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中核华兴
TAISHAN 1&2
TAISHAN 1
FIELD REPORT
Topic
Project Delivery
Location
China
We are building the EPR™ reactor fleet. Together.
On October 23, the Taishan 1 EPR™ reactor reached a major milestone with the successful dome lifting. This reactor is currently built in China by TNPJVC, a joint venture between China Guangdong Nuclear Power Holding Corporation (CGNPC) and Électricité de France (EDF) for which AREVA is leading the supply for Nuclear Island, Engineering and Procurement. The erection of the dome required several months of preparatory work inside the reactor building, including an 8.3-meter wide heavy equipment hatch created through the inner wall for upcoming heavy component installation as well as installation of the polar crane.
With four EPR™ projects under construction in the world, AREVA has unrivalled experience in the delivery of large-scale nuclear projects, including more than a thousand lessons learned captured from Olkiluoto 3 and Flamanville 3 projects. This book of knowledge as well as the return on experience of AREVA's and EDF's teams are now being fully leveraged on ongoing projects, especially on Flamanville 3 and Taishan, and will be incorporated in all future EPR™ projects.
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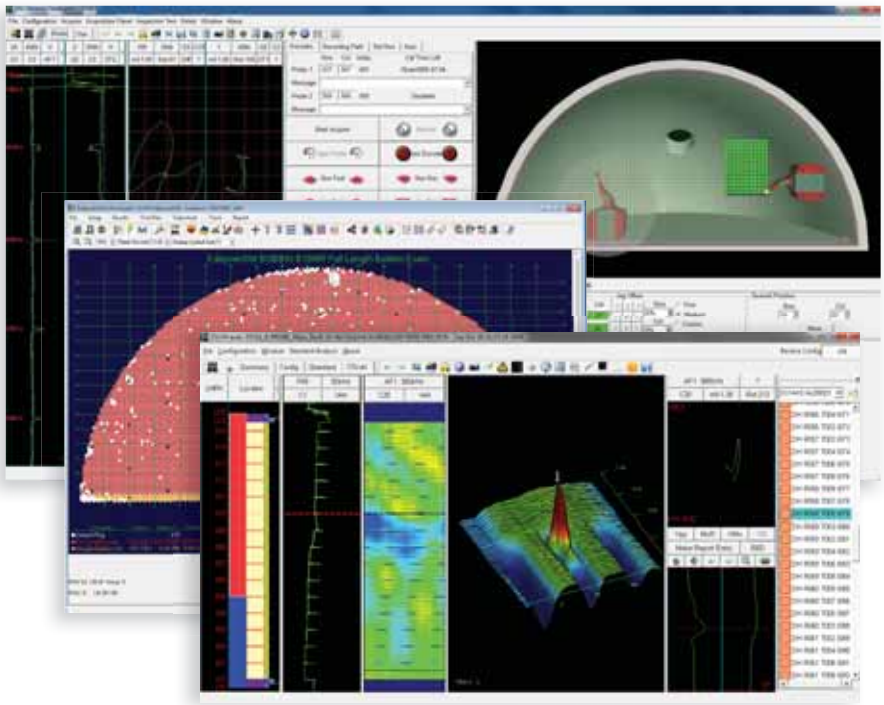

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Nuclear Plant Journal®

January-February 2012, Volume 30 No. 1

30th Year of Publication

International Trade & Waste and Fuel Management Issue

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Articles & Reports

Industry Innovations

Plant Profile

Departments

Journal Services

On The Cover

Canadian Nuclear Safety Commission, Canada authorized Bruce Power to reload fuel into Bruce A, Unit 2 on June 29, 2011 and further authorized Bruce A, Unit 1 to reload fuel on November 22, 2011. The plants were also cleared to continue with the remaining refurbishing activities. See page 50 for a profile.

Mailing Identification Statement

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January-February 2012

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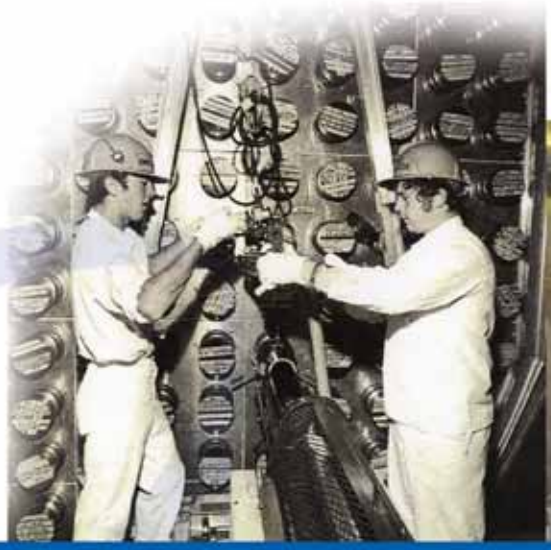

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New Energy

United Kingdom

EDF Energy announced a package of new contracts including the selection of KIER BAM as preferred bidder for a £100million–plus ($157 million) contract for site preparation works at Hinkley Point C, United Kingdom.

The contract will create an estimated 350 UK jobs in 2012 with many workers under this contract living locally around Hinkley Point. The work, includes excavation, earthworks, terracing, installation of construction site infrastructure and formation of roads and networks to allow main construction to begin.

The preparatory works will be followed by the main construction work which will see over 20,000 people work on site over the course of the project.

A second announcement as part of EDF Energy's plans, with Centrica, to build a new twin-reactor nuclear power station at Hinkley Point C in Somerset, UK, is an agreement with AREVA in relation to the early design work for the main reactor systems. This agreement is a critical step to develop detailed equipment specifications that will be used to ask companies to bid for equipment supply contracts. The agreement comes as AREVA is starting to produce the heavy forgings required for critical reactor components, following a contract signed between the companies in July 2011.

Thirdly, EDF Energy announced a £15 million ($23 million) investment to establish a world class national training centre in partnership with Bridgwater College in Somerset, UK. Building on existing work with the college, this facility will address potential skills shortages in the energy sector by delivering professional training and providing a legacy of growth in the local community.

Contact: website: www.edfenergy.com/energyfuture.

United Arab Emirates

The **Emirates Nuclear Energy Corporation** (ENEC) has requested that the UAE Federal Authority for Nuclear Regulation (FANR) approve additional preparatory construction work at the proposed site for the UAE's first nuclear power plants in Braka, UAE.

ENEC is requesting approval to undertake the preparatory work for creation of a smooth flat surface at the bottom of the excavation in preparation for the pouring of the initial safety concrete for Units 1 & 2 and placing reinforcing steel and embedded piping as well as electrical conduits and electrical grounding material in preparation for pouring concrete for the reactor building

As per the regulatory process in the UAE, ENEC is not authorized to pour concrete for the permanent power block until it is granted a Construction License from FANR. ENEC submitted its Construction License Application for Braka Units 1 and 2 to FANR on December 27, 2010 and the application is currently under review.

Contact: email: media@enec.gov.ae.

Design Certification

The Nuclear Regulatory Commission (NRC) has granted the Design Certification Amendment to **Westinghouse Electric Company's** AP1000® pressurized water reactor design. The granting of such certification is the foundation upon which utilities will construct AP1000 units here in the United States.

Utilities in Georgia and South Carolina have been waiting for the granting of AP1000 Design Certification so that each can move ahead with its combined construction and operating license (COL) applications. Once the NRC grants each utility a COL, approximately 3,000 jobs will be created for each construction site, positively impacting America's manufacturing and construction industries with materials and labor expected to be provided from more than 20 states. It's estimated that approximately 35,000 jobs will be positively affected by the construction of just two AP1000 units here in the United States.

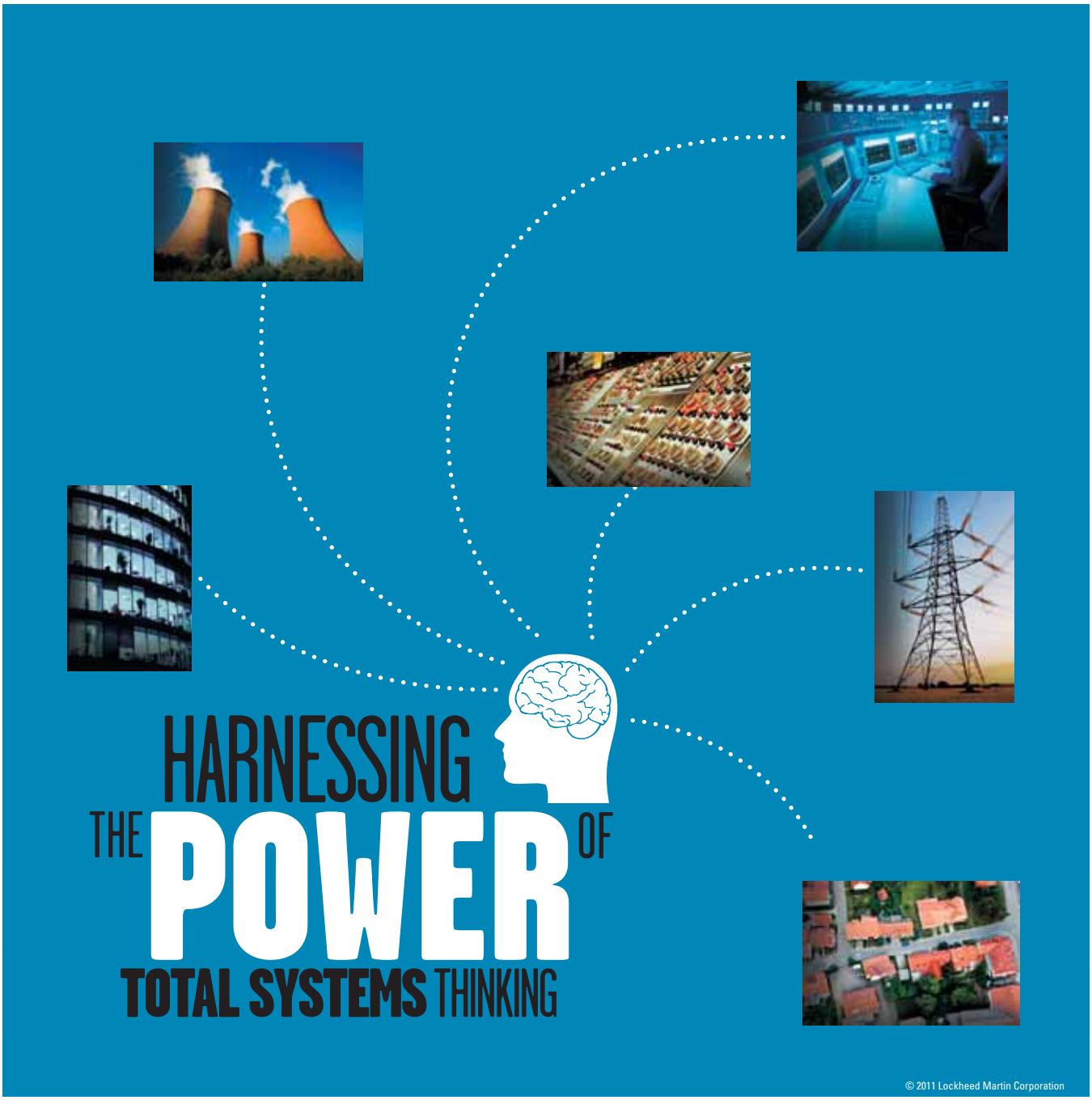
The ultimate granting of Design Certification by the NRC Commissioners acknowledges the recommendation of the NRC Staff that the AP1000 design is safe and meets all regulatory requirements, a conclusion drawn after a highly rigorous technical review process, public scrutiny, and an independent assessment by the Advisory Committee on Reactor Safeguards.

Contact: Vaughn Gilbert, telephone: (412) 374-3896, email: gilberhv@westinghouse.com. ■

Nuclear Power Plants Under Construction as of January 1, 2012

Country	No. of Reactors	Capacity (MWe)
Argentina	1	692
Brazil	1	1,245
Bulgaria	2	1,906
China	26	26,620
Finland	1	1,600
France	1	1,600
India	6	4,194
Japan	2	2,650
Korea	5	5,560
Pakistan	1	315
Russia	10	8,203
Slovak Republic	2	782
Chinese Taipei	2	2,600
Ukraine	2	1,900
United States	1	1,165

The information is based on the IAEA Power Reactor Information System (PRIS). It only lists reactors for which construction has officially started (i.e. when first major placing of concrete, usually for the basemat of the reactor building, has taken place). Source: Nuclear Energy Agency/OECD.



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Through more than 50 years of providing instrumentation and control systems for our nation's nuclear submarine and carrier fleets, Lockheed Martin has demonstrated its ability to navigate the complexities of nuclear power generation – with safety and reliability. Today, we provide systems for power plants around the world. Solutions range from reactor protection and main control room design to engineering services, simulation and training, and microgrid solutions – all in one complete package. Making nuclear power generation safer and more efficient is all a question of how. And it is the how that Lockheed Martin delivers.

www.lockheedmartin.com/mfc/nuclearsands

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Utility

Merger

Exelon Corporation and Constellation Energy announced that they have reached an agreement with Electricite de France (EDF) under which EDF will withdraw its opposition to the Exelon-Constellation merger. The terms address Constellation Energy Nuclear Group (CENG), a joint venture between Constellation and EDF that owns and operates three nuclear facilities with five generating units in Maryland and New York. The agreement reaffirms the terms of the joint venture. No payment was made by either party associated with this agreement.

The Exelon-Constellation merger has received approval by the Department of Justice, the New York Public Service Commission, the Public Utility Commission of Texas and the shareholders of Exelon and Constellation. It also requires regulatory approvals by the Federal Energy Regulatory Commission, the Nuclear Regulatory Commission and the Maryland Public Service Commission.

Contact: Paul Elsberg, telephone: (312) 394-7417.

Refurbishment

Ontario Power Generation (OPG) has submitted the Environmental Impact Statement (EIS) and Integrated Safety Review (ISR) reports to the Canadian Nuclear Safety Commission (CNSC) – two important regulatory requirements in support of Darlington Refurbishment. The submissions demonstrate positive conclusions in support of refurbishment activities and the continued operation of the Darlington station.

The EIS is comprised of more than 4,500 pages of data contained in sixteen volumes, and represents the culmination of years of detailed studies on and around the Darlington site, including public and community consultation. It concludes refurbishment and continued station operation will not result in any significant adverse environmental effects.

In addition, the ISR report, completed over a three-year period and containing more than 10,000 pages, is a comprehensive assessment of plant design, condition and operation.

