

Analytical simulator turned over to Bilibino

Highlight

Russia's most remote nuclear power plant, Bilibino NPP in the nation's far-northeastern corner, was the scene of a ceremony in early June when the U.S.-provided analytical simulator was turned over formally to the plant. Officials of Gosatomnadzor and Rosenergoatom were on hand for the turnover, as were project team members from the All-Russian Institute for Nuclear Power Plant Operations (VNIIAES), simulator developers LAKROM (Russia) and GSE Power Systems, Inc. (United States), and Pacific Northwest National Laboratory. Earlier this spring, the simulator was declared "ready for training" after passing its site acceptance tests (see **Activity Report**, April 2000).



Bilibino NPP site director Mikhail Tchudakov (right) accepts a plaque commemorating successful completion of the analytical simulator project at the plant. Presenting the plaque on behalf of the U.S. team is Joe Cleary, Pacific Northwest National Laboratory.



***Specifications developed
for control system
testing equipment;
testing technology
being transferred***

***Safety parameter display
system planned for
world's first
VVER-1000 reactor***



Following the turnover ceremony, participants reviewed the status of the plant's training program and instructional materials for operators. Plans for training Bilibino's simulator instructors also were discussed. (John Yoder, DOE, 301-903-5650; Joe Cleary, PNNL, 509-372-4094) v

Russia

The Russian nuclear regulatory agency Gosatomnadzor (GAN) requires that electronic systems be tested and their performance verified before being placed into operation at Russian nuclear power plants. Earlier this year, VNIAES proposed to establish a facility for conducting such tests at its headquarters in Moscow. VNIAES plans to upgrade an existing analytical simulator for use in ex-plant testing of new automated control systems. VNIAES also proposes to use an actual project—upgrade of the control system for Kalinin NPP's special water purification process—as the pilot demonstration for the new facility. At the request of Russia's Ministry of Atomic Energy, the U.S. team is working with VNIAES to implement the testing platform concept by helping transfer technology for control system testing.

In mid-June, project team members from VNIAES, Kalinin NPP, the U.S. Department of Energy, and Pacific Northwest National Laboratory met in Oradell, New Jersey, with representatives of Burns & Roe Enterprises, Inc., to discuss developing specifications of the equipment needed to transfer the testing technology. Participants agreed on the scope of the control equipment needed for test demonstration purposes at the VNIAES facility. They agreed also that the Kalinin special water purification control system upgrade would be the pilot system for demonstrating the VNIAES test facility. Following the meeting, one specialist each from VNIAES and Kalinin NPP remained at Burns & Roe offices for an additional week to develop the specifications for the control system. (Grigory Trosman, DOE, 301-903-3581; Ron Wright, PNNL, 509-372-4076) v

Specialists from Russia and the United States met June 19 through 23 to finalize plans for developing the safety parameter display system for Novovoronezh Unit 5. Participating in the discussions were representatives of Rosenergoatom, Gosatomnadzor, Novovoronezh NPP, the Russian design organization ConSyst, and U.S. contractors Burns & Roe Enterprises, Inc., Data Systems & Solutions, and Western Services Corporation. A specialist from Pacific Northwest National Laboratory also was involved.

The group spent two days at the Moscow headquarters of ConSyst, discussing roles, responsibilities, and schedule for the

***Russian plant safety
assessment projects
reviewed***

***Fire safety projects
completed at Chernobyl***



effort. ConSyst, primary Russian contractor for this project, is working in collaboration with Burns & Roe.

The group then spent two days on site at Novovoronezh NPP, which included a morning-long walkdown of Unit 5 to evaluate hardware locations for the system. A key outcome sought for the meeting was agreement on the date by which a detailed description of the system, particularly the number of hardwired input sensors, would be finalized.

Novovoronezh Unit 5 is the first Soviet-designed VVER-1000 reactor to have been constructed in the former Soviet Union. The reactor began operating in April 1980. Unit 5 now also will become the first VVER-1000 in Russia to develop and install a safety parameter display system.

