spent fuel separations, said the smaller version of the plant could still be as large as 800 mt/yr. He made the comment during a joint interview with Joseph Giitter, the head of the special projects directorate in NRC's Office of Nuclear Material Safety and Safeguards.

Some observers have said it is likely a commercial-scale reprocessing plant would have to be licensed by NRC (INRC, 21 Aug. '06, 1).

Both Giitter and Stout indicated that a key factor, more important than the size of the facility, is the role of the private sector. Giitter said he expected that private-sector involvement, even if the facility were on a government site, would trigger NRC oversight, barring a congressional directive to the contrary.

The June 1 NRC memo says, "Currently, DOE's implementation strategy relies on the involvement of private companies to commercially construct and operate" the fast reactor and reprocessing plant. Such facilities, the memo says, "would be subject" to the NRC's regulatory authority.

The hedged language in the MOU, Stout said, is so that DOE can "preserve its option" to build, for example, a smaller-scale facility on a DOE site without private-sector involvement.—*Daniel Horner, Washington*

## California group wants hearing on Diablo Canyon assessment

San Luis Obispo Mothers for Peace is continuing to press NRC's commissioners to hold a hearing on the supplemental environmental assessment the staff prepared on potential terrorist attacks at the Diablo Canyon independent spent fuel storage installation, or Isfsi. In separate filings this month, Pacific Gas & Electric and the staff both argued such a hearing is not necessary. Mothers for Peace replied by reasserting its belief that the supplement does not contain sufficient information for its adequacy to be evaluated.

NRC staff published a draft EA supplement May 29 (NuclearFuel, 4 June, 11), saying that its security requirements combined with the design requirements for dry storage casks provide adequate protection against successful terrorist attacks at nuclear power plants. The supplement responds to the US Court of Appeals for the 9th Circuit, which last year ruled that NRC could not exclude terrorist attacks from its analysis of environmental impacts under the National Environmental Policy Act, or NEPA. The court rejected NRC's argument that the possibility of a terrorist attack was "too remote and highly speculative" for consideration under NEPA and remanded the case to NRC for further action, while acknowledging the agency's wide discretion in determining how to fulfill its NEPA responsibility. In January, the US Supreme Court declined to hear Diablo Canyon owner/operator PG&E's appeal of the case.

PG&E argued in its July 9 filing that the five contentions Mothers for Peace filed June 28 do not meet the standards for amended or late-filed contentions. The intervenor group argued that NRC staff failed to describe the methodologies used in its analysis or to provide the underlying data on which it relied, and sought access to the security studies NRC used in developing the supplemental EA. PG&E said that contention "fails to establish any specific litigable issue and seeks relief that is inconsistent with the commission's direction in this case" as laid out in orders to the staff.

Counsel for NRC staff argued in a July 13 response that much of the analysis relied upon documents that are classified or contain safeguards or sensitive unclassified non-safeguards information, and therefore must be protected. The brief cites a legal precedent allowing the conduct of "limited NEPA proceedings, which will satisfy the agency's obligations under NEPA, while preserving the confidentiality of protected information." The 9th Circuit Court cited that precedent when it remanded the case to NRC for further action, the brief noted. The commission, in its orders to staff, recognized some underlying information might need to be withheld. But Mothers for Peace did not "provide any basis for an argument that the information that is in the EA is inadequate to explain the fundamental rationale for" the staff's determination that no environmental impact statement is required, the staff's response said.

Mothers for Peace also faulted the EA supplement for failing to identify plausible attack scenarios. But the utility argued that was never the purpose of the supplement. The purpose, according to PG&E, was to "assess whether an attack must be considered and, if so, the environmental impacts of an attack." The staff made that assessment, and determined that the likely resulting dose from plausible scenarios is below 5 mrem, which is bounded by the design-basis accidents included in the original EA, PG&E argued. The utility further said Mothers for Peace did not meet the burden of showing plausible events could result in significant offsite consequences, instead only asserting that the staff's analytical process was "poorly described."

The staff countered that the supplement does reference specific threats and, while details were limited, provided sufficient information to describe a general methodology. "Notwithstanding [Mothers for Peace's] desire that the staff disclose additional information, the protection of sensitive security information is required by law and, as recognized by the Ninth Circuit, cannot be disclosed even to satisfy NEPA," the staff brief said.

Mothers for Peace further contended that NRC failed to consider credible threat scenarios with significant environ-

mental impacts, which it supported with a report describing scenarios that would result in greater environmental damage than the NRC supplement considered. That report asserts that a relatively small group of attackers could successfully penetrate several storage canisters and use an incendiary device to ignite the spent fuel's zirconium cladding, dispersing cesium-137 that would render a 7,500-square kilometer area uninhabitable.

But the utility argued that the contention "simply presumes an attack on the Isfsi and asserts that the consequences ... would be significant," without addressing the likelihood of a successful attack. In contrast, the staff's analysis asserts that the probability of an attack is "very low." And neither NEPA nor the 9th Circuit decision "compels the NRC to litigate — to some definitive conclusion — the question of the likelihood of success" of the proposed scenario. The utility further asserts that NRC's physical security requirements protect against the type of sabotage outlined in the Mothers for Peace report.

The staff replied that the contention "fails to provide any foundation" for its claim, countering that NRC screened threat scenarios to determine plausibility, looking at such factors as iconic value, complexity of planning required, resources needed, execution risk, and public protective measures. Regarding the Mothers for Peace report, the staff brief said, "it would not be appropriate for the staff to respond, in a public NEPA document, to claims regarding specific threat scenarios." While Mothers for Peace may speculate as to what scenarios were considered, NRC said, "mere speculation is not sufficient to support a contention in a hearing."

The group contended the supplement further violated NEPA because it did not look at cumulative impacts of the Isfsi together with the high density spent fuel storage racks in the Diablo Canyon pool, something the utility calls "a clear attempt to bootstrap the previously licensed wet storage at Diablo Canyon into this licensing proceeding" for the Isfsi. But the matters are separate, PG&E argued, and the contention has already been raised and dismissed.

Staff argued that cumulative impacts were considered under the original EA for the facility, even if that document did not specifically address terrorist threats. Because staff determined in the supplement that terrorism will not result in significant environmental impact, the brief reasoned, that original determination "remains unchanged and cumulative impacts were not addressed again" in the supplement.

### Group responds

In a July 18 reply to the utility's and staff's opposition to its contentions, Mothers for Peace reiterated its belief that the supplemental EA "completely fails to document or explain the basis for its conclusion that intentional attacks on the Isfsi would have no significant environmental impacts." The brief characterizes the opposition briefs as arguing that, in order to protect sensitive information, NRC staff "was entitled by law to prepare an environmental analysis as vague and unsubstantiated as the EA supplement" and that the supplement "did provide enough information to allow a meaningful evaluation of the environmental impacts" of intentional attacks on the facility. But neither party has shown that Mothers for Peace failed "to raise a genuine and material dispute of fact or law regarding the adequacy of the EA supplement to satisfy NEPA," the group argued.

Accusing the staff of justifying deficiencies in the EA based on the legal necessity of protecting sensitive information, the group says the staff "ignores other important principles of NEPA and NRC regulatory policy for use of protected information in licensing decisions, which do not permit the staff's wholesale and unjustified refusal to disclose the basis for the EA supplement." Mothers for Peace argues that making federal agencies accountable to the public for environmental decisions is "one of the cardinal purposes of NEPA."