The ISR report concluded the existing Darlington station demonstrates a high level of compliance with modern codes and standards. The ISR did not identify any issues that would limit safe long-term operation of the station and no gaps were identified that would affect current safe operation.

To ensure the ISR addressed all safety areas, an aggregate assessment was performed by a team of independent nuclear industry experts. The assessment concluded that the Darlington station performance is strong, the plant is operating safely and the ISR activities fully meet the requirements the CNSC.

Both submissions will now be extensively reviewed by CNSC staff.

Contact: telephone: (416) 592-4008, website: www.opg.com.

Industry

Principles of Conduct

The world's leading civilian nuclear power plant vendors and the **Carnegie Endowment for International Peace** have successfully concluded the first implementation review of the Nuclear Power Plant Exporters' Principles of Conduct initiative, just three months after its launch.

In the meeting, the companies agreed to create a secretariat to facilitate regular communication among the participating vendors between review meetings, facilitate communication with the general public, plan review meetings, collect updates on implementation issues, and operate as a depository and clearinghouse of information for the process.

The companies agreed to hold periodic review meetings during which they would update each other and the secretariat on their progress in implementing the Principles, share and consider existing and evolving industry best practices, and review and modify the Principles as appropriate. In addition to periodically reviewing the document and its implementation, the companies have also undertaken to expand their outreach efforts to other stakeholders in the nuclear energy sector with the aim of promoting similar norms of responsible conduct across the industry.

Participating companies include: AREVA, Atomstroyexport, Candu Energy, GE Hitachi Nuclear Energy, Hitachi-GE Nuclear Energy, Korea Electric Power Company, Mitsubishi Heavy Industries, Toshiba, Westinghouse Electric Company, ATMEA.

Contact: Karly Schledwitz, telephone: (202) 939-2233, email: kschledwitz@ceip.org.

SMRs

The **U.S. Department of Energy** announced the first step toward manufacturing small modular nuclear reactors (SMRs) in the United States, demonstrating the Administration's commitment to advancing U.S. manufacturing leadership in low-carbon, next generation energy technologies and restarting the nation's nuclear industry. Through the draft Funding Opportunity announced, the Department will establish cost-shared agreements with private industry to support the design and licensing of SMRs.

Small modular reactors, approximately one-third the size of current nuclear plants, have compact designs that are expected to offer a host of safety, siting, construction and economic benefits. Specifically, they could be made in factories and transported to sites where they would be ready to "plug and play" upon arrival, reducing both capital costs and construction times. The small size also makes SMRs ideal for small electric grids and for locations that cannot support large reactors, providing utilities with the flexibility to scale production as demand changes.

The draft Funding Opportunity Announcement (FOA) solicits input from industry in advance of a full FOA, which will support first-of-a-kind engineering, design certification and licensing through a cost-shared partnership. The full FOA will fund up to two SMR designs with the goal of deploying these reactors by 2022.

Contact: telephone: (202) 586-4940.

Corporation

Realignment

The Babcock & Wilcox Company (B&W) is realigning its commercial nuclear business in response to changing market conditions, growth opportunities and the continuing progress of its small modular reactor (SMR) business.

Babcock & Wilcox Nuclear Energy, Inc. (B&W NE) will comprise all non-SMR commercial nuclear operations, including global nuclear services, commercial nuclear equipment manufacturing and all related global sales initiatives. Michael D. Lees is named President of the organization. Lees will also continue to serve as President of Babcock & Wilcox Canada Ltd. headquartered in Cambridge, Ontario.

Babcock & Wilcox Modular Nuclear Energy, Inc. (B&W MNE) will comprise all operations that relate to the research, development and deployment of B&W's SMR initiative using B&W mPower™ technology. Christofer M. Mowry is named President of B&W MNE. B&W's majority-owned subsidiary, Generation mPower LLC, will report into B&W MNE.

Contact: Ryan Cornell, telephone: (330) 860-1345, email: rscornell@babcock.com.

Acquisition

Curtiss-Wright Flow Control Company (CWFC) has acquired the assets of Advanced Engineered Products, Inc. (AEP) for $1.85 million. AEP is a leading supplier of nozzle dams and other products and services for the commercial nuclear power industry. Its innovative nozzle dam product is smaller and lighter and can be installed rapidly, reducing radiation exposure and minimizing critical outage time. Westinghouse has adopted the AEP nozzle dam as a standard part of its AP1000® nuclear reactor design.

Contact: Sharon Dey, telephone: (703) 286-2011, email: sdey@curtisswright.com.

New Leadership

Day & Zimmermann's Engineering, Construction and Maintenance (ECM) group announced key leadership changes within its DZ Atlantic business, including the appointment of Guy Starr as president of DZ Atlantic, and Ross McConnell as senior vice president of nuclear operations.

Guy Starr, previously president of DZ Engineering and DZ Construction, will have responsibility for all open shop construction and plant maintenance work in the nuclear, fossil, and process and industrial markets. He will also oversee the company's suite of specialty services (condenser, valve, and radiological) as well as the fabrication and machining operation based in Moss Point, Mississippi.

Ross McConnell previously served as DZ Atlantic's vice president of staffing, valve, plant and radiological services. In his new role, Mr. McConnell will have overall responsibility for all of the unit's work in the nuclear power market.

Walt Sanders has joined Day & Zimmermann NPS® unit as senior vice president, operations. In this role, Mr. Sanders will use his twenty eight years of leadership experience in power industry project execution to drive excellence in strategic planning, resource allocation, performance management and talent management. He will also be engaged in optimizing the company's day-to-day operational activities to ensure world-class project delivery.

Contact: Maureen Omrod, telephone: (215) 299-2234, email: Maureen.omrod@dayzim.com.

Classroom Simulators

L-3 MAPPS has been selected by STP Nuclear Operating Company (STPNOC) to develop classroom simulators to augment full scope simulator training at the South Texas Project Electric Generating Station. The classroom simulators will be developed using L-3's Orchid® Touch Interface solution released earlier this year and will enter service in the second quarter of 2012.

L-3 MAPPS' Orchid Touch Interface takes control and auxiliary room panel virtual displays to a new level of realism. High-fidelity panel graphics are displayed on large touch screen monitors with 1080p full HD resolution. Three monitors are mounted on each frame, known as a bay, and five bays will be delivered to STPNOC. The setup is flexible, and STPNOC will be able to use all five bays in one classroom simulator configuration or in various combinations for up to five classroom simulators. The top monitor of each three-monitor bay articulates, allowing passage through a standard door frame. Each bay is mounted on swivel casters for easy maneuvering from one room to another. Orchid Touch Interface's touch screen interface allows students to operate the panel graphics manually and obtain life-like visual responses.

In addition to updating the full scope simulator's virtual panel graphics for the classroom simulators, L-3 MAPPS will emulate the qualified display processing system (QDPS) displays, which are currently stimulated on the full scope simulator, using L-3's Orchid Control System.

Contact: Andre Rochon, telephone: (514) 787-4953.

VP Business Development

Michael McGough has joined **NuScale Power** as Vice President of Business Development with responsibility for sales, marketing, business development, proposal management, customer relationship management, customer advisory board, and branding. McGough joins NuScale from UniStar Nuclear where he was Senior Vice President, Commercial Operations, with responsibilities for sales, marketing, business development, communications, commercial processes and advocacy.

Contact: Bruce Landrey, telephone: (503) 715-7900.

Certified Product Line

Radiation Protection Systems, Inc. a U.S. manufacturer of portable ventilation units for the nuclear industry, announced today that six more models of their High Efficiency Particulate Air (HEPA) filtration units have been added to their CSA C/US certified product line.

The following RPS portable HEPA ventilation models are now entitled to bear the CSA C/US marking:SP-505A, MAC-21, SP-700, SP-700EP, SP-1000LV, SP-1600, PFB(H)-1600, PFB(H)- 2500, PFB-1600, PFB-2500, PFB-2500SP.

Many of these HEPA-filtered ventilation units are available with variable frequency speed controls (VFD)

(Continued on page 12)

Corporation...

Continued from page 11

and bag in/out filter change for enhanced worker protection.

Contact: Marc Greenleaf, telephone: (860) 445-0334, email: greenleafm@rpsct.com.

Electrical Penetration Assemblies

SCHOTT has been selected to supply its hermetic glass-to-metal sealed Electrical Penetration Assemblies (EPAs) to China's first commercial High Temperature Reactor (HTR) in the province of Shandong. The first feedthrough has now been delivered to the Institute of Nuclear and New Energy Technology (INET) at Tsinghua University for testing and training purposes.

Chinais focused on creating its independence in energy generation through scientific and technological advancements, in a safe and environmentally-friendly manner. A demonstration plant is currently under construction at Shidaowan, in the Shandong province of China. SCHOTT has been selected to equip the reactor with its unique glass-to-metal sealed Electrical Penetration Assemblies (EPAs).

Contact: Matthew Kraft, telephone: (914) 831-2288, email: Mathew.kraft@us.schott.com.

Software License

Ventyx®, an ABB company, announced that Belgian energy company Electrabel has licensed Ventyx asset health management software to facilitate enhanced equipment reliability at the company's nuclear power plants in Belgium.

Electrabel, a GDFSuez company, is implementing the Ventyx SystemIQ software in its three units at the Tihange plant in Wallonia. The software has also been licensed for potential future implementation at four units at Electrabel's Doel site in Flanders.

The Web-based SystemIQ software will facilitate system performance monitoring and health reporting at the sites. Designed to automate data collection, the software integrates with supporting applications such as work management, corrective action, condition monitoring and diagnostics, and inventory management. Electrabel is implementing the software to help improve the Tihange plant's load factor, equipment reliability and compliance with regulations such as the Institute of Nuclear Power Operations (INPO) AP-913 rule.

Ventyx software is available in a range of languages.

Contact: Gary Frazier, telephone: (770) 989-4188, email: gary.frazier@ventyx.com.

Control Element Assemblies

KWN, a company jointly owned by **Westinghouse Electric Company** and KEPCO Nuclear Fuel, has begun production of control element assemblies (CEAs) for Combustion Engineering-designed nuclear plant customers worldwide. The first order of 56 CEAs will be delivered in February 2012 to the Yonggwang Nuclear Power Plant, Unit 5, Korea.

Control element assemblies are a key component of the system that controls the nuclear reaction in a reactor. Westinghouse and KEPCO Nuclear Fuel formed KW Nuclear Components Co., Ltd. (KWN) in 2008 to fabricate the CEAs.

The start of manufacturing at KWN marks the completion of a significant effort to develop the production facility, which was completed in April 2011. This effort included training KWN employees at the Westinghouse Windsor Fuel Components Facility (Windsor, Connecticut-USA), developing the facility's quality assurance program, and implementing state-of-the-art manufacturing processes and procedures.

Contact: Scott Shaw, telephone: (412) 374-6737, email: shawsa@westinghouse.com.

Design Acceptability

The UK regulators – Office for Nuclear Regulation (ONR) and Environment Agency (EA) - have granted Interim Design Acceptance Confirmation (IDAC) and Interim Statement of Design Acceptability (ISoDA) to **Westinghouse Electric Company's** AP1000® reactor design.

The announcement comes after four and a half years of work as part of the Generic Design Assessment (GDA) process. During this time the regulators have scrutinised all aspects of the design to ensure that it meets UK standards.

Contact: Adrian Bull, telephone: 44 0 1772 297714, email: bullaj@westinghouse.com

MOU

Westinghouse Electric Company announced an important Memorandum of Understanding (MOU) with DBD Limited relating to the future development of the Westinghouse AP1000® reactor design in the UK.

The agreement covers a range of topics where it is hoped that the two organizations can collaborate to help bring the AP1000 nuclear power plant into commercial operation in the UK. This includes support through the final stages of the Generic Design Assessment process, site-specific licensing, planning support and associated safety-case development.

Contact: Adrain Bull, telephone: 44 0 1772 297714, email: bullaj@westinghouse.com.

Acquirement

Zachry Nuclear Engineering, Inc. has acquired software producer and engineering services provider, Numerical Applications, Inc. (NAI). NAI provides a wide spectrum of engineering analysis services including thermal hydraulic, radiological, chemical and safety solutions, and is the leading developer of nuclear software such as GOTHIC™, CentralStor™ and RADTRAD-NAI™.

Numerical Applications, a division of Zachry Nuclear Engineering, Inc. will expand Zachry's geographic footprint, with offices from Washington to the Carolinas, while giving NAI access to the broad resources of San Antonio-based engineering, construction and maintenance provider Zachry Holdings, Inc.

Contact: Lydia Adams, telephone: (210) 588-6795, email: adamslr@zhi.com. ■

New Products, Services & Contracts

New Products

Lighting System

BIRNS, Inc., ISO 9001:2008 certified in design and manufacturing of unique lines of high performance lights for demanding nuclear containment applications, has introduced the new BIRNS Corona™. This lighting system provides brilliant high pressure sodium vapor floodlighting for nuclear pools, turbine inspection and reactor cavity during fuel handling, or any application where long-term use, low levels of maintenance and the most powerful illumination are required. It has unparalleled light output—132,000 lumens, with a 1kW lamp—and can be operated indefinitely in air, and immersed in cold water without damage.

The BIRNS Corona is easily decontaminated and relamps by hand in under 60 seconds. Plus, it provides the lowest operating costs of any industry lighting system, with a 24,000 hour lamp life, using lamps that are commercially available for less than $300. The unique design is created for safety and longevity, with a dry, one-atmosphere chamber inside a separate rugged quartz envelope, so no water ever comes into contact with the lamp itself, and the lamp is not subjected to the pressure, thermal shock, and corrosive effect of the underwater environment. It has a unique mirror finish parabolic reflector to maximize light output and is meticulously engineered with a rugged, all stainless steel construction, including a specially reinforced captivated heavy-gauge stainless-steel mesh screen with four Ø10mm (Ø3/8-in.) solid stainless welded steel bars to increase rigidity and protect against mechanical impact.

The versatile, rugged system has type 316 stainless steel connectors sealed with redundant o-rings in a detachable subsea grade power cable assembly, providing complete mechanical protection for the electrical pins, indexed with a stainless steel keyway to prevent mismating.

Contact: Amy Brown, telephone: (805) 830-5876, email: abrown@birns.com.

TubeLight

The **BIRNS** TubeLight™ is the ideal solution for maximum light output delivered in a minute package. It provides 10,000+ lumen brilliance, and comes with a wide range of accessories to tailor it to demanding underwater drop-light applications. It's compact (only Ø48mm), so it works well in incredibly tight spaces, and versatile (100W to 500W) to fit seamlessly in an array of systems.