Unit 5 is the third reactor at Novovoronezh to be outfitted with the safety-enhancing system. In 1999, Science Applications International Corporation and ConSyst completed work on safety parameter display systems installed in Novovoronezh Units 3 and 4 (VVER-440 reactors). (Rich Reister, DOE, 301-903-0234; Rich Denning, PNNL, 614-424-7412; Frank Panisko, PNNL, 509-372-4472) v

Participants in the in-depth safety assessments under way at Soviet-designed nuclear power plants in Russia met for two days in mid-June to review progress and status on those projects. Meeting at VNIIAES facilities in Moscow, attendees included representatives of Minatom, Rosenergoatom, the European Bank for Reconstruction and Development, and Kola, Leningrad, and Novovoronezh NPPs. U.S. team members from the U.S. Department of Energy and Argonne National Laboratory also participated. Discussions included schedules and issues related to writing the in-depth safety assessment reports for Novovoronezh and Kola NPPs. (Walt Pasedag, DOE, 301-903-3628; Phil Pizzica, ANL, 630-252-4847) v

Ukraine

Over the past five years, the U.S. team has provided a variety of fire safety improvements to Chernobyl Unit 3. The improvements include

- 80 sets of firefighter turnout gear
- penetration sealant and cable coating material
- fire protective coating for the structural steel in the turbine hall
- 250 fire doors
- 400 powder fire extinguishers, 300 carbon dioxide fire extinguishers, and 100 lance nozzles and hoses

- a fire detection and alarm system
- 30 self-contained breathing units with 69 tanks
- an air compressor for the breathing units
- a base radio and 20 portable radios.

In June, Ukrainian customs officials released the radios. The radios were delivered to the plant, and the fire detection and alarm system were programmed and tested. These activities complete the U.S. project in support of fire safety improvements for Chernobyl Unit 3. Although the operating unit is scheduled for shutdown by the end of 2000, fire safety at the site will remain a concern for an extended time beyond that.

The Chernobyl site fire department has developed a list of additional fire safety equipment for which it is seeking international financial support to provide adequate fire protection across the plant site. The U.S. Department of Energy has committed to providing a foam spray tanker truck to the fire department as its contribution to the international effort. (Grigory Trosman, DOE, 301-903-3581; Rich Denning, PNNL, 614-424-7412) v

***South Ukraine hosts
simulator turnover
ceremony***

Representatives of the U.S. team formally turned over a full-scope simulator to South Ukraine NPP in early June. The state-of-the-art simulator will be used to train control room operators for South Ukraine Unit 3, a VVER-1000 reactor.



Project participants watch as a ceremonial ribbon is cut to mark formal turnover of the Unit 3 full-scope simulator to South Ukraine NPP. Shown in foreground, left to right, are John Yoder, U.S. Department of Energy; Borys Bilyk, South Ukraine site director, and Sergei Vybornov, South Ukraine training manager.



Participating in the turnover-related activities were representatives of Energoatom and the Main State Inspectorate, as well as the simulator contractors LAKROM (Russia) and GSE Power Systems, Inc. (United States). Managers of the simulator project

***Audit planning workshop
held at South Ukraine***

from the U.S. Department of Energy and Pacific Northwest National Laboratory represented the U.S. team at the ribbon-cutting ceremony.

Work to develop the simulator for Unit 3 began in July 1995. Site acceptance tests were completed at the plant in April 2000 (see April **Activity Report**). The turnover ceremony marks the completion of this project for the U.S. team. (John Yoder, DOE, 301-903-5650; Joe Cleary, PNNL, 509-372-4094) v

Nuclear specialists from several organizations gathered at South Ukraine NPP June 12 through 15 to develop a plan and checklists for an upcoming audit at the plant. The workshop, sponsored by South Ukraine's quality assurance department, was aimed at preparing for an early-July audit to assess compliance and work performance related to radiation monitoring of the environment at the plant.

Workshop participants included two persons from Energoatom's quality assurance department and one representing the Nuclear Power Plant Operational Support Institute (NPP OSI). The manager and staff of the South Ukraine quality assurance department, as well as staff of the South Ukraine environmental laboratory, also participated. Specialists from Babione Enterprises and Pacific Northwest National Laboratory represented the U.S. team.