Furthermore, the group asserted, the Freedom of Information Act requires NRC, when possible, to disentangle sensitive information from nonsensitive information to allow release of the latter, or provide specific justification if it does not. In licensing hearings, Mothers for Peace added, NRC regulations allow interested parties to seek access to relevant classified and safeguards information under appropriate procedural protective measures. Further, unlike in the legal precedent NRC cites, in this case staff has shared much of the withheld information "with nuclear licensees and nuclear industry lobbyists. Thus, it would be extremely unfair for the NRC to hide the information from the public to the extent of refusing even to identify the information so that it could be requested in the discovery process."

Mothers for Peace further argues that staff's reply shows there are genuine and material disputes regarding the adequacy of the staff's rationale for withholding information "because the staff has completely failed to provide specific information regarding the nature of the withheld information or to attempt to justify withholding it." The group further asserts it raised a genuine factual dispute regarding whether the information provided is adequate to support meaningful review.

The group concludes the objections raised "are without merit. The commission should admit the contentions and hold a formal adjudicatory hearing on the adequacy of the EA supplement."

NRC received comments on the draft supplement from more than 30 individuals, groups, or units of government, including the states of Utah and Nevada by the June 28 deadline. Staff has 60 days from the deadline to review the comments and finalize its draft. The commission set a target of finalizing a decision on the March 2004 site-specific Diablo Canyon license — either reaffirming, revoking, or conditioning it — by February 2008.

*—Maureen Conley, Washington*

## Exelon working with Rosenergoatom on emergency preparedness

A bilateral program of cooperation on emergency preparedness issues between Exelon Nuclear and Rosenergoatom, the Russian nuclear utility, is providing ben-

efits and insights to both parties, James Meister, vice president of operations support at Exelon Nuclear, said in an interview last week.

Last summer, a Russian delegation visited Exelon Nuclear's Chicago headquarters and expressed interest in emergency preparedness and security issues, areas in which the Russians understood Exelon Nuclear was "strong," Meister said July 16. That fall, Rosenergoatom invited Exelon Nuclear officials to attend an emergency preparedness exercise and visit the Novovoronezh nuclear power plant in Voronezh Oblast, Russia, Meister said.

In June, a Russian delegation attended an NRC-graded emergency preparedness exercise at Exelon's Byron station in Illinois, and toured the company's technical support center and emergency operations facility. Members of the delegation included Igor Gorelov, head of the Rosenergoatom Crisis Center; Nina Ivanova, division head of Rosenergoatom's International Relations Department; and Vladimir Povarov, deputy chief engineer at the Volgodonsk nuclear power plant.

The visitors "dove deeply" into the exercise, observing Exelon Nuclear's preparation for NRC review and the agency's critique of the exercise, Meister said. Members of the Russian delegation told Exelon Nuclear representatives that they were "very impressed with how self-critical we are, with the integrity of the critiques, and with how much we learn from each exercise," Meister said. After the visit, Rosenergoatom and Exelon signed a five-year bilateral agreement to share information and best practices in emergency preparedness and response, he said.

Under the agreement, Exelon Nuclear and Rosenergoatom will share emergency procedures and "tools to display information in emergency response facilities," Meister said. "Vendor-owned software" and security information will not be shared under the agreement, he said.

No financial or other compensation is being provided by either party under the agreement. "This is good will in both directions," Meister said.—*Steven Dolley, Washington*

## INTERNATIONAL REGULATION

# Scientist charges Japan regulator left 'loopholes' in seismic rules

A dissident former member of the Japan Nuclear Safety Commission's panel that recommended the tightened nuclear seismic guidelines issued this year told reporters July 20 that the guidelines were "still very insufficient" and contained "loopholes" allowing reactor owners to avoid making seismic upgrades.

Katsuhiko Ishibashi, a seismologist at the Research Center for Urban Safety and Security at Kobe University, and a former member of the NSC subcommittee, said many of Japan's 55 power reactors do not meet seismic safety criteria established by the Agency for Natural Resources and Energy, a division of the Ministry of Economy, Trade and Industry. The METI criteria, for example, stipulate that nuclear power plants should be built on solid rock beds. Ishibashi said that many plants are built on young, soft rocks.

On July 16, the Niigata earthquake caused a short circuit in an electrical connection on a Kashiwazaki-Kariwa-3 transformer, one Japanese safety official said. The short circuit resulted in an oil fire. According to the official, preliminary investigation suggests that the quake had caused soft ground under the transformer and the affected electrical equipment to slip, causing separated cables to contact and triggering the short circuit.

Unlike NSSS and turbine equipment at the site, he said, the power off-take and transformer components were not required to meet the highest category of seismic resistance. The guidelines may be stiffened to require more equipment to meet these specifications, he said.

Ishibashi said that, while METI's general seismic safety criteria assume that reactor sites are selected on the basis of seismic studies, "actually, in most cases, the largest earthquakes are not considered" during these studies. Computer programs used to model earthquakes in such studies, he said, cannot account for all earthquake behavior.

Japan began building power reactors before advanced earthquake fault models were developed and before the science of plate tectonics was fully established, Ishibashi said. After the latest revision, he said, Japan's seismic guidelines still do not take account of large, so-called "great slab" quakes, which are difficult to predict. Instead, he said, consideration is limited to interplate earthquakes and active faults. "The possibility of large earthquakes in places without active faults has been ignored," Ishibashi said.

Ishibashi warned that infrastructural damage and chaos caused by an earthquake in the vicinity of a nuclear plant could make it nearly impossible for an accident at a reactor to be managed.

In their evaluation of the Niigata event last week, Japanese officials were less dramatic, but they suggested that some of the damage found by Tepco at the Kashiwazaki-Kariwa site underscored the risks that earthquakes posed for accident management. The smoky transformer fire at Kashiwazaki-Kariwa-3 burned for 1.5 hours, according to Japanese officials, because the fire brigade had difficulty getting there with all the other damage in the area.

During the first three days after the quake, Tepco made an inventory of 63 cases of damage to equipment at Kashiwazaki-Kariwa. The list included several cases of ruptured service water piping. This piping, under the current guidelines, is not required to meet the highest seismic standards. To protect the plant against the possibility that water supplies for fire-fighting may be interrupted, experts said, the guidelines may be amended to require that this piping meet seismic resistance criteria.

Ishibashi said that the recent revision of the earthquake guidelines incorporated the latest information for determining earthquake ground motion. However, he said, the new guidelines are in part "vague," and they may not be appro-

priately applied by authorities.

After new guidelines were drafted last year, he said, about 700 public comments were received by NSC. Many of the comments recommended changes to the draft, including objections that an active geological fault near the Shimane site was overlooked. But the committee "said it would not go back over the same debate again and refused to amend the draft," he said. "I recommended that changes be made, and due to my strong dissociation with the manner of the debate and with the final draft, I resigned from the committee during the course of the final meeting" in September, he said.