Perfect for bright illumination of narrow inspection tubes, or for complete, easy to manipulate 360° lighting of any pool, it's suspended by its cable for general-purpose drop light use, and can be mounted singly or in pairs for use with underwater cameras.

This lighting system operates at up to 300M, and has sturdy stainless-steel construction, with easy decontamination, comprehensive GFCI/ELCB compatibility, and a unique wire-free design.

Contact: telephone: (805) 487-5393, email: service@birns.com.

Radiation Monitor

CANBERRA has announced the EcoGamma-g environmental gamma radiation monitor, designed to operate in the most extreme conditions with unsurpassed accuracy, range and stability. EcoGamma-g incorporates CANBERRA's unique "Time To Count" technique to provide excellent accuracy and linearity through its 10 nSv/hr to 10 Sv/hr, 30 keV to 3.0 MeV operating range. Its assembly is housed within an IP67 rated weatherproof aluminum enclosure designed to provide stable, reliable performance in demanding operating environments. The monitor's extensive historical database logs operational data, and its 180 day storage capability safeguards vital information even if communication with the instrument is temporarily lost. The design of the Eco-Gamma-g offers an unparalleled degree of positional integrity and repeatability of its calibration routine, and features such as built-in temperature monitoring and Total Integrated Dose (TID) tracking support preventative and predictive maintenance by the user.

The platform neutral firmware application of the EcoGamma-g enables two-way communication via web, connected system or computer right out of the box, and its modular design accommodates a range of power, communication and hardware requirements.

The EcoGamma-g is suitable for indoor or outdoor use by nuclear facilities including nuclear power plants, fuel cycle facilities and laboratories.

Contact: Joanna Lipper, telephone: (203) 639-2441, email: Joanna.lipper@canberra.com.

Laser Scans

Construction Systems Associates, Inc.'s (CSA) PanoMap® is now available for the Android tablet or smartphone and is designed for a variety of applications including plant walkdowns, inspections, and spatial field applications. The app can hold thousands of 360° laser scans of your facility.

The database can include original scans as well as 3D CAD models merged into the scans. Smart labels, which can represent audio, photos, drawings, and other files, can be added.

A smartphone or tablet provides easy access to a plant's 3D scan spatial database. The user can navigate through scans via the plant-specific menu of locations using screen tap and menu formats that are familiar to smartphone users. The keyplan is identified by building, elevation, or zone—the user selects an area in the drawing, taps on a scan, and the scan is displayed.

(Continued on page 14)

New Products...

Continued from page 13

CSA software supports scan data collected by laser scanners from all major manufacturers using either the native laser scan format or .ptx format.

PanoMap users benefit from compact file size—the point cloud data is reduced in the PanoMap format without compromising the accuracy of the data.

Contact: telephone: (770) 955-3518, website: www.csaatl.com.

Valve Controls

Enertech, a business unit of Curtiss Wright Flow Control Company and supplier of electro-hydraulic, gas spring actuators used for safe plant shut down application has developed an extended mission model to support nuclear plant cool down during station black out (SBO) conditions. Conventional electro-hydraulic, gas spring actuators are limited to one direction; fail safe positioning of isolation valves.

Enertech's advanced technology permits bi-directional cycling of isolation valves and dampers from stored energy for a 72 hour period or longer without dependency on off-site power, emergency diesel generator AC power or air supply. This technology complies with motive force diversification objectives and operates on low consumption DC power. The space required to facilitate Enertech's stored energy module is a fraction of that required by traditional air supply tanks and control panels used in early designs. Enertech's extended mission actuator is qualified for harsh environment to IEEE 382, 344 and 323 for survival in high energy line break as well as severe seismic and other design basis conditions including its position feedback instrumentation for optional modulating control service. Enertech has received orders for this safe plant shut down technology and offers it to Utility and Station Owners for plant upgrade and to valve and damper OEMs.

Contact: Deane Beck, telephone: (714) 388-8527, email: dbeck@curtisswright.com.

Services

Fabrication

AT&F Steel (www.atfsteel.com) specializes in medium-to-heavy fabrications for the energy, heavy industrial and defense industries. Being a steel and fabricating service center, AT&F provides metals, cut parts, cylinders, shells, cans, formed shapes and structural components to manufacturers, designers, engineering and procurement contractors, and utilities. State-of-the-art fabricating services include: laser, plasma, oxy fuel cutting, heavy, long precision press brake forming, thick plate rolling, welding, NDE, heat treating, blasting and machining.

AT&F Advanced Metals (www.advmetals.com) is dedicated to the design, fabrication, inspection and repair of process equipment for corrosive environments using special metals. Producing lab and commercial scale processing equipment, as well as pressure vessels, heat exchangers, piping systems and custom fabrications, AT&F Advanced Metals specializes in Titanium, Tantalum, Zirconium, Niobium, 300 Series Stainless, Duplex Stainless and nickel-based alloys fabricating.

Contact: Kevin Cantrell, telephone: (216) 252-1500, email: cantrellk@atfco.com.

Cyber Security

Black & Veatch's utility and nuclear operating experience, combined with our cyber security and compliance expertise, make us a uniquely qualified security partner for your critical infrastructure protection. Services include identifying/assessing critical digital assets, performing audit/gap analysis, providing customized training tools/programs, implementing security recommendations, and tailoring a comprehensive enterprise compliance program for establishing and maintaining a robust security plan and culture.

Contact: Julie Nurski, telephone: (913) 485-7596.

Operating Solutions

From studies to major plant modification, from physical security to cyber security updates, from design to installation of independent spent fuel storage installations, **Black & Veatch** is a single source for meeting your safety, security, reliability and cost requirements. We have highly efficient and advanced project management, design, configuration management, procurement and construction management capabilities.

Contact: Julie Nurski, telephone: (913) 485-7596.

Project Solutions

Black & Veatch provides full-service nuclear power planning, engineering, procurement and construction. Services include feasibility, site and technology selection; scheduling, cost estimating and cost control; seismic design validation; digital control system design; cyber/physical security; combined construction and operating license (COL) application/leadership; detailed design engineering; equipment specification development and qualification; procurement/procurement management; construction planning and management; on-site construction; and training.

Contact: Julie Nurski, telephone: (913) 485-7596.

Scaffolding Monitoring

UniTech Services Group has developed an automated conveying system that efficiently and accurately monitors scaffolding that has been used in and retired from nuclear facilities. UniTech's custom-developed scaffolding monitoring system surveys a facility's radiologically contaminated equipment on all surfaces, both external and internal. UniTech has the capability to monitor both Beta/Gamma and Alpha loose and fixed contamination.

UniTech uses its Straight Scaffolding Monitor to quickly and automatically frisk round straight pipes, accurately monitoring for contamination. This is a process for which other systems have historically failed to assure accurate and reliable results, so UniTech's Straight Scaffolding Monitor represents an important advancement.

UniTech has also developed a way to deal with another particularly vexing problem that often precludes free release of scaffold pipes. When surplus scaffolding pipes are pulled from nuclear facilities, the metal inside the hollow pipe may or may not be contaminated. ,

Contact: Gregg Johnstone, telephone: (413) 543-6911, email: gjohnstone@unitechus.com.

Contracts

Control Systems

EDF has awarded **AREVA** with a contract to upgrade the monitoring and control systems which guarantee the safety of its 1300MW power plants (Paluel, Flamanville, Saint-Alban, Cattenom, Belleville, Nogent sur Seine, Golfech and Penly).

The work, to be carried out on 20 reactors, is an integral part of EDF's industrial program for the continuous improvement of its nuclear installations. The aim is to enhance the performance of the monitoring and control systems, which guarantee nuclear safety.

The first tranche of the works will commence in 2015, to coincide with the third 10-yearly reactor inspections.

Contact: Fleur Floquet-Daubigeon, telephone: 33 0 1 34 96 05 97, email: marie.descorbiac@areva.com.

Waste Transport

The Department of Energy (DOE) awarded two small-business contracts to CAST Specialty Transportation, Inc. and Visionary Solutions, LLC, to provide trucking services to transport transuranic (TRU) waste, from DOE and other defense-related TRU waste generator sites to the Waste Isolation Pilot Plant (WIPP) site, near Carlsbad, New Mexico. The contracts are firmfixed- price with cost-reimbursable expenses over five years.

CAST Specialty Transportation, Inc. of Henderson, Colorado, will begin services immediately. Visionary Solutions, LLC, of Oak Ridge, Tennessee, will begin their contract in July 2012. Both companies are the incumbent contractors, performing trucking services for TRU waste since 2007.

Contact: Bill Taylor, telephone: (803) 952-8564, email: bill.taylor@srs.gov.

Structural Supports

Two orders were awarded by Westinghouse Electric Company to **Energy Steel & Supply Co**. for the supply of structural supports and assemblies at two nuclear power plants in the United States where four AP1000® pressurized water reactor units are under construction. Deliveries are projected to span fiscal years 2013, 2014 and 2015.

Contact: Waylon Waters, telephone: (810) 538-4983, email: waters@energysteel.com.

Long-term Availability

Spain's Iberdrola and Nuclenor have awarded **GE Hitachi Nuclear Energy** (GEH) with multi-year services contracts to help ensure the long-term reliability, availability and safe operation of the Cofrentes and Santa María de Garoña nuclear power plants.

The Cofrentes station, located in the province of Valencia and owned by Iberdrola, generates power using a GE boiling water reactor (BWR) that began operating in 1985. The Cofrentes station is one of the largest of Spain's eight nuclear power plants and generates nearly 5 percent of Spain's electricity. The S.M. Garoña station, located in the province of Burgos and owned by Nuclenor, uses a GE BWR that has been in operation since 1971. It has achieved numerous awards due to its excellent efficiency and capacity factors. Nuclenor is split-owned by Iberdrola and Endesa.

Contact: Michael Tetuan, telephone: (910) 819-7055, email: Michael.tetuan@ge.com.

RadWaste

NUKEM Technologies, the specialist Nuclear Engineering Company, has won a three-year contract to work with the European Commission in providing support to Power Plant and Nuclear Facility operators in the Ukraine to improve the overall Radioactive Waste situation in the country. The project is one of a number to be launched by the EC with the aim of ensuring a robust and cohesive strategy for the Ukraine, that will cover all aspects of radioactive waste generation, storage and remediation, as well as covering decommissioning activities, and the Chernobyl legacy waste.

Contact: Beate Scheffler, telephone: (49 6023 911147, email: beate.scheffler@nukemtechnologies.de.

I&C

Rolls-Royce, the global power systems company, has won a contract with AREVA to supply safety instrumentation and control (I&C) technologies and systems for the French nuclear reactor modernization program. The systems will be installed in the twenty-strong French fleet of 1300 MW nuclear reactors operated by Electricité de France (EDF).

The project will ensure that the reactor fleet continues to meet safety and licensing requirements through the deployment of the latest I&C technologies, systems and components provided by Rolls-Royce. This I&C project is being carried out by AREVA as part of the third round of ten-yearly planned reactor outages managed by EDF.

Contact: Paul Vallance, telephone: 44 0 1332 622820, email: paul.vallance@rolls-royce.com.

Strainer Replacement

Korea Hydro & Nuclear Power (KHNP) has awarded a contract to **Transco Products Inc**. for the design, qualification, testing, manufacturing, and installation of replacement emergency core cooling system strainers at eight operational nuclear units in the Republic of Korea. The work, similar to replacements performed at PWR's in the United States under the GSI-191 program, will involve replacements at the Kori, Yonggwang, and Wolsong nuclear plants, and will be completed between 2012 and 2013 during the plants normal maintenance and refueling activities. Transco previously supplied new emergency core cooling strainers for KHNP at the Shin Kori and Shin Wolsong nuclear power plants. This new contract involves a combination of design, testing and manufacturing activities in the United States, and qualification, testing and installation activities in the Republic of Korea; and comes on the heels of the recently completed Free Trade Agreement between the two countries.

Contact: Pari Patel, telephone: (312) 896-8463, email: ppatel@transcoproducts.com. ■

New Documents

EPRI

1. *Steam Generator Management Program: Foreign Object Wear Scar Sizing Prototype Development.* Product ID: 10222822. Published September, 2011.

This report describes the research and development of an optical-based solution to characterize a tube wear scar from the secondary side of a steam generator. A custom lens solution was manufactured and tested for this initial prototype development phase. Testing was performed to provide proof of concept and to provide data that can be used in future development of a field-ready, secondary-side wear scar measurement system.

2. *BWRVIP Fuel Reliability Program: AREVA Priority 1 Fuel Inspections Results Assessment Report.* Product ID: 1022892. Published October, 2011.

In an effort to meet the recommendations of Electric Power Research Institute (EPRI) report 1015032, Fuel Reliability Guidelines: Fuel Surveillance and Inspection, AREVA NP Inc. worked with the EPRI Fuel Reliability Program (FRP) and utilities to assign an inspection prioritization "ranking" to the AREVA-fueled U.S. boiling water reactor (BWR) and pressurized water reactor (PWR) fleets and conducted and completed a series of fuel inspections from 2007 to 2010 at the highest priority plants.

3. *Improved Basis and Requirements for Break Location Postulation.* Product ID: 1022873. Published October, 2011.

The report discusses insights obtained from operating plant experience. It also describes a study of the relationship among cumulative fatigue usage factors, leak probability, and risk for a limited set of components. Finally, a suggested approach to address postulated pipe rupture is outlined for consideration in the development of future regulations applicable for design of nuclear power plants.

4. *Westinghouse BWR Fuel Performance Program – Phase 2: 2011 Update.* Product ID: 1022887. Published October, 2011.

This report along with a previous report provides EPRI members the program results from investigations of BWR fuel rod performance for rods constructed with the latest Westinghouse Electric Sweden AB (WES) cladding material and operated to high average burnup levels (>70 GWd/MTU).

5. *Structural Integrity of Advanced Claddings During Spent Nuclear Fuel Transportation and Storage: Volume 2: Creep Testing of LK3 Zircaloy-2 Cladding Tubes.* Product ID: 1022918. Published November, 2011.

Thermal creep is the dominant deformation mechanism of fuel cladding during transportation and dry storage of spent nuclear fuel. This project generated thermal creep data and creep models of Westinghouse ZIRLO® and LK3 Zircaloy-2 cladding tubes for use in spent-fuel storage and transportation applications. The final report consists of two volumes. This document (Volume 2) provides the project results obtained on non-irradiated and irradiated LK3 Zircaloy-2 cladding tubes. Volume 1, published in June 2011 as EPRI Report 1022919, provides results obtained on non-irradiated and irradiated standard ZIRLO and non-irradiated optimized ZIRLO claddings.