The Energoatom and NPP OSI representatives identified national and Energoatom requirements for the radiation monitoring. The South Ukraine laboratory staff provided technical expertise and knowledge of plant procedures related to the audit. The U.S. team members described audits and assessments as done in the United States. They also provided examples of documents related to environmental monitoring and copies of audit criteria documents from two U.S. nuclear power plants. At the conclusion of the workshop, all participants agreed they were well prepared for the upcoming audit. (Dennis Meyers, DOE, 301-903-1418; Lief Erickson, PNNL, 509-372-4097) v

***Zaporizhzhya and South
Ukraine implement new
operator training
program***

During June, training and technical specialists from Ukraine's Khmelnytsky NPP and the Engineering and Technical Center for the Training of Nuclear Industry Personnel implemented pilot training programs for control room reactor operators at Zaporizhzhya and South Ukraine NPPs. The programs, developed specifically for each plant with the technical support of a U.S. specialist from Sonalysts, Inc., were taught for the first time



***Kozloduy continues work
on training program
development***

***Dukovany completes risk
advisory system
installation***



at Zaporizhzhya during the first week of June and at South Ukraine June 26 through 30. Trainees at both plants were incumbent control room reactor operators and their supervisors. A representative of Human Performance Analysis Corporation observed and provided evaluative feedback on the implementations. Based on the feedback, each course will be modified as needed before being made a part of each nuclear power plant's training curriculum for plant personnel. (John Yoder, DOE, 301-903-5650; Don Draper, PNNL, 509-372-4079) √

Bulgaria

A representative of Sonalysts, Inc., continued working with training and technical specialists from Kozloduy NPP on the development of training programs related to emergency operating instructions (EOIs). Kozloduy technical personnel are providing expertise on the EOIs, while the U.S. specialist is helping develop a training program on EOIs. Preparations were made to implement the pilot program, tentatively scheduled now for September. (John Yoder, DOE, 301-903-5650; Don Draper, PNNL, 509-372-4079) √

Czech Republic

On June 28, Dukovany NPP hosted a review of its recently implemented risk advisory system (see box next page). Participating in the review were specialists from the Nuclear Research Institute Rez, host-country contractor for the Dukovany probabilistic risk assessment; Dukovany NPP personnel; and SCIENTECH, Inc., whose real-time plant risk software Safety Monitor™ is the basis for the Dukovany system.

The primary audience for the review was a U.S. team representative from Pacific Northwest National Laboratory. The U.S. team had provided technical support to Dukovany to implement the SCIENTECH software, which Dukovany purchased. The review meeting constituted the final project closeout activity for the U.S. team.

Reviewers described how the system was installed and how personnel in the plant's safety department will use it to evaluate previous activities and plan future work such as equipment maintenance. The plant also will provide a copy to the Czech nuclear regulatory agency for review and use. Dukovany personnel also indicated their immediate plans to extend plant models included in the probabilistic risk assessment to encompass recent design and operational changes and all shutdown modes. (Walter Pasedag, DOE, 301-903-3628; Jeff Binder, ANL, 630-252-7265; Tye Blackburn, PNNL, 509-372-4092) √

***Risk advisory system
implemented at Bohunice***



A risk advisory system (RAS), also known as a safety or risk monitor, is an on-line, plant-specific, real-time analysis tool used to determine the instantaneous plant risk based on actual status of systems and components. A RAS is based on a nuclear power plant's current as-built, operated, and maintained configuration and reflects the status of plant components (e.g., any components out-of-service for maintenance or testing). The underlying RAS model is consistent with the plant's living probabilistic risk assessment (PRA) and is updated with the same periodicity. The RAS makes it possible for plant staff to easily examine past operating practices, current plant conditions, and future planned activities (e.g., maintenance schedules). This is accomplished by providing an easy-to-use interface consistent with terminology and nomenclature familiar to plant staff. The RAS makes the PRA model and resulting insights available to non-PRA analysts (i.e., it "mainstreams" the PRA to those actually operating and maintaining the facility). The result is plant personnel who are risk-aware and who more thoroughly consider impacts to safety from past, current, and planned activities.

The technology and applications of RASs are not new. Development of the technology began in the early 1980s, with the first true RAS installed in 1987 at Heysham Unit 2 in the United Kingdom. Further technology development and refinement eventually led to two commercially available RASs that began to be installed in U.S. plants in the mid-1990s. At present, RASs are installed at more than 100 plant sites in at least eight countries. In addition, the U.S. Nuclear Regulatory Commission recently licensed a RAS for use in training the commission's inspectors in PRA and PRA applications.

Slovakia

On June 23, a representative of the U.S. team met with project staff at Bohunice NPP to review the U.S. Department of Energy-supported implementation of a risk advisory system (see box above) for the plant. Key organizations involved in this project and represented at the meeting included the Slovakian nuclear regulatory authority, UJD; RELKO, the host-country contractor for the Bohunice probabilistic risk assessment; and Data Systems & Solutions, who supplied the risk analysis system software. Specialists from Bohunice and Mohovce NPPs participated in the review as well.