According to Ishibashi, Chugoku Electric Power Co. "claimed that it had established by detailed investigation that there were no active faults in the vicinity of the [Shimane] plant." In 2006, he said, Japan's regulator, the Nuclear and Industrial Safety Agency, NISA, and the NSC "endorsed this finding and approved construction of a third reactor at this site." Last June, however, he said, a research group including university experts "confirmed that a fault did indeed exist there [and] it became clear that a large earthquake, exceeding Chugoku's estimate, could occur at this location." This finding, Ishibashi said, "exposed a shocking level of incompetence in locating active faults on the part of both the power company and the screening authorities."

Application of the modified guidelines has already suggested that peak acceleration values may be greater than assumed under the original guidelines. In April, Hokuriku Electric Power Co. found that a March 25 earthquake near its Shika nuclear plant produced a PGA for 0.625 seconds of 0.71 g. Based on the original guidelines, peak ground acceleration during the so-called S2 or "extreme design earthquake" for Shika had been estimated at only 0.37 g. At the time of that quake, both Shika-1 and -2 were offline.

One year before, the Kanazawa District Court ordered Shika-2 shut, in part, it said, because it did not meet the requirements of the original Japanese design-basis earthquake of 6.5 on the Richter scale. Government-sponsored seismologists had concluded the year before that a quake measuring 7.6 could occur in the area of the plant. The court also faulted the methodology used in calculating the magnitude of earthquakes for the design basis. Japanese seismic experts, including Ishibashi, suggested to Platts that the court shutdown order may not have been justified, and the courts have since allowed the plant to operate pending Hokuriku's appeal.

In Ishibashi's view, the "most endangered nuclear power plant site in Japan" is the Hamaoka site hosting five BWRs owned by Chubu Electric Power Co. Hamaoka, he said, "is located just above the hypothesized huge fault plane of the impending [Richter scale] 8.0-class Tokai earthquake on the Pacific coast." A quake in that location is predicted by many Japanese seismic experts.

Chubu officials said that, using its latest earthquake model, regulators were satisfied that Hamaoka could resist an 8.0-class quake. The model did not, however, locate any asperities — points of contact between tectonic plates which could render an earthquake far more destructive — at Hamaoka. During the modeling, Chubu postulated asperities at six different locations away from the site where two plates may meet. "But not at the plant site," Ishibashi said. "An asperity could be located right there."

*—Mark Hibbs, Bonn and Tokyo*

# French quake experts to study structural effects of Japan tremor

A French experts' mission will go to Japan soon to study the earthquake that struck large areas of Niigata prefecture July 16, according to officials in Paris.

The mission is being organized at the request of France's Ministry of Environment, Sustainable Development and Town and Country Planning in order to assess the impact of the Niigata quake on structures in the quake zone, the officials said, asking not to be identified.

The mission will be organized by the French Association for Paraseismic Engineering, with the goal of gaining as much knowledge as possible from the Niigata earthquake, which damaged scores of buildings and caused malfunctions that threaten to keep the Kashiwazaki-Kariwa nuclear power plant down for a year (see story, page 1).

France operates 58 nuclear power plants similar in size to the seven units at Kashiwazaki-Kariwa. However, Japan is much more seismically active than are virtually all zones in France. But like many utilities worldwide, Electricite de France is being asked to reassess the risks that a major earthquake could pose to structures at its 19 reactor sites, as science provides more data and improved understanding of tremors.

The mission could leave as early as week after next, one official said. It is expected to be led by an Areva structural mechanics specialist, Jean-Francois Sidaner, and will include experts from other organizations, including the Institute of Radiological Protection and Nuclear Safety, IRSN, which has one of the country's premier seismic risk laboratories.

Edward Marc Cushing, of IRSN's Berssin seismic assessment unit, said that a post-seismic mission has to be conducted "neither too early, because things are disorganized, nor too late, because you will have lost the traces" of what happened.

IRSN published July 19 an information note on the Niigata quake (http://www.irsn.fr/document/files/File/dossiers/seismes/seisme_niigata_japon_16_07_2007.pdf) which shows, in a map, how close the quake's epicenter was to the Kashiwazaki-Kariwa site, only about 10 kilometers (about 6.2 miles). It was also only about 10 km under seabed, IRSN said.

The IRSN map shows maximum ground accelerations (Gal) registered in the area of the earthquake on July 17, in centimeters per second squared, with the highest value being 812.7. Cushing said that measurement came from an open area just south of the nuclear plant site. The highest

ground acceleration measurement within the plant site was around 680 cm/s2, according to earlier information from IRSN. The numbers correspond to 0.81 g and 0.68 g, respectively. Cushing said that 0.8 g is "very high," but that the highest accelerations ever measured are more than twice as high, corresponding to about 1.7 g.

The IRSN note said that the Japanese seismic-tectonic context is different from the French context in that in France, active faults are "much 'slower' [to react] and earthquakes of the same order of magnitude are much less frequent, even if they are considered possible" in zones like the Alps, Provence, the Pyrenees, and Alsace.

Cushing added that the area of Niigata is vulnerable in that the ground is composed of soft sediments, which are more susceptible to movement during an earthquake.

*—Ann MacLachlan, Paris*

## Swiss seismic hazard study 'will set standard' for Europe

A ground-breaking probabilistic study of seismic hazards for Swiss nuclear power plants, which found that those risks were significantly underestimated in the plants' design basis, were so surprising, one expert said, that Swiss nuclear safety authorities immediately ordered a new study to verify them.

The results of the first phase of the Pegasos study, the first of its kind in Europe and only the second in the world, will be "refined" over the next two years before safety authorities determine how to apply them in practice, according to officials participating in the process.

Despite some resistance to the new methodology used in the study, both within the expert community and — especially — from licensees whose plants are potentially affected, a European expert, Julian Bommer, said Pegasos has "set a standard" for earthquake hazard analysis that is likely to have a "ripple" effect throughout Europe.

The Pegasos study is part of a trend toward reassessment of seismic hazards worldwide, based on modern methods, Bommer said July 18. "Nuclear power plants were built in Europe in the 1970s and 1980s when seismic hazard assessment was in its adolescence. Now, when we are revisiting nuclear power plant sites using modern standards, we are coming out with generally higher levels of earthquake loading."

Because Pegasos' results are "robust," he said in a telephone interview, "the Pegasos scenario is likely to be played out at other places in Europe."

Bommer said the Pegasos methodology, first developed in the US, seeks to reconcile divergent results produced by different expert teams in a structured way. "With a broad team of experts and broad technical opinion, you end up with a bigger estimate of uncertainty bands than you previously assumed." When that uncertainty is factored into probabilistic seismic hazard assessments, or PSHA, it raises the level of risk to be taken into account in a plant's design basis earthquake, according to experts in seismic risk.

Hazards go up both because of randomness, or variability, in measured data and because of "epistemic uncertainty" stemming from the lack of data, which can be resolved only through expert judgment, Bommer said.

Faced with the Pegasos results, the Swiss Federal Nuclear Safety Inspectorate, HSK, has called for "transitional solutions" by which licensees can estimate the seismic risk for each nuclear plant and propose means to mitigate that risk.

In a summary of Pegasos, posted (in German) on HSK's web site (NW, 5 July, 8), HSK said the initial results indicated that seismic hazards are nearly twice as high as had been estimated in earlier studies.