6. *Fuel Reliability Database (FRED) Version 3.3.* Product ID: 1022631. Published November, 2011.

The Fuel Reliability Database (FRED) offers a broad-based platform to exchange high fidelity fuel-related information that enhances industry's fuel reliability and performance knowledge.

7. *Nuclear Maintenance Applications Center: Passive Component Maintenance Guide for Nuclear Power Plant Personnel.* Product ID: 1022955. Published November, 2011.

Through the use of this guideline, in close conjunction with the industry guidance provided, Electric Power Research Institute (EPRI) members should be able to significantly improve and consistently implement the processes associated with the safe and reliable operation of their systems that include passive equipment.

8. *Guideline for On-Line Monitoring of Nuclear Power Plant Instrument Channel Performance.* Product ID: 1022988. Published November, 2011.

This report provides a guideline for a utility to develop an on-line monitoring (OLM) program for evaluating instrument channel performance at nuclear power plants (NPPs).

9. *Welding and Repair Technology Center: Mechanical and Welding Mitigation Guidelines.* Product ID: 1022878. Published November, 2011.

This document identifies and describes the mechanical and welding mitigation measures that have been and may be used in the future to reduce or eliminate the likelihood of stress corrosion cracking. It also illustrates decision-making approaches that can be used to help determine which mitigation strategy is best for the given situation.

10. *Assessment of Browns Ferry 2 Cycle 12 Fuel Corrosion Failures.* Product ID: 1022902. Published November, 2011.

The overall investigation objectives are to identify the fuel that failed in BF-2 Cycle 12, to characterize the fuel rod and operational conditions associated with the failure, and to identify the fuel failure mechanism and provide insight into the root cause.

11. *Waste Class B/C Reduction Guide, Revision 1.* Product ID: 1023017. Published November, 2011.

The EPRI project team—consisting of utility and other industry radwaste, chemistry, and operations experts—reviewed the options documented in EPRI's 2005 and 2007 Class B/C waste reduction reports (1011727, 1015115) and any emergent opportunities. Using that information, they developed a template for evaluating applicability, implementation, and performance issues associated with each option.

The above EPRI documents may be ordered by contacting the Order Center at (800) 313-3774 Option 2 or email at orders@epri.com. ■

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UCC boasts an exceptional safety record and unmatched in-water experience with its 200+ expertly trained dive team. This experience and commitment to safety has recently earned them prestigious service awards from two of the world's largest nuclear OEMs. These awards are a testament to the long standing tradition of success and reliability UCC has provided to the global nuclear industry for the past 40 years.

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OR CALL (800) USA-DIVE

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Meeting & Training Calendar

1. **NEI**/DOE Small Reactor Forum, February 27, 2012, Grand Hyatt Washington, Washington, D.C. Contact: Paul Genoa, telephone: (202) 739-8034, email: phg@nei.org.

2. Web-Based Radiation Course, March 12, 2012. Contact: Kruti Patel, **Nuclear Plant Journal**, telephone: (630) 858-6161 x 105, fax: (630) 852-8787, email: kruti@goinfo.com.

3. Nuclear Energy Korea 2012, March 19-21, 2012, Busan, South Korea. Contact: **Korea Atomic Industrial Forum**, telephone: 82-2-785-2570, fax: 82-2-785-3975, email: annconf@kaif.or.kr.

4. International Experts' Meeting on Reactor and Spent Fuel Safety in the Light of the Accident at the Fukushima Daiichi Nuclear Power Plant, March 19-22, 2012, Vienna, Austria. Contact: **International Atomic Energy Agency,** telephone: 43 1 2600, email: official.mail@iaea.org.

5. International Conference on Progress in Nuclear Energy and Education, March 20-22, 2012, London, United Kingdom. Contact: **Lancaster University**, website: www.progressnuclearenergy.com.

6. Nuclear Industry, China 2012, China, April 3-6, 2012, China National Convention Center, Beijing, P.R. Contact: Lin Yi, telephone: 86 10 652 68 150, 65260852, email: linyinic@126.com, website: www.nic-expo.net/nic2012.

7. World Nuclear Fuel Cycle 2012, April 17-19, 2012, Helsinki Congress Paasitorni, Helsinki, Finland. Contact: **Nuclear Energy Institute,** telephone: (202) 739-8000, email: conferences@nei.org.

8. Nuclear Fuel Cycle Conference, April 23-25, 2012, Manchester, United Kingdom. Contact: **Institution of Chemical Engineers** (IChemE**)**, telephone: 44 0 1788 578214, email: jsharp@icheme.org.

9. Used Fuel Management Conference, May 8-10, 2012, The Renaissance Vinoy, St. Petersburg, Florida. Contact: **Nuclear Energy Institute,** telephone: (202) 739-8000, email: conferences@nei.org.

10. Third International Conference on Nuclear Power Plant Life Management, May 14-18, 2012, Salt Lake City, UT. Contact: **IAEA**, website: www.pub.iaea.org/MTCD/meetings/meetings2012.asp.

11. Annual Nuclear Industry Conference and Nuclear Supplier Expo: Nuclear Energy Assembly, May 21-23, 2012, Westin Charlotte, Charlotte, North Carolina. Contact: **Nuclear Energy Institute,** telephone: (202) 739-8000, email: conferences@nei.org..

12. ATOMEXPO 2012, June 4-6, 2012, Moscow, Russia. Contact: telephone: 7 495 66 33 821, fax: 7 495 66 33 820, email: atomexpo@atomexpo.com.

13. Facility Decommissioning Training Course, June 4-7, 2012, Chicago, Illinois. Contact: Lawrence Boing**, Argonne National Laboratory,** telephone: (630) 252-6729, email: lboing@anl.gov.

14. Emergency Preparedness Forum, June 6-8, 2012, Renaissance Seattle Hotel, Seattle, Washington. Contact: **Nuclear Energy Institute,** telephone: (202) 739-8000, email: conferences@nei.org.

15. 33rd Annual **Canadian Nuclear Society** Conference and 36th Annual CNS/CAN Student Conference. June 10-13, 2012, Saskatoon, SK, Canada. Contact: telephone: (416) 977-7620, email: cns-snc@on.aibn.com.

16. **American Nuclear Society** Annual Meeting 2012, June 24-28, 2012, Chicago, Illinois. Contact: telephone: (708) 352-6611, email: meetings@ans.org.

17. 2012 International Congress on the Advances of Nuclear Power Plants, June 24-28, 2012, Hyatt Regency, Chicago, Illinois. Contact: Organized by: **American Nuclear Society**. Contact: website: www.icapp.ans.org, email: icapp2icapp.ans.org.

18. U.S. Women in Nuclear, July15-18, 2012, Swan and Dolphin Hotel, Orlando, Florida. Contact: **Nuclear Energy Institute**, telephone: (202) 739-8000, email: conferences@nei.org.

19. 8th International Topical Meeting on Nuclear Plant Instrumentation, Control, and Human-Machine Interface Technologies, July 22-26, 2012, The Westin San Diego, San Diego, California. Sponsored by: **American Nuclear Society.** Contact: website: npic-hmit.ans.org.

20. Radiation Protection Forum, August 5-8 2012, Westin Waterfront, Boston Massachusetts. Contact: **Nuclear Energy Institute**, telephone: (202) 739-8000, email: conferences@nei.org.

21. Utility Working Conference and Vendor Technology Expo, August 5-8, 2012, Westin Diplomat, Hollywood, Florida. Contact: **American Nuclear Society,** telephone: (708) 579-8282. ■.

Research & Developments

Benchmarking Practices

U.S. plant practices and organizations are structured to support a large amount of maintenance on-line (about 70%), such large-scale adoption may not be optimum in all cases. EPRI is benchmarking on-line maintenance approaches at non-U.S. plants to identify and characterize mature alternative approaches that may be more appropriate on a smaller scale.

EPRI identified three possible candidate plants for benchmarking: the Cofrentes boiling water reactor plant in Spain, the Trillo pressurized water reactor plant in Spain, and the Leibstadt boiling water reactor plant in Switzerland. The benchmarking has a broad scope: extent of on-line maintenance applied, organization and staffing, work scheduling and planning approaches, regulatory considerations and configuration risk methods, and maintenance practices. The benchmarking is conducted through a combination of written questions and on-site interviews with plant personnel.

Contact: Ken Huffman, telephone: (704) 595-2555, email: khuffman@epri.com.

Chemistry Optimization

EPRI is collaborating with **Comisión Federal de Electricidad** (CFE), Mexico's national electric company, to identify and implement improvement opportunities that support stress corrosion cracking mitigation, fuel reliability goals, and radiation dose control at the Laguna Verde nuclear plant. The assistance includes cycle chemistry evaluations, strategic water chemistry planning, and radiation dose and source term assessments.

EPRI is assisting Laguna Verde personnel in reviewing long-term chemistry trends for adverse system performance and in optimizing chemistry control programs to mitigate intergranular stress corrosion cracking (IGSCC), improve fuel reliability, and reduce dose. Such optimization is particularly timely because of an ongoing extended power uprate project at Laguna Verde to increase thermal output by 20% at each of the two units.

The collaboration between EPRI and CFE has identified three priority recommendations. Priority 1: Optimize Water Chemistry. Priority 2: Source Term Reduction. Priority 3: Chemical Decontamination.

Contact: Susan Garcia, telephone: (650) 855-2239, email: sgarcia@epri.com.

Monitoring Technique

Between 2004 and 2006, primary-to-secondary leaks in steam generators caused three forced outages at two 900 MW units in France. In each instance, inspections revealed a circumferential crack in a tube near the tube-free chimney region of the steam generator. Engineers hypothesized that deposit build-up on the tube support plates caused tube vibrations that led to high-cycle fatigue and eventual crack initiation.

EDF developed a monitoring technique to determine the level of deposit build-up on the tube support plates. The level of deposit build-up can then be used to determine whether and when further action, such as chemical cleaning, may be warranted.

The EDF technique monitors the response of the steam generator widerange water level during a routine down-power and compares the results with output from a transient simulation of a steam generator to determine the deposit build-up level.

Contact: Rick Rusaw, telephone: (704) 595-2690, email: rrusaw@epri.com.

Lessons Learned

Since initiating its nuclear power plant standardization program in 1984, **Korea Hydro & Nuclear Power Company** (KHNP) has brought more than 20 reactors on-line and has been able to reduce construction schedules with each new unit. For its six Optimized Power Reactor 1000 MWe units, construction schedules were reduced by 12 months (19%) from the first unit to the sixth; and for the newer Advanced Power Reactor 1400 MWe units, KHNP has achieved a five-month (9%) schedule reduction over the first three units.

(Continued on page 21)

Fukushima Update

IAEA

The report titled, "Additional Report of the Japanese Government to the **IAEA**" dated September 2011 compiles additional information on the Fukushima accident.

(1) Efforts are being made to bring about restoration from the accident after the June 2011 Report.

(2) The report compiles the current state of efforts to make full use of 28 lessons learned.

(3) The report indicates the state of affairs regarding the response to those who have suffered as a result of the nuclear accident (an off-site response) and the state of examination of a mid- to long-term plan for the site after restoration from the accident is completed (an on-site plan).

Particularly with regard to (3) above, the Government of Japan not only naturally advances its own initiatives but also considers it to be of paramount importance in the context of steadily advancing the initiatives to undertake matters through obtaining information, such as the related experiences and research results of other nations around the world and international organizations, as well as through receiving technical cooperation from them. Japan hopes this report will serve to engender such partnerships.

This additional report records in considerable detail what has been ascertained up until the present time regarding the situation of the responses at not only the Fukushima NPS but also other NPSs affected by the Tohoku District - Off the Pacific Coast Earthquake and the subsequent tsunamis. Moreover, the report gives an account of developments in terms of the response to those suffering as a result of the nuclear accident, including decontamination efforts. For a complete copy of the report visit http://www.iaea.org/newscenter/focus/fukushima/japan-report2/outline.pdf.

France

The French Safety Authority (ASN) is making public its report on the complementary safety assessments (CSA) carried out further to the Fukushima accident in Japan.

Following the complementary safety assessments of the priority nuclear facilities, ASN considers that the facilities examined offer a sufficient level of safety for it not to request the immediate shutdown of any of them. At the same time, ASN considers that for the continuation of their operation, an increase in the robustness of the facilities to extreme situations, beyond their existing safety margins, is necessary, as rapidly as possible.

ASN will therefore be requiring that the licensees take a series of measures and reinforce the safety requirements relative to the prevention of natural risks (earthquake and flooding) and risks associated with other industrial activities, the monitoring of subcontractors and the handling of nonconformities.

Contact: website: www.french-nuclear-safety.fr.

Cold Shutdown

On December 16, 2011, the Japanese government held a meeting of the Nuclear Emergency Response Headquarters (headed by Prime Minister Yoshihiko Noda) at the Prime Minister's official residence in Tokyo. Certifying that the damaged reactors at the Fukushima Daiichi Nuclear Power Station (NPS), owned by the Tokyo Electric Power Co., Inc. (TEPCO), had reached the state of cold shutdown (see definition below), the government announced that the accident itself was "brought under control." The cold shutdown was the target of Step 2 in the roadmap for the restoration from the accident that had been decided upon last April, 2011.

Meanwhile, various efforts will continue at the site, including the installation of reactor building covers for Units 3 and 4, and the construction of a ground water shielding wall on the side of the site facing the ocean in preparation for the removal of spent fuel from the spent-fuel pools. Aside from the site itself, efforts will be concentrated on such matters as decontamination, health management of the citizens in Fukushima Prefecture, and compensation.

Over the medium and long term, the national government will work on preparations for reactor decommissioning, while developing the needed technologies at the site. In addition, it will address issues related to enabling residents to return to their homes, deciding on a site for an interim storage facility, and its purchase and lease of land.

*Contact: **Japan Atomic Industrial Forum**, website: www.jaif.or.jp.*

United Kingdom

Safety reassessments undertaken at UK nuclear power stations in the light of events at Fukushima Dai-ichi have revealed no fundamental weaknesses.

A report published by the **Office for Nuclear Regulation**, the UK's independent nuclear safety regulator, confirms that UK sites have identified and made improvements to enhance safety by learning from events in Japan.