The Bohunice risk advisory system consists of the Electric Power Research Institute's Equipment Out-of-Service Monitor provided by Data Systems & Solutions. Bohunice safety analysts plan to

use the risk advisory system for evaluating past activities and planning maintenance activities and other future work. The probabilistic risk assessment team at Bohunice will control access to the system, which initially is planned for plant operators and staff of the training, maintenance, and safety departments. In preparation for system operation, Bohunice recently extended its probabilistic risk assessment and risk advisory system models to include all plant shutdown modes. Implementation of the system at Bohunice was the final task in the U.S. team's effort in this project. (Walter Pasedag, DOE, 301-903-3628; Jeff Binder, ANL, 630-252-7265; Tye Blackburn, PNNL, 509-372-4092) v

Planned Activities

• *indicates the event is new or has changed in some way since the previous report was issued.*

• **June 28-July 7 - South Ukraine NPP, Ukraine Management and Operational Safety.** Personnel from Energoatom, the Nuclear Power Plant Operational Support Institute, and the quality and environmental laboratory departments of South Ukraine NPP will conduct an audit of environmental radiation monitoring at South Ukraine NPP. Audit results will be presented to plant management. The objectives of the audit are to provide auditing experience to South Ukraine NPP quality personnel and to encourage plant management and worker appreciation of the benefits of audits. (Dennis Meyers, DOE, 301-903-1418; Lief Erickson, PNNL, 509-372-4097)

• **July 9 - Kyiv, Ukraine Plant Safety Assessment.** Nuclear analysts from the Slavutych Laboratory for International Research and Technology and other Ukrainian technical organizations will participate with specialists from Khmelnytsky, Rivne, South Ukraine, and Zaporizhzhya NPPs in a workshop at Kyiv State University. Instructors will provide hands-on training in the use of the safety analysis computer codes MELCOR and CONTAIN. The workshop is part of a U.S. team project to facilitate the development of safety analysis capability in Ukraine. (Walter Pasedag, DOE, 301-903-3628; Igor Bodnar, ANL, 630-252-8336)

July 17-20 - Boston, Massachusetts, USA Engineering and Technology. Specialists from Engineering Planning and Management Inc. (EPM) will host a progress meeting on the safe-shutdown analysis under way at Smolensk NPP. Participants will include analysts from VNIIAES, Atomenergoproekt, and Rosenergoatom, as well as technical specialists from EPM and Brookhaven and Pacific Northwest national laboratories. Participants will review comments on reports covering the probabilistic portion of the analysis and the recommendations for fire safety upgrades to correct identified deficiencies. They also will discuss completion of the project and



implementation of corrective actions at the plant. (Grigory Trosman, DOE, 301-903-3581; Andrew Minister, PNNL, 509-376-4938)

- **July 18-19 - Washington, D.C., USA**

Program Management. The Ukraine Coordinating Committee for the Soviet-Designed Reactor Safety Program will hold its semiannual meeting. Members will determine priorities and funding allocations for projects in Ukraine in 2001 as well as resolve any major issues on projects already under way. Representatives of Energoatom, the U.S. Department of Energy, and Pacific Northwest National Laboratory make up the coordinating committee. (Rich Reister, DOE, 301-903-0234; Bob Moffitt, PNNL, 509-372-4108)

- **July 23 - Kyiv, Ukraine**

Plant Safety Assessment. Participants from the National Taras Shevchenko University of Kyiv, Rivne NPP, and Argonne National Laboratory will meet to review progress on work to validate the RELAP5 computer code for application to VVER reactors. The status of the definition report for the standard problem based on a steam generator transient using plant data will be discussed, and a schedule will be developed to complete the definition and analysis of the standard problem. The exchange of standard problems with Bulgarian organizations also will be discussed and planned. (Walter Pasedag, DOE, 301-903-3628; Jordi Roglans, ANL, 630-252-3283)

- **July 23-24 - Kyiv, Ukraine**

Plant Safety Assessment. A coordination meeting will be held to discuss progress in the VVER special transient analysis project. Representatives from the National Taras Shevchenko University of Kyiv and Argonne National Laboratory will participate. The status of the RELAP5-3D model will be reviewed, and the connection from Kyiv to the Russian International Nuclear Safety Center computers to access RELAP5-3D will be tested. (Walter Pasedag, DOE, 301-903-3628; Jordi Roglans, ANL, 630-252-3283)