But in light of the uncertainties of the results and the ongoing expert discussion, HSK said, in 2005 it had reduced the ground acceleration values to be taken into account in probabilistic safety analyses, PSA, by 20% from the values found by Pegasos. HSK said that the new values had nevertheless raised the peak ground acceleration of the earthquake to be taken into account in the new PSA for the Leibstadt BWR plant from 0.21 g to 0.31 g.

Swiss utilities funded the Pegasos study to the tune of about 10 million Swiss francs (about US$8.3 million currently), between 2000 and 2004. But "they are not so happy" with the results because they fear those will require significant backfits, said Bommer, professor of earthquake risk assessment at the department of civil engineering at Imperial College London.

Bommer, who was part of the Pegasos expert panel, said, "My position is that it's better to seek engineering solutions to the high motions, rather than discrediting the high motions."

Experts from Swissnuclear, the association of Swiss nuclear power plant operators that commissioned the Pegasos study, were not available for comment July 19. But in a document posted on its web site, http://www.kernenergie.ch, Swissnuclear said, "The real world hasn't changed with Pegasos" and noted, "Since the spread of results is broad, further scientific explanations and refinements are needed" before the results can be applied.

The HSK document said that with the Pegasos results, earthquake risks are expected to represent a larger share of the overall risks in the Swiss nuclear plants' PSAs than they did in earlier studies. But it added that the utilities must use "advanced" probabilistic analysis methods to determine with more certainty how plant structures and components would resist the effects of an earthquake, saying such work was ongoing intensively in Switzerland and internationally.

"They need to use more refined programs to analyze the resistance of components" and "a detailed study to [allow] fragility analysis," said Gerhard Schoen, an HSK expert.

He said that the PSAs are designed to "give insights where you can do risk-effective backfits," adding that the schedule for potential backfits "is defined individually" with each plant licensee.

Bommer said that new earthquakes bring new insights: "Every single earthquake we record surprises us. It always forces us to go back and rethink" earlier models. He said that the science is getting better, because uncertainty is now being reduced, "but the estimates in the 1980s were incredi-

bly optimistic," so new studies inevitably lead to higher earthquake risk estimates.

Bommer, who specializes in assessing earthquake risks at nuclear installations, said the new estimates don't necessarily mean massive backfits. "We need to work out a way for dealing with [the new estimates] at the plant. Diablo Canyon is an excellent example," he said. "It was built for lower levels of motion, but subsequently they found engineering solutions" to meet new criteria.

In its information note on Pegasos, Swissnuclear said, "Determination of earthquake hazard is an ongoing process, into which new knowledge is continuously being fed. Based on international experience with new earthquake hazard studies (US, IAEA), the expert discussions and interpretation work on Pegasos can be expected to last for some time yet."

Pegasos is the first full application to nuclear power plant seismic risks of the assessment guidelines issued by the US NRC as Nureg/CR-6372 in 1997, Bommer said. The first study, he said in a telephone interview July 18, was for DOE's Yucca Mountain repository project, and that study is being redone.

Nureg/CR-6372, an expert report, is entitled "Recommendations for Probabilistic Seismic Hazard Analysis: Guidance on Uncertainty and Use of Experts."

Bommer said that CR-6372, which is also known as the SSHAC report for the Senior Seismic Hazard Analysis Committee that developed it, prescribes four levels of how to organize technical expert panels, of which Level 4 "is the most complex and the most expensive," and in fact is significantly different from the first three. Basically, the first three use a so-called Technical Integrator to collect expert data, while in Level 4, according to a report for NRC, a so-called Technical Facilitator/Integrator "organizes a panel of experts to interpret and evaluate; focuses discussions; avoids inappropriate behavior on the part of evaluators; draws picture of evaluators' estimate of the community's composite distribution; [and] has ultimate responsibility for the project."

According to NRC documents, the SSHAC approach was developed after the Electric Power Research Institute and Lawrence Livermore National Laboratory came up with divergent PSHA results, preventing the selection of a reference probability to be used in determining the ground motion to be used in PSAs for plants in the eastern US. The SSHAC report was sponsored by NRC, DOE and EPRI.

After publication of the SSHAC guidance, a project was undertaken to use the new methodology to test "the issue of development of the seismic zonation and seismicity models for two sites: Watts Bar and Vogtle," according to an NRC document about the trial study. "It was found that the uncertainty generated by disagreements among experts could be considerably reduced through interaction and discussion of the data, and by concentrating on the elements common to all experts' interpretations," the document said.

However, the methodology has still only been used in the US on a trial basis, and then only on Levels 2 and 3.

*—Ann MacLachlan, Paris*

# Germany informs IAEA it's ready to hold regulatory peer review

Germany has informed the IAEA that it is ready to host an Integrated Regulatory Review Service, or IRRS, mission beginning in 2008, according to a statement released July 16 by the Federal Ministry of Environment and Nuclear Safety, BMU.

The announcement followed over a year of internal political battling between BMU's political leadership and four states, which expressed concern that the IRRS review would be used as a lever to shut reactors and strip the states of their constitutional regulatory powers.

BMU is led by Sigmar Gabriel, a politician from the formally antinuclear Social Democratic Party, SPD. The head of BMU's department of reactor safety and regulation is Wolfgang Renneberg, also an SPD figure. Four of five nuclear power-generating states, which carry out routine oversight at reactors under BMU's authority, are ruled by pronuclear Christian Democrat, CDU/CSU, parties.

Renneberg first invited the IAEA in 2005 to hold the review in 2006, arguing that a consolidation of regulatory powers under BMU would save resources and increase efficiency. CDU/CSU-ruled states then began firmly objecting to the initiative, and, by mid-2006, the IAEA had been informed by Michael Glos, the CSU politician heading the Federal Ministry of Economy, not to undertake any measures to hold the IRRS until German states and the federal government had resolved internal differences on how to proceed.

This year, according to some sources, the ice was broken after Matthias Machnig, a senior Gabriel aide without strong opinions about nuclear energy, intervened in the debate and overruled Renneberg, who CDU/CSU-ruled states claimed was ideologically committed to phasing out German power reactors.

The states and BMU came to an agreement on terms for holding the IRRS this spring (INRC, 10 April, 2).

One safety expert close to BMU told Platts that, during its interactions with the states this year, BMU had been told by consultants that, should an IRRS mission take place, it would discover that, as a consequence of BMU's programmatic efforts since 1998 to phase out nuclear energy, a few states, chiefly Baden-Wuerttemberg and Bavaria, "have more technical regulatory expertise than the federal government has." He said that, under Green regulators at BMU and at the Federal Radiation Protection Agency, BFS, "nuclear professionals have been harassed and transferred out of key positions. There aren't that many technical experts there left."

In April, it was agreed that Baden-Wuerttemberg would co-host the IRRS with BMU. Its regulatory bureaucracy had been evaluated in 2006 by a consulting commission for CDU/CSU-ruled states, the so-called ILK group, and found to be competent. Baden-Wuerttemberg thereafter agreed to co-host the IRRS.

The mission will be completed in 2010, the statement from BMU said. That implies that its conclusions will not be final until after the next German federal election. It will likely be held in 2009.*—Mark Hibbs, Bonn*

# Under pressure on Kruemmel, Vattenfall airs Brunsbuettel PSR

Nearly a year after Vattenfall Europe AG began battling with state regulators and intervenors to prevent disclosure of findings from a periodic safety review, or PSR, for its Brunsbuettel BWR, the utility agreed to disclose its contents last week.