The findings are contained in the UK national 'stress test' report submitted to the European Council. It requested a targeted reassessment of safety at all European nuclear power plants based on the circumstances which occurred at Fukushima: extreme natural events challenging the plant safety functions and leading to a severe accident.

Licensees of the 33 operating or shutdown reactors in the UK within scope of the report have carried out the tests and the Office for Nuclear Regulation has reviewed the results.

Contact: website: www.hse.gov.uk/nuclear.

Accident Analysis Report

The objective of this report dated December 2, 2011, titled, "Fukushima Nuclear Accident Analysis Report" is to investigate the causes of the accident at the Fukushima Daiichi Nuclear Power Station based on the facts known to date and the results of several analyses

and to put forward necessary measures to improve the safety at other existing nuclear power plants.

Primary measures are identified as countermeasures in order to cope with several technical issues, which were clarified through the investigation that mainly focused on the sequence of events of the accident. Since the investigation is still under way, further investigation results will be compiled by **Tokyo Electric & Power Company** and released. Further investigation will mainly focus on the release of radioactive materials, radiation control, human resources, material procurement, disclosure of information, etc. Complete report is available @ http://www.tepco.co.jp/en/press/corp-com/release/betu11_e/images/111202e13.pdf.

WANO

Laurent Stricker, Chairman of the **World Association of Nuclear Operators** (WANO), visited the Fukushima Daiichi nuclear power plant and its immediate surroundings. Also taking part in the visit were George Felgate, WANO Managing Director, Harunobu Shirayanagi, WANO Tokyo Centre Regional Director, Takao Fujie, President and CEO of Japan Nuclear Technology Institute (JANTI) and Ichiro Takekuro, technical advisor to TEPCO.

Following the visit Laurent Stricker commented:

"It is incredibly humbling to visit Fukushima Daiichi. The past year has been an extraordinary one, as the global nuclear industry has endeavoured to learn from the disaster. Stress tests have been carried out, plants and procedures have been closely examined and organizations such as WANO have sought to strengthen their programs. This is all vital work, which will ensure that nuclear safety is strengthened, not diminished by what happened here on 11 March 2011."

Contact: Claire Newell, telephone: 44 0 20 7495 9242. ■

Research & Development...

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EPRI's Advanced Nuclear Technology Program is working with KHNP to capture and transfer this knowledge to the global nuclear industry. The Construction Technology Experience Project aims to document the experiences from KHNP's construction projects, providing insight into the techniques and advanced construction processes used, KHNP's timely ability to incorporate lessons learned, and the processes used to continuously optimize construction schedules for future work. These insights will be gathered from the design phase through to manufacturing and on-site construction.

Contact: Letitia Midmore, telephone: (650) 855-8576, email: lmidmore@epri.com.

BWRVIP-75-A

A growing number of non-U.S. nuclear utilities are taking advantage of the technical basis in BWRVIP-75-A to extend inspection frequencies and reduce the sample population for certain weld types. **Taiwan Power Company** received approval from its regulator earlier this year to use this EPRI guidance and was able to reduce piping inspections by more than 50% at its Kuosheng boiling water reactor plant during a 2010 outage. The inspection reduction resulted in significant savings in inspection staff resources, radiation dosage and inspection equipment setup, facilitating smooth outage completion and minimized outage duration.

Contact: Randy Stark, telephone: (650) 855-2122, email: rstark@epri.com.

Source: Electric Power Research Institute's (EPRI) Nuclear Executive Update. ■

Going Forward

By Takuya Hattori, Japan Atomic Industrial Forum.

Takuya Hattori

Takuya Hattori is President of Japan Atomic Industrial Forum, Inc. (JAIF). He joined JAIF in June 2006 as Executive Vice Chairman and was appointed to his current position in September 2007.

Prior to joining JAIF, Mr. Hattori served as Executive Vice President of Tokyo Electric Power Co. Inc. (TEPCO). He has 36 years of experience in nuclear power generation at TEPCO.

Mr. Hattori held various general management positions in design, construction, operation & maintenance, general planning at Nuclear Power Division of TEPCO, before he assumed his position as Executive Vice President in 2005, where he was responsible for Research & Development Center, Thermal Power Division, Environmental Division and Construction Division.

He received his B.S. in Mechanical Engineering and M.S. in Engineering in 1968 and 1970 respectively from the University of Tokyo.

Responses to questions by Newal Agnihotri, Editor of Nuclear Plant Journal.

1. *What is your recommendation for improving the international regulatory framework for the nuclear power industry so that all utilities worldwide follow "best practices" to keep their plants safe?*

As the nuclear power industry has such characteristics that if an accident happens at a nuclear power plant, there is a risk that the damage and impact of the accident spread across international boundaries," a framework for international cooperation has already been created with the aim of ensuring nuclear safety. The frameworks for cooperation between regulatory authorities include IAEA as well as bilateral and multilateral cooperation between regulatory authorities. On the other hand, WANO serves as a framework for international cooperation between electriity utilities. Best practices and accident information have to be shared in such frameworks. As for the knowledge and findings gained from the Fukushima accident, in particular, the Japanese government and electric utilities should proactively disseminate related information.

Considering the Fukushima accident, other countries checked safety of their nuclear power plants again. As a result, the U.S. and European countries where stress tests were carried out have reached a conclusion that their power plants do not have any defect that requires emergency measures to be taken. This represents the results of those countries that have constantly implemented measures to improve safety based on the latest knowledge and findings, and I feel strongly again the importance of internationally sharing best practices to ensure nuclear safety.

2. *Which Japanese agency is responsible for coordination of effective implementation of the Japan government's report related to "lessons learned from the Fukushima accident" which was provided to IAEA in September, 2011?*

Under the recognition that "the responsibility for measures to thoroughly ensure safety should be assumed by electric utilities who have the primary responsibility for ensuring safety," the whole electric industry has been reviewing measures for reinforcement of safety based on the experience in the Fukushima accident, putting focus on measures against severe accident. On the other hand, the Japanese government has been thoroughly reviewing safety regulations in time for the inauguration of a new regulatory agency in April 2012. The 28 lessons mentioned in the government's report have to be reflected in the efforts of both the electric utilities and the government.

3. *What is your proposal for an international regulatory enforcement structure so that all the plants all over the world are cognizant of the "best practices" and are encouraged to implement these?*

With the Fukushima accident as a momentum, the frameworks for the above-mentioned international cooperation in the public and private sectors to ensure nuclear safety are moving in the direction of reinforcement. For example, IAEA plans to assess the safety of nuclear power plants in respective countries as its new activities. WANO, moreover, plans to reinforce the present peer review activities. The international regulatory enforcement structure should be beefed up through the reinforcement of such frameworks

(Continued on page 24)

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Continued from page 22

for international cooperation, and we support this structure.

4. *How can different countries take advantage of industry organization such as American Nuclear Society, American Society of Mechanical Engineers, Institute of Electrical and Electronic Engineers, and other institutions which have played a vital role in ensuring safety of nuclear power plants by developing industry standards?*

To reflect the latest knowledge and findings in power plant operation with the aim of improving nuclear safety, it is very effective to make use of standards developed by industry organizations such as ANS, ASME and IEEE. Therefore, we think that regulatory authorities in individual countries should positively endorse wider utilization of the industry standards by electric utilities under the rules for nuclear safety regulation. For information, Japanese electric utilities recognize the standards of ASME as quasi-international standards, and they have actively contributed to the development of standards through providing data and information.

5. *Please describe the major restructuring efforts of different nuclear safety institutions, currently being planned for the Japanese industry.*

Electric utilities announced their plans to form a new independent organization to further promote improvement of safety of nuclear power plants. With the aim of developing close relations with overseas organizations in an organized manner and further reinforcing measures for ensuring safety of nuclear power plants including severe accident measures, this organization aims to consider measures for various challenges and provide suggestions, guidance and recommendations to individual electric utilities, based on the world's highest safety measures from safety and technical points of view. In the U.S., INPO was formed after the TMI accident, and INPO plays important roles for electric utilities to conduct voluntary safety activities at present. We hope that the independent organization to be formed by Japanese electric utilities will be an organization like INPO in the future.

In Japan, preparation works are now underway for inauguration of a new regulatory agency in April 2012, which substitutes the present nuclear regulatory agency. The public confidence in nuclear power has been shaken since the Fukushima accident, and the ensuring of confidence in regulations is the most important challenge at present. In such circumstances, I think that the following three points are of vital importance for the new regulatory agency:

- In view of the importance of responsibility of an organization engaged in nuclear regulation, the agency should make judgments based on high morality and highly sophisticated expert knowledge in carrying out its operations.
- Aiming at increasing the public confidence in the administrative practices to ensure nuclear safety, the agency should establish clear judgment criteria for ensuring safety, make objective and fair judgments based on such criteria, ensure the transparency of regulatory processes as a whole, and fulfill its accountability about these points to the people.
- Considering the internationality inherent in nuclear technology, the agency should constantly promote reviews and improvements with the aim of implementing more scientific and rational regulations that are internationally consistent based on new knowledge and findings, the information about results of operation, and maintenance and analyses of accidents both at home and abroad.

Concluding Remarks

Overseas operation after the Fukushima accident--aiming at the world's highest-level safety technology.

Japan has accumulated achievements of domestic development of nuclear power technologies for more than 40 years and stocked original technologies with improved safety. The country has promoted efforts for nuclear power generation overseas with newly-emerging countries based on such experience from the viewpoints of both contributions to the world and significance for Japan.

It is incumbent on Japan as the country that experienced the Fukushima accident to actively support those countries that show interest in Japan's nuclear power, through seeking for the world's highest-level safety technology. This would lead to the growth of Japanese economy and the maintenance and improvement of Japan's technological and industrial strength which is based on "design and manufacturing." JAIF plans to contribute to overseas operation of Japan's nuclear power generation technology.

Decommissioning works at Fukushima Dai-ichi Nuclear Power Station under international project.

In consideration of the Fukushima accident, those countries that promote and introduce nuclear power generation must strive to prevent occurrence of similar accidents and take every possible measure against accidents. Amid a growing trend of introduction and expansion of nuclear power generation in the world, we think that the nuclear reactors of Fukushima Dai-ichi Nuclear Power Station have to be decommissioned over several decades under an international project so that the experience, knowledge, and findings to be gained from the accident can be made use of to the greatest extent possible as the common property of the world.

Contact: M. Kinoshita, Japan Atomic Industrial Forum; telephone: 81 3 6812 7128, email: kinosita@jaif.or.jp. ■

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Stronger WANO

By George Felgate, World Association of Nuclear Operators (WANO).

George Felgate

George Felgate was appointed Managing Director of WANO in September 2009.

Prior to this position he worked at the Institute of Nuclear Power Operations (INPO) in the US for 26 years, where he served in a variety of leadership positions including Vice President of Plant Operations and Vice President of Analysis. Mr. Felgate has also held positions with the US Nuclear Regulatory Commission, the Koeberg Nuclear Power Station in Cape Town, South Africa, the Fast Flux Test Facility in the US, and the US Navy Nuclear Propulsion Program.

Mr. Felgate holds a bachelor's degree in mathematics from the US Naval Academy and a master's degree from the US Naval Postgraduate School. He is a graduate of the Harvard Advanced Management Program.

Responses to questions by Newal Agnihotri, Editor of Nuclear Plant Journal.

1. *How do you plan to make WANO more efficient, credible and visible?*

WANO's Post-Fukushima Commission, set up shortly after the accidents in March 2011, recommended the following actions to strengthen WANO and its programmes for the future. These recommendations were approved by the Governing Board and then put to a vote of the members at WANO's 2011 Biennial General Meeting in Shenzhen, China. Work on each area is underway and progressing well.

The first area deals with expanding the scope of WANO peer reviews and other WANO programmes to focus not only on preventing a nuclear event, but also on mitigating the consequences of one if it should occur. This includes adding emergency preparedness and severe accident management to existing WANO activities.

The second area focuses on strengthening WANO peer review activities to include more frequent station peer reviews and conducting a corporate peer review at each member utility within the next six years.

The third area looks at improving the quality and consistency of all of WANO's activities and services, starting with thorough assessments of each WANO Region and the London Office.

WANO will also put in place an internal emergency response procedure that clearly defines roles and responsibilities in the event of a nuclear emergency. WANO will take the additional initiative of working with other key industry organizations such as IAEA, WNA and INPO to integrate its plan with theirs.

Finally, to accomplish what needs to be done, WANO will add additional experienced staff in all four Regions.

2. *Has WANO identified committed, powerful utilities and well trained personnel who are capable of responding as promptly as possible to severe accidents anywhere in the world?*

WANO is currently developing working groups to examine the areas of activity outlined. These working groups are comprised of WANO staff and experts from across the industry.

However, it is not part of WANO's scope to create a 'rapid response' unit to be deployed on the ground in the event of an accident, as this question suggests.

3. *I believe MDEP (Multinational Design Evaluation Programme) reviews the plant designs for new plant construction worldwide to bring uniformity to design, licensing, and regulation. How will WANO's new pre start-up review office in China interact with MDEP or any other international organizations worldwide?*

WANO attempts to support and coordinate activities with all international organizations that have initiatives underway in support of nuclear safety. The purpose of our pre-startup group is to help ensure every new unit makes the transition from construction to operation safely, and has in place a strong nuclear safety culture. We do this for all new units regardless of design.

4. *What is your recommendation for improving the international regulatory framework for the nuclear power industry so that all utilities worldwide follow "best practices" to keep their plants safe?*

Comments regarding national regulators are better addressed by the IAEA, which has an oversight role for regulators. It is part of WANO's mission to share best practices that we identify with all nuclear plant operators.

5. *Which international agency is responsible for coordination of effective implementation of the Japan government's report related to "lessons learned from the Fukushima accident" which was provided to IAEA in September, 2011?*

The IAEA would be in a better position to address this question. However, as part of WANO's mission, WANO is collecting the lessons learned from all sources regarding the Fukushima

Daiichi accident and communicating these lessons to our members as appropriate. To date, WANO has issued three Significant Operating Experience Reports, our highest priority operating experience document to members containing recommendations from the accident.

6. *What is your proposal for an international regulatory enforcement structure so that all the plants all over the world are cognizant of the "best practices" and are encouraged to implement these?*

Nuclear safety is served well by a credible regulator and a strong system of self-regulation. It is this self-regulation of the nuclear industry that is WANO's mission.