- **July 25-29 - Armenia Nuclear Power Plant, Armenia**

Plant Safety Assessment. A representative from Argonne National Laboratory will meet with counterparts at Armenia NPP to organize a plant walkdown to evaluate seismic issues. The walkdown, scheduled for September 2000, will help determine whether key safety components meet seismic standards. The Argonne specialist also will discuss safety analysis capability needs with plant representatives. (Dennis Meyers, DOE, 301-903-1418; Mark Petri, ANL, 630-252-3719)

- **July 26-28 - Sofia, Bulgaria**

Plant Safety Assessment. A coordination meeting will be held to initiate the participation of Bulgarian organizations in the RELAP5 code validation project for application to VVER reactors. Participants from the Institute of Nuclear Research and Nuclear



Energy, Kozloduy NPP, and Argonne National Laboratory will attend the meeting. The detailed work plan to define and analyze a standard problem based on plant data will be developed. The exchange of standard problems with Ukrainian organizations also will be discussed and planned. (Walter Pasedag, DOE, 301-903-3628; Jordi Roglans, ANL, 630-252-3283)

• **July 26-28 – Sofia, Bulgaria**

Plant Safety Assessment. Specialists from the Institute of Nuclear Research and Nuclear Energy, Kozloduy NPP, and Argonne National Laboratory will discuss the code assessment project for coupled neutronics/thermal-hydraulics codes. A work plan will be developed to define and analyze a benchmark problem in collaboration with the Pennsylvania State University based on plant data. Candidate benchmark problems will be reviewed. Potential sets of analysis for comparison of the results and the evaluation of point kinetics versus spatial kinetics will be discussed. (Walter Pasedag, DOE, 301-903-3628; Jordi Roglans, ANL, 630-252-3283)

• **August 8-10 – Visiginas, Lithuania**

Engineering and Technology. Specialists from Pacific Northwest National Laboratory and Data Systems & Solutions will meet with computer specialists from Ignalina NPP to develop the conformed specification for a safety parameter display system for Ignalina Unit 2. Participants will discuss how to interface the safety parameter display system with the integrated computer system that Data Systems & Solutions is installing in Unit 2. Because the integrated control system is funded by others, the cost of adding a safety parameter display system at Ignalina will be reduced significantly. (Grigory Trosman, DOE, 301-903-3581; Ron Wright, PNNL, 509-372-4076)

• **August 21-28 – Scholkino, Ukraine**

Management and Operational Safety. Ukraine's Crimea Scientific and Engineering Center will host a workshop to review results of the pilot implementation at Zaporizhzhya NPP of procedures for event analysis, reporting, and lessons learned. Workshop participants will include representatives of all nuclear power plants in Ukraine, Energoatom, the Crimea Center, and Novator-Kiev. The event analysis manager at Zaporizhzhya will report on the pilot implementation at the plant. Novator-Kiev specialists will describe experience with the event analysis database and reporting software they have developed. The Energoatom event analysis manager will report on Energoatom participation in the Zaporizhzhya pilot implementation and then lead discussions of planned activities to implement new procedures and databases at the remaining plant sites in Ukraine. (Dennis Meyers, DOE, 301-903-1418; Lief Erickson, PNNL, 509-372-4079)



September 11-15 – Argonne, Illinois, USA

Plant Safety Assessment. U.S. team members from Argonne National Laboratory will host a review meeting for the Khmelnytsky in-depth safety assessment project. Participants will include project managers from Khmelnytsky NPP and Kyiv Energoproekt, the plant's technical support organization. They will discuss progress and future activities. (Walter Pasedag, DOE, 301-903-3628; Charles Dickerman, ANL, 630-252-4622)

September 27-29 – Slavutych, Ukraine

Chornobyl Initiatives. The International Chornobyl Center will convene its fourth annual conference to facilitate the exchange of information on international scientific and technical activities at Chornobyl. The conference program will include plenary and workshop sessions and technical tours of Chornobyl NPP and the Unit 4 Shelter. Conference organizers are seeking speakers to give presentations at the conference. (Riaz Awan, DOE, 38-050-257-7221; Don Draper, PNNL, 509-372-4079) v



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