The decision to air the report, which Vattenfall previously had asserted in court was proprietary, was made after the company faced public and political pressure over its handling of information about a transient at its Kruemmel BWR at the end of June.

Kruemmel suffered a short circuit and a transformer fire resulting in a reactor scram on June 28. Initial event reports, obtained by Platts, indicated that the scram resulted from an inappropriate response by the reactor protection system to the fire, which gutted one of two 380-kV transformers. A week later Vattenfall informed regulators that the scram was initiated by an operator not following procedures after smoke from the fire had entered the control room, and that backup feedwater systems were used to bring the unit to safe shutdown (Nucleonics Week, 4 July, 1).

Over the past two weeks, Gitta Trauernicht, Minister of Social Affairs and top nuclear regulatory official in the state of Schleswig-Holstein, has conferred with Sigmar Gabriel, Federal Minister of Environment and Nuclear Safety, BMU, the chief federal regulator, about the events at Kruemmel. On July 12 both said that state and federal regulators had initiated an investigation into Vattenfall's "reliability" to operate both Kruemmel and Brunsbuettel.

Both Gabriel and Trauernicht are politicians from the antinuclear Social Democratic Party. Both have made statements since the Kruemmel fire that they favor continuing with the German nuclear phase-out schedule and would not favor allowing life extension of older reactors, including the 30-year-old Brunsbuettel unit.

Industry sources said Vattenfall had poorly managed the information related to the Kruemmel event, but they charged Gabriel and Trauernicht with having taken political advantage of the affair to try to prevent Vattenfall and other owners from extending the lifetimes of older reactors. Decisions by federal officials about the lifetimes of four units, representing about 4,000 MW of installed capacity, are imminent.

The regulatory investigation is exerting great pressure on Vattenfall, these sources said. Under German nuclear law, its operating licenses for the reactors could be suspended indefinitely if regulators determine that the company does not meet certain yardsticks for professional knowledge and training.

Regulators said last week that discrepancies in the accounts provided by Vattenfall between June 28 and July 5 about what happened at Kruemmel, along with apparent errors committed by control room personnel, had prompted the probe.

## Vattenfall relents

In response to these developments, Vattenfall Europe announced last week that its CEO and chief nuclear officer would be replaced, along with personnel in the corporate public affairs department. In tandem with these moves, new management announced that the company would drop its legal case against the state and intervenors and make public the results of the Brunsbuettel PSR (NW, 19 July, 1).

In 1997, BMU set the requirement that a PSR be carried out for each German power reactor every 10 years. A PSR for Brunsbuettel has been carried out beginning in 2002. Since then, Vattenfall and Trauernicht's safety experts have been deliberating over how to handle about 600 deficiencies identified by the PSR.

The matter is sensitive now because, under the German phase-out schedule set in 2000, Brunsbuettel, if operated at full power, will be shut down in 2009. Vattenfall, however, has petitioned the federal government to allow it to transfer generation hours from other reactors to Brunsbuettel to keep it operating longer. A final decision is pending.

State regulators told Platts that regardless of how federal officials respond to the Vattenfall petition, before Brunsbuettel could operate longer, Vattenfall would have to accommodate regulators on all outstanding safety issues identified by the PSR.

One year ago, shortly after safety issues at Brunsbuettel were raised by regulators following a partial blackout at the Forsmark-2 BWR in Sweden, Trauernicht disclosed that regulators had found certain similarities in the array of electrical systems at Brunsbuettel, and that over 100 points raised by the PSR for that reactor were still unresolved after four years. A German environmental group, Deutsche Umwelthilfe e.V., or DUH, led by a former federal regulator, Rainer Baake, petitioned state regulators to release the PSR data. State regulators agreed, but Vattenfall then sued in court to protect data it said was proprietary. A lower court sustained objections raised by Vattenfall but the case in under appeal (INRC, 22 Jan., 7).

The list of unresolved safety issues identified by the PSR , as of June 30, 2006, can now be found on the state regulators' web site: http://schleiswig-holstein.de/MSGF/DE/Aktuelles/liste/Brunsbuettel.

The findings of the PSR are categorized on four levels of safety relevance, K1 through K4. K1 findings are "safety deficiencies requiring immediate resolution"; K2 findings are "deficiencies in meeting safety requirements that must be resolved in the near term"; K3 findings are "deficits in documentation needed for oversight that must be corrected in the longer term"; and K4 findings are "PSR documentation deficiencies that must be corrected in the longer term." In addition, there is a category K0 that is not defined.

None of the currently unresolved issues in the PSR are categorized as K1. The PSR identified 172 K2 deficiencies, of which seven have been resolved. There are 360 K3 deficiencies, of which 12 have been resolved. There are 160 K4 deficiencies, of which one has been resolved. For many of the issues, the summary report said, Vattenfall has filed reports to address deficiencies; regulators have not completed their review of these reports.

Separately, according to a review of the PSR, which DUH said it obtained from unidentified sources, the PSR found 66 issues categorized as K0, eight of which are still unresolved.

The summary of the PSR findings released by the state indicates that, after four years of discussion with regulators, Vattenfall has yet to document that it meets certain safety requirements related to source term; leak-before-break criteria; reactor protection system and instrumentation and control system functioning; material behavior in the pressure vessel and other components; and reactor response to external events such as earthquakes and fires. Vattenfall must also still document the effectiveness of safety systems under certain accident scenarios, the summary report shows.

*—Mark Hibbs, Bonn*

# Latin American, Spanish regulators to add reactor safety to forum

The Ibero-American Forum of Nuclear Regulators decided at its annual plenary meeting in Cancun, Mexico earlier this month to expand the international forum to include information and technical exchanges on nuclear power programs, according to officials in Spain and at the IAEA.

The 10-year-old Foro Iberoamericano de Organismos Reguladores Radiologicos y Nucleares has traditionally focused on radiation safety primarily surrounding nuclear medicine applications.

But at the annual plenary meeting of the group July 7 in Cancun, member states decided both to expand the forum's scope to include nuclear power programs and to increase member financial contributions to the forum's operation.

Founding members of the forum are Spain, Argentina, Brazil, Cuba, and Mexico. Uruguay has recently joined and Peru is attending now as an observer and may formally join the organization in the future, according to Spanish officials.

Only three of the South American members of the forum currently operate nuclear power plants — Argentina, Brazil and Mexico.

One result of the decision to expand exchanges regarding nuclear power plant safety will be a mission of the South American regulators to Spain this fall.

The Spanish nuclear regulator Consejo de Seguridad Nuclear, or CSN, said in a July 6 news that the South American members of the forum will visit, possibly in November, to study Spain's recently launched reactor oversight program (INRC, 9 July, 7).

Known as Sistema Integral de Supervision de Centrales or SISC, the CSN program is modeled on the US NRC's 7-year-old reactor oversight process.

The CSN said the mission will allow the South American regulators to become familiar with the comprehensive SISC as well as to view the CSN's accomplishments in public transparency. CSN says SISC is an example of those accomplishments.