7. *How can different countries take advantage of industry organization such as American Nuclear Society, American Society of Mechanical Engineers, Institute of Electrical and Electronic Engineers, and other institutions which have played a vital role in ensuring safety of nuclear power plants by developing industry standards?*

How and to what extent countries make use of the organizations listed in the question, is a decision for each operating organization. WANO does not take a position regarding whether members should take advantage of these organizations. However, WANO establishes its own standards of excellence in a broad range of areas through benchmarking and sharing of best practices.

8. *What will be WANO's additional role in ensuring effective support to the utilities in:*

- *Efficient operation of the plant*
- *Effectively bringing the plant to a shutdown mode in case of a beyond design basis accident*
- WANO's four programmes – operating experience, peer reviews, technical support and exchange and professional and technical development – provide ongoing support to its members to enable them to operate their plants to the highest standards of nuclear safety. Our focus is always on nuclear safety, and not efficiency. However, it is well-recognized that efficient operations correlates well with safe operation.
- WANO will, in the future, include emergency preparedness and severe accident management as part of its core activities. In doing so, WANO will verify that procedures, training, and equipment are in place to safely shutdown a nuclear unit under a variety of conditions.

9. *How will WANO support the utilities, will it be with hardware (equipment), management, and training to deal with an accident?*

WANO will continue to support its members with practical advice and support on safety matters, shared operating experience, training and development opportunities in the field of nuclear safety and regular peer reviews to support and monitor each plant's progress. As noted above, WANO's emphasis will be on ensuring each utility has in place the procedures, training, and equipment to deal with both design basis and beyond design basis accidents.

10. *What are WANO's current plans to take advantage of the latest information technology (IT) to have an affective contact to communicate with its numbers?*

As part of its aim to increase its visibility, WANO will be using a range of communication tools to impart information to its staff, members and key stakeholder audiences. No one specific technology has been identified with which to meet this aim.

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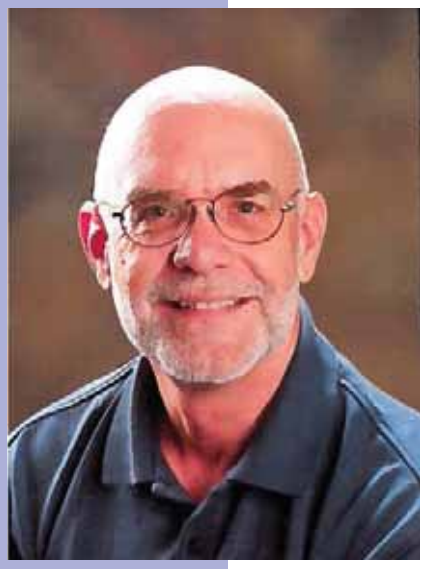
Machine Vision Technology

By Chris Hebel, Ron DiSabatino, and Kate Gresh, Exelon Nuclear.

Chris Hebel

Chris Hebel started at Quad Cities Station in 1982. Chris has worked in Systems Engineering, Operations, On-Line Work Control, and Outage Work Control, over the past 30 years, before returning to Engineering as the Quad Cities BWR Reactor Internal Components Engineer. Chris graduated from Southern Illinois University Carbondale with a B.S. in Engineering.



Ron DiSabatino

Ron DiSabatino joined Exelon Nuclear, LLC in 2006. DiSabatino is an engineer in the Asset Management group at Exelon's corporate office in Kennett Square, PA and has responsibility for BWR Reactor Internal Components. He has experience with engineering programs at both the corporate office and at Exelon's Peach Bottom Atomic Power Station and holds a B.S. and M.S. in Mechanical Engineering from the University of Maryland.

Recently developed underwater laser scanning technology, specifically designed for in-vessel use, was used to precisely measure a weld and surrounding components on the Jet Pump 13/14 Riser Elbow-to-Pipe weld location (RS-2) in the Quad Cities Unit 1 reactor. The scanner has an accuracy of +/-.004 in. (0.10mm) at a 12 in. (300mm) distance and the point cloud output is designed to be processed by 3-Dimensional software into fully-measurable Computer Assisted Design (CAD) files. Pre-deployment testing and training was carried out by Westinghouse Electric Company engineers at their BWR mock-up. The subsequently successful Quad Cities scans resulted in significantly better results than could be obtained by traditional methods and scanner deployment took only 12 hours, followed by CAD file rendering.

When first-time, in-vessel modifications need to be planned, it is critical to have sufficient as-built details available to design the correct tooling and hardware. When these details are not available, measurements must be taken during a refueling outage.

In mid-May 2011, Thomas Wojcik, the Quad Cities Manager for Engineering Programs, emailed that an indication was identified on the jet pump 13/14 Riser Elbow-to-Pipe weld location (RS-2) in Quad Cities Unit 1. This was the first time in the U.S. nuclear industry experience that an indication had been observed at this specific location on a jet pump riser. What makes this RS-2 degradation so challenging is that installation of a first-of-a-kind modification would need to be accomplished in a future outage. Further, this issue is compounded by a lack of sufficient as-built details. These requirements meant that the measurements had to be scheduled during the recent 2011 refueling outage and, to complicate matters, be taken in one of the more difficult-to-reach areas of the BWR annulus.

Previous similar experiences involved simply taping a ruler onto a pole, lowering it into the reactor annulus and, using underwater cameras, attempting to measure the critical dimensions needed by the design engineers. This method requires physical contact and not as accurate as one would wish. Normally it would have been the only method available to measure the Quad Cities jet pump weld. But this time it was different.

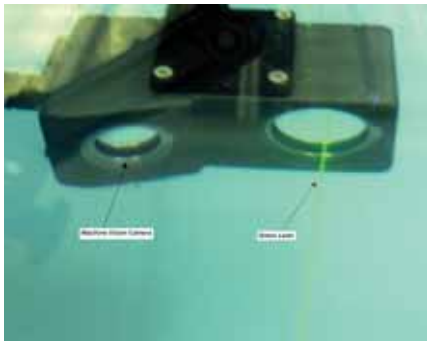
At Exelon, we have experienced numerous challenges correctly fabricating and installing modifications to reactor internals the first time using measurement data from a T-square ruler, or a mechanical profiling tool. In the recent past we have needed to add more than 11 days of critical path time to rework tooling and hardware in order to get modifications to reactor internals to fit properly. It all comes down to not being able to obtain sufficiently accurate measurements in-vessel using the traditional methods. What was needed was an accurate, non-contact, underwater measuring process.

Unfortunately, the environment within BWR reactor internals presents five challenging problems that usually defeat non-contact measurement devices. The first is that water refracts and distorts light, so a process that works in air will not usually work underwater; second is the very high radiation field; third is the tightly constrained working area; fourth is the heat thermals produced by the fuel in the core; and the fifth is the turbulence of the core cooling water circulation that buffets measuring devices during data acquisition. Keith Moser, Exelon Innovations Manager, searched for a better non-contact underwater measuring process literally taking him to three continents, numerous vendors and several research facilities in order to evaluate promising technologies. On one of his visits, a nuclear service provider recommended that Moser visit Newton Research Labs near Seattle, Washington.

Newton Research Labs was a different company from what Moser had been used to working with in the

nuclear industry. They are a small, but very high-tech company, beginning as a start-up at MIT where the founders had focused on the combination of machine vision technology with robotics. In the early days of the company, they had even applied their machine vision expertise to compete in international robotic soccer tournaments and, due to their superior technology, won most of them. Building from this playfully-serious beginning, Newton Labs adapted and grew this technology into advanced manufacturing and industrial processes which included the machine vision guidance system for Zetec, Inc.'s robotic inspection devices for steam generators.

What was most impressive about Newton Labs was that they were ready and able to quickly come up with a technical solution to accurate, non-contact measurement within the challenging environment of reactor internals: that solution was an underwater laser scanner. The first Newton prototype scanner projected a line-scan laser coupled with a high-resolution machine vision camera. Both units were packaged within a compact, radiation-resistant housing that allowed access into the tight areas of the reactor internals. But the most evolutionary feature was not the hardware, but the software algorithm that canceled the refractive characteristics of water and enabled the recording of a dense and accurate point cloud. Even the first prototype delivered underwater measurements of impressive speed and accuracy. To resolve the issues of thermals from the core's heat, a second-generation Newton scanner was deployed in the Byron fuel pool and after collecting thousands of views, an updated algorithm was developed to remove the blurriness from the thermal-influenced images.



Newton's underwater Machine Vision Camera.

The Newton scanner's performance showed that this technology was ready to be tested by a service provider that could ensure that the measuring device would be able to perform in core flow conditions during refueling. This task originally proved to be more difficult than anticipated, as all but one service provider passed on the new technology.

The one exception that did accept the challenge was Westinghouse, whose efforts were led by James DuBay. James' background in large part influenced his decision to road-test the Newton Labs underwater laser scanning technology. He already had extensive experience with hands-on reactor modifications, engineering, and project management work on BWR reactor internals. James pursued an MBA degree from the University of Colorado in their entrepreneurship program, and after achieving his MBA, connected with Westinghouse BWR Services.

At Westinghouse, the laser scanning technology was a natural fit since DuBay had first-hand knowledge of the challenges inherent in as-built modifications of reactor internals, and his entrepreneurial mind saw the potential of the underwater laser measuring technology as a business opportunity. Its ability to provide far more accurate as-built dimensions than the original design drawings in-vessel meant that modifications could be accomplished faster and with greater precision. The other benefit with his position at Westinghouse was access to BWR reactor internals mock-up at its state-of-the-art BWR training center in Chattanooga, Tenn., where he could put the technology and its hardware through their paces and find out where any potential pitfalls might lie.

When the opportunity presented itself to obtain measurements at the Quad Cities plant, the hard development work and several beta tests had already been done and the scanner was ready for actual in-vessel use. The next step was to prepare a reproduction of the specific RS-2 jet pump location at the Westinghouse Chattanooga mock-up facility. This step proved to be invaluable and enabled the equipment and contingencies to be thoroughly and specifically tested before actually going on site and as a result, considerably shortened the required critical path time.

At the Quad Cities site, Thomas Wojcik, Chris Hebel, Ron DiSabatino and Kate Gresh provided the team site coordination and support. The Westinghouse team was given a 12-hour window on the refueling floor to deploy and complete the scans. They met the time frame and the results were impressive: the scans in the high radiation belt line region, as anticipated, resulted in considerable noise in the point cloud data, but post-processing with Geomagic software provided very clear 3-D images that were readily dimension-able.

In all, more than 20 scans were taken; scans which captured critical dimensions requested by the design engineers. After capturing the raw data, the 3-D point clouds were stitched together using Geomagic post-processing software. The accuracy of the detailed images was outstanding and significantly better than previous measurement methods; to the extent that weld profile dimensions, which in the past required the use of a $1 million mechanical profiling tool and additional days of critical path, were measured to within a few mils of accuracy within a single 12-hour shift.

For their efforts the Quad Cities team was awarded the North American Young Generation in Nuclear (NA-YGN) Innovation Award at Exelon's June 2011 CNO Staff Meeting, and Quad Cities engineers are anticipating a much smoother procedure during the next outage when they make their first-of-a-kind jet pump modifications, greatly aided by the precise, in-vessel measurements now possible with the new underwater laser technology.

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Kate Gresh

Kate Gresh joined Exelon Nuclear, LLC in 2009 as a Corporate Programs Engineer. Gresh worked in the areas of finite element analysis, flaw evaluation, and composite pipe wrap, before working in materials management for BWR Reactor Internal Components. Gresh holds a B.S. in Civil Engineering from the University of Illinois.

Noise Monitoring

A pilot project at the Palo Verde Nuclear Generating Station capped a decade of EPRI-led collaborative R&D by successfully demonstrating software and methods for measuring and monitoring eddy current noise. Eddy current noise can create interference during nondestructive examination of steam generator tubing.

The knowledge and tools demonstrated in the project:

- Enhance understanding of steam generator tube condition
- Help improve steam generator tube inspections to prevent undetected indications from developing into leaks or ruptures during operation
- Are now available for implementation by other nuclear utilities

The Challenge

Eddy current techniques are widely used in the nondestructive evaluation of nuclear plant components, including steam generator tubing. Noise sources can impact the quality of the eddy current signal, interfering with the detection and sizing of degradation. These noise sources may come from the test system (parasitic noise) or from the environment (deposits, structure, or tube conditions).

Measuring and monitoring noise in steam generator tubing eddy current data has challenged engineers for years. In 2000 an undetected crack in a steam generator tube caused an unplanned nuclear plant shutdown. Analysts missed the crack due to excessive eddy current noise in the vicinity of the flaw.

Multiyear Collaboration

To address this challenge, EPRI's Steam Generator Management Program launched a multiyear project to devise a noise measurement and monitoring methodology and develop the capability to automatically perform noise measurements and monitoring during steam generator inspections.

This is a Success Story from Electric Power Research Institute.

Investigators used information from the nondestructive evaluation and engineering communities to develop recommendations for noise analyses. The project team also developed automated noise-measuring software that could be used while performing tube integrity inspections. An early version tested at Beaver Valley Unit 1 in 2005 demonstrated that the software could measure noise, but could not monitor noise during a steam generator inspection. Using the lessons learned from this pilot, EPRI continued working with eddy current vendors to further develop the software and monitoring methods.

The results of this long-term collaboration are compiled in an EPRI report, Measuring and Monitoring Noise in Steam Generator Tubing Eddy-Current Data for Tube Integrity Applications (Report Number 1016554). The report includes a recommended eddy current examination scope for noise measurement and monitoring, a noise assessment process, and examples for field implementation.

Steam generator owners can use the report as a resource when implementing noise evaluations.

The report also includes a functional specification for automated noise monitoring software, which EPRI provided to vendors so they could develop automated software for measurement and monitoring of eddy current noise. Two vendors, Zetec and Westinghouse Electric Company, have developed software based on the specification.

EPRI also developed software called Model-Assisted Probability of Detection (MAPOD) that uses the output from noise monitoring software.

MAPOD calculates the probability of detection from a given eddy current system for a user-specified dataset, including site-specific eddy current noise.

Palo Verde Pilot Project

Arizona Public Service used the information and tools developed by EPRI at a second pilot project performed at Palo Verde Nuclear Generating Station on replacement steam generators with Alloy 690 thermally treated tubing.

The project team performed noise analyses on the eddy current data from the plant's baseline inspection of one steam generator to obtain noise distributions. These noise distributions were then used as inputs to probability of detection predictions in MAPOD and to set thresholds for noise monitoring. During the in-service inspection, the team performed noise analyses on the same steam generator to compare to the baseline noise measurements and to identify outlier noise values for further review. The project team performed the work during the outage to assess capabilities for performing the analyses during a steam generator inspection.

Results and Benefits

The Palo Verde pilot project successfully demonstrated that the automated noise monitoring software worked efficiently in measuring and monitoring noise during an eddy current examination in replacement steam generators.

This first-time demonstration brings the industry a step closer to being able to continually monitor noise in steam generator eddy current data. This capability helps steam generator engineers understand the condition of tubing being inspected, guiding decision-making on which tubes should be tested with other techniques or which should be taken out of service by plugging. This prevents missing indications that could grow to tube leaks or ruptures during operation. The noise measurement and monitoring software is now available for implementation by steam generator owners.

"Palo Verde has been involved with several technological advances in the examination of steam generator tubing, from rotating and array probes to analysis feedback protocol," said Doug Hansen, Arizona Public Service Level III Eddy Current Analyst. "This pilot program sets the stage for leading the industry into the next series of advanced data quality and analysis software processes."

Continuing Work

EPRI plans to incorporate the noise-monitoring recommendations into its steam generator inspection guidelines. Additional pilot projects are being conducted to demonstrate the software on steam generators with multiple degradation mechanisms.

Contact: Helen Cothrom, Electric Power Research Institute, 3420 Hillview Avenue, Palo Alto, CA 94304; telephone: (865) 773-4033. ■

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Fire Drill Simulator

By Gary Bena and Mike Yeager, FirstEnergy Nuclear Operating Company.

Gary Bena

Gary has 25 years experience in the Fire Safety world ranging from extinguisher maintenance to fire fighting training instruction. Gary is currently the supervisor of BETA Lab's fire safety unit and has been instrumental in applying the extinguisher simulator to training programs for nuclear professionals.

Michael Yeager

Michael Yeager is currently the External Business Manager for FirstEnergy Nuclear Operating Company's (FENOC) BETA Laboratory. He has over 20-years of commercial nuclear power industry experience including plant operations and engineering.

Prior to joining FENOC-BETA Lab in 2005, Mr. Yeager held a number of engineering and Operations positions at FENOC's Perry Nuclear plant.

Mr. Yeager holds a Bachelors degree in Electrical Engineering and achieved a Shift Technical Advisor (Senior Reactor Operator certificate) certification for the Perry Nuclear Plant.

Nuclear Energy Institute's Top Industry Practice (TIP) Award's highlight the nuclear industry's most innovative techniques and ideas.

This entry was a 2011 NEI Process Award winner.

The team members who participated included: Gary Bena, Fire & Safety Services Supervisor, FirstEnergy Nuclear Operating Company; Brad Bell, Instructor, FirstEnergy Nuclear Operating Company; and Ron Baker, Instructor, FirstEnergy Nuclear Operating Company.

Summary

FirstEnergy Nuclear Operating Company (FENOC) desired a way to provide consistent, high quality fire watch/hot work extinguisher training that meets OSHA 1910.157g hands-on training requirements and builds workforce safety skills. Using a small organization that supports the entire corporation, FENOC adopted an innovative approach for OSHA-compliant fire extinguisher training via the use of a fire extinguisher training simulator (see Graphic 1). The simulator provided new and experienced personnel with realistic training scenarios for incipient fire training while avoiding fuel costs, chemical costs, live-fire safety risks, weather related training cancellations and reduced the amount of labor hours required for training. It was treated as an enhancement to live-fire training, not a replacement because personnel could learn/practice fire extinguisher skills while still keeping the option for live fire where appropriate.

Safety Response

Industrial safety margin was enhanced by using fire extinguisher simulator training to improve individual proficiency levels and to increase the number of qualified individuals. Persons receiving this training were able practice for a longer period, experience a variety of fire scenarios (Storage locker fire, spill fire, etc.) and repeat exercises to achieve the desired skill level. A more proficient staff reduces fire related consequences and therefore reduces challenges to the facility (nuclear safety).

The ability to quickly and properly address fire situations protects personnel and equipment by increasing the likelihood of successful fire mitigation. Likewise, a greater number of qualified individuals improve safety by increasing the odds that a fire will be stopped in its incipient stage (more skilled people available to extinguish a fire). Moreover, the ability to make the simulated fire more difficult to extinguish improved the students' application of proper fire fighting techniques. This feature was is not available with a live-fire training.

Overall safety was improved by avoiding unnecessary outdoor live-fire training events in support of outages, especially spring outages in colder climates. Hazards related to weather, including wind, ice and snow, increase the potential for personal injuries, so reduction of livefire situations during inclement weather results in a potential reduction of personal safety occurrences.

Cost Savings Response

An annual cost avoidance savings of $215,500 results by reducing the number and frequency of extinguishers that are discharged and live fires that are avoided (detailed below):

Annual Fleet Savings

- Extinguisher chemicals and labor to recharge expended extinguishers = $41,800
- EPA permit fees, fuel for live fires = $6,700
- Travel time costs for transit to/from an approved live-fire site (labor hours savings) = $75,000
- Shorter class length, simulator vs. live fire (labor hours savings) = $75,000
- Set-up and clean-up costs associated with live-fire training, additional instructors & safety personnel (labor hours savings) = $20,000
- Cost of Simulator (Amortized) = -$3,000 *
- TOTAL Annual = $215,500 **

Overall cost savings were approximately $144 per student per class. The savings were based on reduced labor hours and fees for the nuclear fleet for a total of $215,500. This method was used for outage related gate access training and fire watch training for inhouse employees and contractors with great success. Cost savings and efficiency gains became particularly significant because training for gate access and fire watch duties occurred at the site's primary training center or outage processing center. The site's gate access training regimen

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* Cost of simulator is approximately $60,000 amortized over a 20 year life span.

** Based on 2 Refueling outages per year and training of 1500 students per year. (FirstEnergy also uses this approach in non-nuclear operations for a total corporate savings of $455,850).

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Fire Drill...

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was streamlined as live-fire situations were eliminated. The process allowed contractors and administrative staff to be qualified, providing flexibility to the plant's permanent technical, operations and maintenance staff for work on other core duties, which improved outage efficiency.

For informational purposes, the cost analysis also includes some data on how non-nuclear areas of our utility benefited from extending the program beyond nuclear operations.

Innovation Response

The fire extinguisher simulator provides a unique and innovative way to accomplish hands-on training without the usual burdens of live-fire training. The fire extinguisher simulator is portable and can be assembled in less than an hour in any area greater than 10 feet x 20 feet.

Graphic 1: Student practicing proper fire extinguisher technique.

The simulations are very lifelike. The simulator's extinguisher uses an air line to recreate the "kick" feel from discharging a real extinguisher and sensors track the spray path to reinforce proper technique. Sound is also an integral part of the experience because the roar of the fire can be heard and, when desired, substitute smoke can be discharged into the room. Furthermore, different extinguisher sizes, types (stored pressure and cartridge-operated) and fire difficulty levels can be modeled. The simulator is sophisticated enough to adjust extinguishing time limits based on the size and type of the extinguisher. Time to extinguish is therefore consistent with the associated model being used. Smaller units have less extinguishing material available and consequently have a shorter timeframe for use (i.e. the extinguisher runs out faster).

Also, the difficulty of the fire can be adjusted. For example, fires that are more difficult to extinguish can be set and flash back scenarios are also possible.

Additionally, specific site work areas can be addressed by taking a digital photograph and using it in the simulation instead of the default images. As an example, a simulated fire could be set on a site specific chemical storage locker or piece of equipment.

The simulator made it easy for first–time trainees to learn proper techniques in a safe, controlled environment as well as helping experienced personnel sharpen their skills. Students could repeat or practice skills that needed improvement.

Productivity/Efficiency

Because more employees are trained in a shorter time period, efficiency and staffing flexibility are improved. By training students in two hours instead of four, a direct efficiency improvement is realized. In terms of labor for FENOC, 3,400 hours are saved due to the use of this standardized, common process for fire extinguisher training. 3,000 hours are saved by reduced class time plus 400 hours in reduced instructor time, prep, tear down and transit time.

Moreover, since the training is held on-site with multiple classes in the same shift, more employees may be qualified. Up to 200 students per shift could participate in the hands-on portion of training for one fire scenario or 150 per shift on two fire scenarios. With more qualified people available, work planning and scheduling efficiency improve because fire watch resources are easier to get at the needed time. Work activity delays, postponements or cancellations from having too few qualified fire watch individuals decrease. The organization becomes more productive because more workers have this skill.

Transferability

The simulator is commercially available and because of the simulator's portability, fire extinguisher knowledge can be transferred to all business segments of an enterprise. Or, an individual plant could make use of the simulator for its own specific training regimen. Also, utilities could invest in a simulator for themselves or contract with an experienced provider to conduct the training for multiple plants/facilities and thereby transfer knowledge throughout their organization. In fact, some non-utility companies have contracted with FENOC to provide OSHA-required training using the simulator at various locations around the country.

Essentially, training can be provided to anyone in the nuclear industry. Knowledge is also transferable because more individuals become proficient and are able to provide insights to others.

Finally, the skills learned can be taken home to better prepare employees in case a fire situation occurs.

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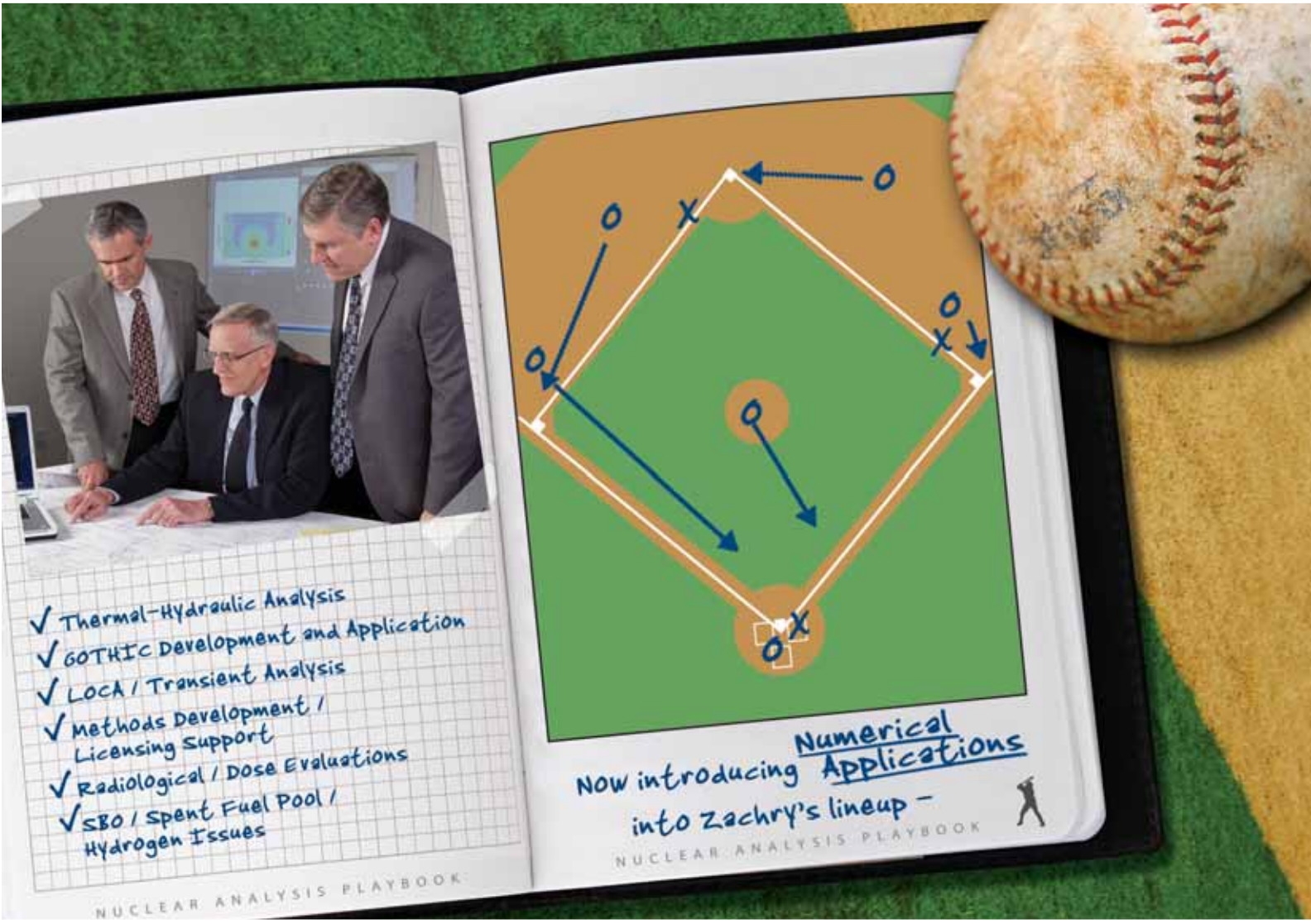

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Fukushima Daiichi Emergency Water Treatment

By James Braun and Tracy Barker, AVANTech, Inc.

James Braun

James Braun is a graduate of Youngstown State University with a BS in Chemical Engineering and a minor in Nuclear Engineering, and a Masters in Business Administration from Lake Erie College. He is currently Founder, Owner, President and Chief Executive of Avantech Incorporated implementing all facets of the business.

Tracy Barker

Tracy Barker is a graduate of the University of Tennessee with a BS in Chemical Engineering and a patent holder for innovations in the treatment of nuclear wastewater. He is currently Founder, Owner and Vice President and Principle Engineer of Avantech Incorporated implementing and overseeing the technical development of the business. Mr. Barker has been developing unique and innovative solutions for efficient treatment of radioactive wastewater for the past 26 years.

The Challenge:

The Great East Japan Earthquake that took place on March 11, 2011 created a number of technical challenges at the Fukushima Daiichi Nuclear Plant. One of the primary challenges involved the treatment of highly contaminated radio-active wastewater. Avantech Inc., in cooperation with Toshiba and Shaw Global Services, LLC developed a unique patent pending treatment system that addressed the numerous technical issues in an efficient and safe manner. The goals of this system were to safely remove the cesium (Cs), minimize waste generation, and ensure operations within the short time frame.