CSN Chairman Carmen Martinez Ten made an official visit to Chile following the July forum in Cancun, CSN said. Martinez Ten met with officials from the Comision Chilena de Energia Nuclear, or Cchen, and members of Chile's presidential advisory commission that is evaluating prospects for a Chilean nuclear power program, CSN said. She also met with Chilean Energy Minister Marcelo Tokman, who told Martinez Ten that no decision on creating a nuclear power generation program in Chile would take place during the term of the current Chilean government, according to a Cchen press release. But the Spanish-Chilean collaboration could help Chile form an information base for future decisions on nuclear power, Cchen said.

### IAEA support

The Ibero-American Forum of Nuclear Regulators is supported through an extra-budgetary program of the IAEA's Department of Nuclear Safety and Security.

Tomihiro Taniguchi, IAEA deputy director general and head of that department, said in a telephone interview July 16 that the members of the forum "are expanding the scope" of the organization to address the new interests in nuclear power programs in Latin America.

Taniguchi said the agency is "willing and ready to support these countries" and noted the IAEA recently issued a document for countries considering developing nuclear power programs, called "Consideration to Launch a Nuclear Power Programme," which is available on the agency's web site: http://www.iaea.org/NuclearPower/Downloads/Launch_NPP/07-11471_Launch_NPP.pdf.

To date, the financial support for the Ibero-American forum has come mostly from in-kind contributions from its members. At the July meeting, members decided to increase their financial contributions to the forum. Although only in the range of "several tens of thousands of dollars," the cash contributions represent a "very good step forward," Taniguchi said.

Another official in the IAEA's safety department, Luis Lederman, said in a July 18 phone interview that one of the forum's main projects to date was last year's launch of the Ibero-American Network on Nuclear and Radiation Safety, a web-based network through which the various regulatory authorities can share information and training materials. Lederman said other projects are ongoing in the area of safety and security of radiation sources and in investigating probabilistic analyses of accidents involving radiotherapy.

*—David Stellfox, Brussels*

# Westinghouse pushes for reversal of NRC decision on Crossflow

Scrambling to stop NRC from suspending approval of a key document supporting the use of its Crossflow ultrasonic flow meter, or UFM, Westinghouse asked the agency to instead specify just the portions of the topical report where the NRC staff has concerns.

NRC's suspension of the topical report, which serves as the technical underpinning for the Crossflow UFM, would deal a blow to Westinghouse and likely have commercial ramifications. The decision, if it stands, would impact all new and future Crossflow applications. Still pending are license amendment requests for measurement uncertainty

recapture, or MUR power uprates, for Omaha Public Power District's Fort Calhoun and Constellation's Calvert Cliffs.

The NRC staff said in a summary of a May 1 public meeting between the staff and Westinghouse that there could be an impact on "a number of licensees" that plan to use the technology for MURs or support power recovery. MURs are classified by NRC as power increases of less than 2%

The meter clamps onto plant piping to more precisely calibrate feedwater flow that is used to calculate reactor power. But measurement discrepancies, or overpower events, that occurred between 2003 and 2005 prompted an NRC staff review of the Crossflow meter.

Westinghouse says it wants to resolve the three-year NRC review to lift the cloud that has been hanging over the use of the meters. However, Westinghouse sees a different path forward than the agency staff.

The original topical report was approved in March 2000, but as a result of the subsequent review, the NRC staff issued a new, draft safety evaluation on the Crossflow four months ago. In was in that document where the staff raised concerns and suspended approval of the report.

In a brief letter sent July 11 to Westinghouse, NRC's Stacey Rosenberg, chief of the special projects branch within the Office of Nuclear Reactor Regulation, said the staff was considering the request. Rosenberg did not indicate when the staff might make a decision.

At the May 1 meeting, representatives from Westinghouse and the Crossflow developer, Advanced Measurement Analysis Group Inc., told the NRC staff that when the device is properly installed and operated, it can measure feedwater flow rates within the uncertainty range stated in the topical report. Westinghouse said the draft safety evaluation of the topical report did not provide "sufficient detail" on the staff's concerns. Moreover, Westinghouse said in slides presented at the meeting, it is "unable to identify the NRC's underlying concerns during the several years' worth of meetings."

Westinghouse urged NRC to look at the plants where the meters are performing well and not just examine the meters that were improperly implemented. It said in the slides that NRC didn't have to reject the entire topical report. "The NRC can simply disallow use of that portion of the implementation approach in which they have concerns that need to be resolved," it said.

One possible way to resolve open issues is for NRC to allow for additional information to be submitted on a plant-specific basis, Westinghouse said. In a June 4 letter to NRC, Westinghouse said it believes information in the suspended topical report sections could be substituted with plant-specific information from applicants. Later, as part of a longer term effort, Westinghouse could update the topical report to include information "acquired during its investigations of plant performance problems," it said.

Westinghouse's competitor, Cameron's Check and Check Plus Leading Edge Flow Meters, or LEFMs, also came under NRC scrutiny several years ago. The two systems were approved by NRC in 1997 and 2001. But in 2002, several issues found with UFMs and their use in plants for determining thermal power drew NRC's attention.

In July 2006 NRC said it had finished its evaluation and found the performance of the Caldon LEFM UFMs to be consistent with the vendor's topical report. Caldon was acquired by Cameron in January 2006 and now goes by the name of the new owner.—*Jenny Weil, Washington*

## Earthquake ... *from page 1*

where they are built.

In Japan, the new earthquake standards, four years in the making, already were prompting backfits at 27 of Japan's 55 reactors, according to industry sources.

In the US, any application of new data to existing plants would be controversial given efforts by the industry to ensure regulatory stability. In 2004, during early site permit reviews, NEI protested a probabilistic seismic hazard methodology that included periodic update of seismic hazards from reference plants, saying requiring reassessments of those hazards during plant life would result in needless expenditure and would not provide the licensing "finality" envisioned in the licensing rule.

The quake, measured at 6.6 on the Richter scale, struck a large area in western Niigata prefecture at 10:13 am local time July 16. The quake killed at least 10 people, injured hundreds, made thousands homeless, and disrupted roads and utilities. Its epicenter was about 10 kilometers below the seabed off the Jo-chuetsu area in Niigata, also about 10 km from Kashiwazaki-Kariwa, whose seven BWRs came online between 1985 and 1997. The most recent Niigata earthquake, in October 2004, measured 6.8 on the Richter scale and its epicenter was about 80 km away.

Analysis by French expert organization IRSN showed onshore ground acceleration radiating out in a semicircle from a shoreline point close to Kashiwazaki. The strongest acceleration measured near the plant was 812.7 Gal (centimeters per second squared, about 0.81 g) with the rate attenuating as it approached Japan's mountainous central spine. Tepco said three station seismographs gave readings that ranged from 311 to 680 Gal (0.31 to 0.68 g). The Japan Atomic Industrial Forum said the applicable design-basis PGA ranged, depending on measurement point and direction, from 235 to 274 Gal (about 0.23 to 0.27 g).

### No damage to NSSS

Last week, Tepco released a series of reports on damage found, including a list of 63 items damaged. Experts said the damage was confined to components built to industrial seismic standards, less stringent than nuclear safety-related requirements. Damage was found in switchyards, storage areas, and systems such as service water piping feeding fire suppression systems. More than 100 low-level waste drums stacked in storage toppled over, and "tens" of them lost their lids, Tepco said.

Tepco reported that water in all seven spent fuel pools sloshed over pool edges and was found on floors. At unit 6,

some of the water seeped from the reactor building floor through a cable conduit and floor drain to enter a sump system, from which it was incorrectly flushed to sea. Tepco reported the 316 gallons were contaminated with 60,000 Becquerels, and later corrected that to 90,000 Bq, still well below regulatory limits but feeding worldwide media reports of "radiation releases."

Two days after the event Tepco also reported detecting radioactive isotopes of iodine, cobalt-60 and chromium-51 with a total activity of about 400 million Bq in the unit 7 ventilation stack. Tepco is investigating their origin but sources said the isotopes are thought to have come from venting condenser air that should have been filtered first. One source termed it "nearly certain" that the Cr-51 was emitted from the condenser. In BWRs, other experts said, Co-60 and I-131 or I-133 may also be found in trace amounts in condenser air that would be detected by sensitive monitoring equipment. Tepco "will be checking for fuel damage," one Japanese official said, "but these levels of iodine don't necessarily point to any cladding ruptures caused by the earthquake."

The most visible damage was an oil-fed fire in a unit 3 transformer, which burned 1.5 hours because local fire brigades had difficulty getting to it. The quake occurred on a holiday when the plant had minimal operating staff.

One expert close to the seismic standards review said last week that the new standards would be studied and amended if necessary, but termed it less likely that the review would prompt Japan's Nuclear Safety Commission to recommend that a more severe design basis earthquake become the standard for all Japanese reactors.

Revelation on July 16 that an active earthquake fault was located near the Kashiwazaki-Kariwa site, he said, did not itself point to a need to revise the guidelines. However, he said, some Japanese experts would argue in favor of such a change "because no one expected that the ground acceleration [registered at Kashiwazaki] would be that great."

## US requirements site-specific

NEI issued July 17 a one-page fact sheet saying US nuclear plants must be able to withstand earthquakes of a magnitude equivalent to or greater than the largest known earthquake for the region where they are located. "Japan requires that reactors withstand earthquakes of 7.75 on the Richter scale," NEI said. "The United States has similar requirements for US reactors."

NRC requires licensees to conduct an analysis of the geological, seismological, and engineering characteristics of a site in order to establish a so-called safe-shutdown earthquake ground motion, or SSE. The NRC regulations (10 Code of Federal Regulations Part 100.23) also require the development of "engineering solutions to actual or potential geologic and seismic effects at the proposed site."

NRC spokesman Scott Burnell said all plants must be able to shut down safely and maintain core cooling for an extended period. "The practical implications are that systems, structures and components relevant to safety must be able to withstand a safe-shutdown earthquake and continue to perform their function," he said.

For proposed new plants, the concept remains the same, Burnell said. "The safe-shutdown earthquake is site-specific," he said. "So if the site is proposed, it must be analyzed. The effect of that analysis will be to determine the strongest earthquake that has occurred over the past 10,000 years [at the site]. That is generally considered to be the safe shutdown earthquake."

The concept of the SSE emerged in the early 1970s and was codified into the federal regulations in 1973, according to a history of the requirements in Nureg/CR-6926;BNL-Nureg-77569-2007, published in March. In the late 1980s and early 1990s, the industry "conducted large scale programs to systematically investigate the seismic hazard and to apply state-of-the-art [probabilistic seismic hazard analysis] methodologies to obtain seismic hazard estimates for nuclear power plants in the Central and Eastern United States," the report said. The seismic hazard estimates developed as part of that effort were incorporated into an NRC regulatory guide (RG 1.165), which was published in March 1997.

But as companies began taking steps several years ago toward building new plants, by applying for early site permits to secure NRC assurance that a site was suitable for one or more reactors, there was concern about using the regulatory guide. The guideline contained a new, probabilistic assessment method for determining site ground motions, which NEI said in a November 2004 letter to NRC could result in "unpredictable and unrealistically high ground motion estimates for some prospective ESP sites."

## Performance-based approach tested

NEI argued that sites in the eastern US might be at a particular disadvantage. It said the probabilistic methodology could impact companies' decisions to move ahead with a new plant order. The industry recommended a "performance-based" approach for determining site-specific ground motions.

Exelon was the first to use a performance-based methodology for determining safe-shutdown ground motion in its Clinton ESP application. Exelon's decision to use the methodology cost it several months of additional review by the NRC, which had never before done such a performance-based review.

NRC's Reg Guide 1.208, issued in March, says the minimum PGA for any site, under 10 CFR Part 50, is 0.1 g. It discusses the problems in calculating site-specific hazard curves when the ground is soil, as it was at the Kashiwazaki site, rather than rock.

The guide also notes that new information may come to light while units are being built. "During the construction of nuclear power plants licensed in the past, previously unknown faults were often discovered in site excavations," and seismic reanalysis incorporating those faults was required before an operating license was issued, it said. With the advent of the untested combined construction permit-operating license, or COL, the reg guide says, such discoveries "should be mapped and assessed as to their rupture and ground motion generating potential while the excavations' walls and bases are exposed, and the NRC staff should be

notified when excavations are open for inspection."

"We are constantly looking at available information," Burnell said. "It's not based on Japan; it's an ongoing process. Anytime relevant data comes out, we'll take a look at it."

Burnell said the agency has a bilateral agreement with Japan and expects it will share the results of the earthquake effects with NRC. Although NRC staff has no plans to go to Japan, Burnell said, there's a standing group among several US government agencies — including the US Geological Survey and the National Science Foundation — that travel to sites of significant earthquakes shortly after an event to see what information can be gathered independently.

NRC staffers are meeting with representatives of the Electric Power Research Institute July 23-24 at EPRI's office in Palo Alto, California to discuss seismic issues related to siting new reactors. The meeting was scheduled in advance of last week's earthquake in Japan. *—Jenny Weil and Margaret Ryan, Washington; Mark Hibbs, Bonn; Ann MacLachlan, Paris*

## Planners of Pan American Games consider nuclear security aspect

The massive security at the ongoing XV Pan American Games in Rio de Janeiro includes a seamlessly built-in nuclear dimension.

This is only the second mega sporting event to have a nuclear security focus since the 2004 Olympics in Athens, Greece, "but its necessity is now increasingly recognized by governments," Anita Nilsson, head of the Office of Nuclear Security at the IAEA, told Platts. "All the signs," Nilsson said, "now clearly indicate that terrorists may target places where lots of people are gathered. Also, that even a crude explosive device able to disperse a relatively small amount of radioactive material, a so called 'dirty bomb', could cause not only long-lasting contamination but very considerable panic and trauma." Nuclear security is about preventing any type of incident or disruption. "The trick is for the nuclear component to be effective without being intrusive," Nilsson said. "That is, without obstructing or slowing the flow of people into a venue, any more than they would be by the overall security, but still being able to detect and analyze radioactivity on a person or in a vehicle. Security personnel, with a little training, can apply instruments and techniques to instantly eliminate what may be called innocent radiation signals, such as from medical diagnostic applications. Other signals not in that category can be quickly assessed by instruments that can analyze the radiation type."

The ONS has now finalized a publication, called Nuclear Security at Major Public Events, which is expected to be released this summer. It provides guidance on how to deploy the nuclear security element, though without revealing too much of what a would-be terrorist would find instructive. "It does however reflect what is actually being done for large gatherings, what is being increasingly implemented worldwide," Nilsson said.

In Rio an estimated 500,000 people may come to see the more than 5,000 athletes from 42 countries across the Americas compete in some 40 different sports from July 13-27. The nuclear element has been introduced via an ONS project set up early this year, in collaboration with Games organizers and national security authorities.

Nilsson said more planning time is preferable. Anything less than a year makes it more difficult, she said. For the next big event, the Beijing Olympics in summer 2008, talks have been going on since July 2006, and a formal corporation arrangement with China Atomic Energy Authority was signed this June.

Asked if the nuclear security dimension is expensive, Nilsson agreed it is. "But compare it with the cost of the whole security package that would be put in place at these events anyway, and it is a reasonable addition," she said. "And if you extend that and compare it with what the cost would be if a device with even a small amount of dispersal radioactive material is set off in such a place, it would be very inexpensive indeed."*—Gamini Seneviratne, Vienna*

## NFS ... *from page 1*

Environment and Public Works Subcommittee on Clean Air and Nuclear Safety, have asked NRC for more information on the NFS accident and reasons it wasn't disclosed earlier. Marc Morano, communications director for Inhofe and the Republican members on the environment committee, said July 19 that Inhofe was "looking into the incident and assessing the facts to determine the best course of action."

The accident took place at NFS' Blended Low-Enriched Uranium, or BLEU, Preparation Facility, where downblending operations are performed. The company blends high-enriched uranium with natural uranium to produce low-enriched uranium. The BLEU facility was licensed in January 2004, and downblending activities began in June 2004.

On March 6, 2006, about 35 liters (9.2 gallons) of high-enriched uranyl nitrate, or UN, solution running through a transfer line accidentally spilled into a filter glove box, then seeped through drains in the box and ran down to the floor, where it came within four feet of an "elevator pit," or depression in the floor, according to NRC and Dingell's account of the accident. Had the uncontrolled leak of UN solution filled the glove box just a few more inches, or accumulated in the elevator pit, a criticality accident could have occurred, they said.

The leak was discovered by an NFS supervisor who saw yellow liquid spilling from under a doorway into the hall, Dingell said.

The NFS facility was shut down for about seven months following the accident, resuming operations in October 2006. NRC Office of Nuclear Reactor Regulation Director William Travers called the leak "significant" and said there were two Severity Level 2 apparent violations stemming from the incident, according to the newly released transcript of the May 30 closed-door meeting with NFS. NRC has a four-severity level system, with Level 1 violations being the most significant and Level 4 being the least serious and generally involving non-

compliance with NRC requirements. The accident also was rated at Level 2 on the seven-level IAEA International Nuclear Event Scale, indicating there was an "incident." Level 3 indicates a "serious incident," and Levels 4-7 are considered "accidents" of increasing safety significance.

At the May meeting, Travers said problems at the NFS facility began well before the March 2006 incident. Because of problems going back to 2005, NRC has added an additional resident inspector at the site and is now conducting licensee performance reviews every six months, rather than once a year. NRC also has had to conduct special inspections over the past couple of years, including one after the near-criticality event, he said. Over the past year, NRC identified eight Severity Level 3 issues at the facility, Travers said. He did not say what the issues were, but most were discussed in a December 1, 2006 licensee performance review, which was released last week.

### Settlement reached under ADR

Rather than use traditional enforcement tools such as citing violations and assessing fines, NRC decided to use alternative dispute resolution, or ADR, which seeks resolution of issues through a process such as mediation or arbitration, overseen by a neutral third party. Travers said NRC offered ADR to NFS to see if both parties could "better focus on the root cause of the issues," according to the transcript. During the negotiation sessions, the NRC "leveraged their willingness to agree that safety culture, configuration management, and areas of concern, including performance, procedural adherence, [and] corrective actions" were the "fundamental issues that needed to be resolved through a great deal of management attention," he said.

Under terms of the confirmatory order, NFS is required to have a safety culture assessment performed by an independent third party within 270 days of the date of the order and a follow-up assessment within two years. The order says NRC cannot cite NFS for any violations stemming from the accident. However, the settlement allows the agency to take escalated enforcement against NFS for violations resulting from previously identified problems.

NRC said in the July 19 statement that it was releasing the order based on a directive from the NRC commissioners for the staff to work with the DOE Naval Reactors Program to reevaluate the criteria used to withhold nearly all material about the NFS facility and the BWXT fuel facility in Lynchburg, Virginia. The confirmatory order will be published soon in the Federal Register to provide an opportunity for a hearing by anyone adversely impacted by the order.

*—Jenny Weil, Washington*

## State attorneys general support lawsuit on Indian Point renewal

Concerned about Entergy Nuclear's request to extend the operating licenses for the two PWRs at the Indian Point station, the New York and Connecticut attorneys general filed a brief July 10 supporting a lawsuit that would force NRC to look at emergency planning and siting criteria as part of the agency's license renewal review.

New York Attorney General Andrew Cuomo and Connecticut Attorney General Richard Blumenthal said in a joint filing that they have an interest in protecting their citizens and environment from a major release from Indian Point. The "friend-of-the-court" brief was filed with the US Court of Appeals for the Second Circuit in support of a lawsuit filed in mid-June by Andrew Spano, county executive of Westchester County, New York and two environmental groups — the New Jersey Environmental Federation, and the New Jersey chapter of the Sierra Club.

"Our brief reinforces a position I have long held – New York needs to work toward an energy future without Indian Point," Cuomo said in a July 12 statement.

The attorneys general said they want NRC to focus on factors such as emergency planning, evacuation, plant security, seismic issues, and demographic changes since the plant was built. Their filing argues that NRC's regulations, which limit the scope of license renewal reviews to consideration of the management of aging passive and long-lived structures and components, benefits only the industry.

NRC has said its license renewal process is designed to focus only on certain aging systems, structures and components and not on active components or safety and security issues that are covered under ongoing surveillance or oversight of operating plants.

NRC's response to the Westchester County suit is due by August 31.

Indian Point spokesman Jim Steets said July 17 that NRC is following its regulations on license renewal. "I don't see a lot of possibility or potential for success" of the lawsuit, Steets said. "The renewal process is designed specifically to ensure a plant can operate safety for 20 years beyond their original licensing period." Indian Point is not named in the lawsuit.

Entergy submitted April 23 its license renewal request for Indian Point-2 and -3, whose licenses end in September 2013 and December 2015, respectively. The request is to operate the units until 2033 and 2035.

Last month, the NRC wrote to Entergy to say that some information was missing from the application and the staff could not formally begin its technical review. In a June 18 letter, Pao-Tsin Kuo, director of NRC's license renewal division, said Entergy did not include information demonstrating compliance with the requirements for a station blackout. Kuo said the application specifically was missing information on the gas turbines used as an alternate power supply.

Steets said Entergy responded within days of receiving NRC's letter. Entergy currently relies on gas turbines for unit 2, but has diesel generators as a backup power supply for unit 3. The company was planning to replace the gas turbines and therefore didn't include an aging management plan for that equipment. He said Entergy committed to replace the gas turbines by spring 2008. Entergy is now waiting for NRC for the next step in the application review process, Steets said.*—Jenny Weil, Washington*

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