1. Radionuclide Removal

As U-235 fissions during normal power operations, it produces heat (used for power production) and a variety of radioisotopes know as fission products. Of these fission products Cs-134/137 have the most notoriety due to their strong gamma-ray. Ordinarily these fissions products are maintained within the fuel pellet or fuel rod, but during a meltdown such as that experienced at Fukushima, they are released into the water and air around the fuel. Emergency measures during the accident included the use of seawater (45,000 µS/cm (micro Siemens- the measurement of the salinity of the water, typical drinking water is 100 or less)) for cooling the reactor following the earthquake and tsunami. The mixing of seawater and fission products produced a particularly challenging waste stream due to its high salinity and extraordinarily high radioactivity. Due to its high Cesium (5×10^6 Bq (Becquerel)/cc) content, this mixture known as "accumulated water", was stored underground in site buildings and facilities. Removing the Cesium was critical to ensure the safety of plant personnel, minimize further off-site radiation exposure and to expand upon Tokyo Electric Power Company (TEPCO's) options for water storage. The removal of Cesium in a seawater environment while minimizing waste generation and personnel exposure became the goal.

The removal of cesium in a high salinity water has been studied using differing techniques including co-precipitation, ion exchange, solvent extraction, electrochemical and membrane processes. Ion exchange and natural zeolites are an obvious choice but they do not have a high selectivity for radionuclides, especially Cs. Crystalline silicoti-tanates (CSTs) are a new class of ion exchangers that were jointly invented by researchers at Sandia National Laboratories and Texas A&M University. One particular CST, known as TAM-5, is remarkable for its ability to separate parts-per-million concentrations of cesium from highly alkaline solutions (pH>14) containing high sodium concentrations (>5M). It is also effective for removing cesium from neutral and acidic solutions, and for removing strontium from basic and neutral solutions. Cesium isotopes are of particular concern due to gamma radiation exposure and volatility at the high temperatures experienced during some waste stabilization techniques such as vitrification. Tests performed at numerous locations with early lab-scale TAM-5 samples established the material as a leading candidate for treating radioactive waste volumes such as those found at the Hanford site in Washington.

Thus Sandia developed a Cooperative Research and Development Agreement (CRADA) partnership with UOP, a world leader in developing, commercializing, and supplying adsorbents. CSTs are now commercially available from UOP. These materials exhibit a high capacity for cesium in a wide variety of solutions of interest to the Department of Energy, and they are chemically, thermally, and radiolytically stable.

Avantech chose the UOP media because of the stability and distribution coefficient (i.e. – sorption capacity) of the CST. With a distribution coefficient greater than 20,000 L/kg, the UOP IONSIVTM media had more than enough capacity for the removal of cesium in a once through process. Avantech and UOP worked extensively to ensure the ion

exchanger design provided the optimal design conditions for effective removal of cesium. Furthermore, because the media had not been deployed on a full scale basis, preparation of the media became paramount.

2. Shielding

In developing the overall process it was quickly understood that the capacity of the CST media far exceeded our ability to safely shield and cool the ion exchanger. Therefore, we limited the ion exchanger to less than 200,000 curies of activity. The goal was to enable the working staff to be able to maintain the equipment in a work environment of less than 200 millirem per hour or less. As a result, we integrated the ion exchanger into a permanently shielded container much like a transportation cask. The integral shielding was de-signed for a six inch lead equivalent and resulted in the overall vessel weighing approximately twenty three metric tons or fifty thousand pounds. Lead shot was utilized because it expedited the product development and eliminated several transportation issues associated with shipping significant weights between the United States and Japan.

The end view of the Shielded Ion Exchange Module (SIXM) with the shielding annulus shown in Avantech's manufacturing facility.

3. Heat Generation

A variety of factors including dose rate, weight and decay heat lead to an accumulated radioactivity limit of 200,000 Ci (7.5E+15 Bq). With two hundred thousand curies of radioactive material in a SIXM, heat generation became a problem during long term storage. Providing a design that dissipated decay heat was critical to preventing a phase change in the ion exchange media and potentially melting lead in the SIXM walls. Avantech and Shaw evaluated numerous passive cooling approaches to resolving this issue. The end result was a cooling annulus between the ion exchanger and the shielded wall with a serpentine of cooling pipes to allow air to passively cool the ion exchanger.

4. Hydrogen Gas

Hydrogen gas was a significant concern during both operations and storage of the radioactive material. Accumulation of hydrogen in the process was eliminated through the use of automatic vent valves.

Once an ion exchanger was removed from service it was placed on a dry storage pad. Once in dry storage, the ion exchanger would build up decay heat and ultimately evaporate the remaining moisture within the vessel. A concern was raised that hydrogen could accumulate as a result of water radiolysis during the initial storage of the vessels. To alleviate the concern, a battery operated blower was connected to the SIXM vessel during the first forty-eight hours of storage to ensure adequate dissipation of any potential hydrogen.

The Integrated Process

The integrated process was designed to ensure filtration and two stages of ion exchange in two parallel trains. This was accomplished utilizing seven vessels for each train; two filtration, three primary ion exchange, and two polishing ion exchange vessels. The ion exchange vessels were operated in a "lead-lag" carousel scenario to optimize the media usage and allow for a managed distribution of radionuclides.

Each media vessel was designed to look and operate exactly the same to minimize potential operator errors and ensure consistent material handling. The vessels were designed with trunnions that allowed for easy crane handling.

The customer had a strong desire to have a simple contact handled operation that minimized the potential for operator error and the reliance on automation. Automation was utilized to monitor the process, trend key data, and perform the key flushing activities.

The equipment lay-out.

Operating Results

System operation has proven to be very successful because of the simplicity of the design and the effectiveness of the operation. The system has operated at a decontamination factor in excess of 2 million since starting up while achieving throughputs of over 1800 bed volumes of wastewater per bed volume of secondary waste (BV). Due to these high throughputs the system has experienced minimal down time and TEPCO has been able to reduce the size of their waste storage facility.

System operations were initiated in the desired time frame and since start-up the facility has reduced its water inventory and been able to maintain the desired water levels and cooling for safe shutdown of the facility. The system has also proven to be highly reliable operating without incident since inception.

Acknowledgements

This project has been such a great success because of the significant technical contributions and timely responsiveness of Shaw Global Services, Toshiba/IHI, UOP, B&W, and the many supportive organizations. Seven days a week, twenty four hours a day this team worked to make this happen. This is a testament to great teamwork.

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Enhanced Productivity

By Brian Bookbinder and Bart Hickman, Alphasource, Inc.

Brian Bookbinder

Brian C. Bookbinder is the C.E.O of Alphasource, Inc., a manufacturer and innovator of Foreign Material Excusion (FME), Drop Prevention, Nuclear Safety Product Supplies and RFID Technology Services. He received his M.B.A. from Drexel University and is an active member of ANS and The National Safety Council. As a major proponent for nuclear power generation, he maintains a sharp focus on producing innovative, quality products to simplify processes and procedures, automate time-consuming and repetitive tasks and in making the workplace safe and productive.

Bart Hickman

Bart Hickman has been the FME and RFID sales specialist at Alphasource for over five years. He has more than 20 years of technical sales and sales management experience as well as extensive project management expertise. Through his past positions with Honeywell and Siemens he also has managed a number of Industrial Automation projects for a wide array of industries including power generation, petrochemical, pharmaceutical and others.

Several nuclear facilities in the USA decided to look for alternatives to their existing method of keeping track of personnel and assets in their facilities. After much research into technologies that would help with these tasks, Radio Frequency Identification (RFID) was the information technology chosen to improve these inefficiencies. Hand written logs at Foreign Material Exclusion (FME) Zones are time consuming and prone to HU (Human Performance) issues. Missing or misplaced tools and other equipment were also a major concern and constitute a large expenditure of funds to resupply. It was estimated that one type of item, hand-held cordless power tool losses during one outage approached $100,000. Clearly a new method of asset and personnel tracking and accountability was needed to increase efficiency and decrease losses.

Many alternatives and methods were investigated including barcodes, electronic databases and others. Some of the criteria the new system had to satisfy included ease of use, accuracy, ease of customization, the ability to mesh seamlessly with existing software platforms and expansion capability to grow organically within the changing needs of the organization as well as incorporating other departments and assets into the system.

The sites decided on RFID after considering other alternatives. RFID (radio frequency identification) uses radio frequency to read tags or labels that identify the person and asset with a tag. Unlike barcodes, line of sight is not needed. RFID tags can be under clothing or embedded in an asset and can still be readable by the RFID antenna. The information stored in a tag is not static and can be changed or updated as conditions or circumstances dictate. The RFID software acts as an electronic database which can track and report on any number of variables including inspection dates, calibration information as well as who has possession of the asset and its location.

By utilizing RFID technology, assets can be automatically tracked, ownership established and HU issues are decreased or entirely eliminated. We will examine some of the efficiencies and substantial cost savings that deploying RFID technology at a Nuclear Generating System (NGS) can provide.

What is RFID?

Simply put, RFID is a method of keeping track of objects. Similar to barcode, RFID can help you maintain an accurate count along with its corresponding location However, this is where the similarities end. RFID labels can be read from one inch to several hundred feet away (where barcode requires a direct line-of-site.). With RFID, objects can also be precisely pinpointed through triangulation, offering unparalleled benefits in environments where accountability is paramount. RFID technology enables items and objects to be identified and tracked with 99.9% accuracy, allowing tooling and supplies to be “read” by a reader even when placed in tool buckets, bags and concealed pouches.

RFID has been around for many years and has been adopted by some of the largest department store chains and retailers, aerospace and automotive manufacturers, the pharmaceutical industry, the federal government and others. It has also been used by tollway authorities to collect toll from the motorists.

Following are details of existing RFID deployment and the areas they are currently being used in a Nuclear Generating Station (NGS):

1) Tool cribs are excellent candidates for realizing the benefits from RFID technology. RFID systems will greatly reduce check-in/check-out times as well as increasing personnel

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accountability for tools and other assets. Existing barcode systems can be incorporated into a new RFID system and the same forms and screens can be used to reduce change anxiety. Hand written logs will be completely eliminated along with their associated HU issues. Personnel returning assets can be held instantly accountable for outstanding items. Tooling costs will be reduced because items are more likely to be returned when accountability is increased. Items that need calibration or periodic inspections will be automatically prevented from being used if they are not within their proscribed criteria. This will prevent costly errors and having to duplicate tasks or procedures. This will also reduce dosage as these tasks will not have to be duplicated.

2) FME zones are a natural application for RFID technology. By utilizing RFID at High Risk or FME-1 Zones, the process of using hand written logs for identifying everyone and everything entering these zones will be eliminated. The inherent electronic database functionality will reduce the waiting time for entering the zones and allow more time for performing the work that is scheduled. RFID systems will also eliminate the time consuming and error prone function of log reconciliation. As at the tool crib, log reconciliation will be precise, immediate and automatic. HU issues will be decreased and the chances of having a foreign material incident (FMI) will be greatly diminished, saving substantial time and money.
3) Security departments are using RFID to manage and track inventory as well as weapon tracking and accountability. Record keeping and logging requirements are now done automatically using RFID. RFID also keeps track of security personnel qualifications and weapon data such as test firing and cleaning dates. The system prevents personnel without the correct qualifications from removing a weapon and also ensures that the weapon taken has the right criteria such as test firing, cleaning, etc. The system tracks who has what weapon, where weapons are located or stored and even keeps track if weapons are at the manufacturer for service or repair. Customizable reports can be instantly printed for inventory, weapon and personnel status or other data. One station has reported saving over one hour in total time during Force-on Force drills thanks to using RFID technology.

4) C-Vans and gang boxes are also suitable for RFID deployment. Several stations, as well as service providers, have reported that after demobilization, items and assets are difficult or even impossible to find. By using an RFID system those items are automatically inventoried by exact location. Time consuming and often fruitless searches for equipment are eliminated. The time spent gearing up for an outage will also be greatly reduced because an inventory already exists for each storage unit. The number of missing or lost items will be reduced because there will be time to check inventories before, during and after outages. This greatly reduces tooling and equipment costs as well as saving man hours and dosage.

There are many other areas that will benefit by employing RFID technology including the warehouse, Team Fix it Now (FIN) teams, valve maintenance, fire fighting equipment, Chemistry, Radiation Protection (RP or HP), Measuring & Testing Equipment (M&TE), work order tracking and accountability, Lifting and Rigging as well as keeping track of high dollar value assets.

In summary, NGS deployment of RFID technology can be beneficial in many significant ways. .

- RFID automatically bulk captures data, giving you real-time visibility of nuclear power generation industry assets, asset allocation, employees and supplemental workforce.
- RFID provides valuable end-to-end visibility needed to streamline everyday tracking of materials, equipment and personnel
- RFID enables increased productivity: employees spend less time tracking down missing equipment and instantly provides current M&TE and inspection data, improving staff utilization.
- RFID not only reduces errors and increases efficiency during regular business operations, but it has been proven to be very beneficial during nuclear power plant outages; delivering multiple benefits with little or no extra human effort.

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Freeing Up Fuel Pool Capacity

By Jas Devgun, Sargent & Lundy, LLC.

Jas Devgun

Dr. Jas Devgun is a Manager in Nuclear Power Technologies at Sargent & Lundy LLC. He has thirty years experience in the nuclear industry and nuclear research. He has led a variety of nuclear projects during his professional career and has also served on numerous committees including those of ANS, OECD/NEA and IAEA. He is designated a Fellow of the Waste Management Symposia organization.

Sargent & Lundy team members who participated: Jas Devgun, Dennis Demoss, Steve Raupp, Steve Malak, and Robert Schuetz.

SFPs and the CRBs

Spent Fuel Pools (SFPs) at most commercial power reactors are at or near capacity. One significant issue for SFPs is the irradiated components (non-fuel materials) that have been stored in the pools. The primary non-fuel items of concern which contribute to the volume at Boiling Water Reactors (BWRs) are the irradiated control rod blades (CRBs), but, to a lesser extent, other hardware materials.

The control rods in a BWR are used not only for shutdown of the reactor, but also to control the reactivity and power distribution in the core (through partial insertion). While the Pressurized Water Reactors (PWRs) also use control rods for shutdown of the reactor, they do not present the same waste management issues as the BWRs due to differences in control rod design, insertion configuration & use, neutron absorbing material, and exposure/ irradiation. This article focuses on the BWRs and relates to the situation in the United States.

Individual plants are continually challenged by limited storage space in SFPs and multiple movements of components that become necessary during the outages.

The nuclear lifetime of the BWR control rods is limited. Routine discharges of control rods are made and are dependent on the exposure, the core size (and total number of control rods) and the mode of control rod operation. During operation, control rods are withdrawn (except control rods that are partially inserted and used for power shaping) and hence only the uppermost section is exposed to the neutron flux and over many years the neutron absorption capability of the upper section is depleted. Some control rod discharges may occur during each fuel cycle, and in other cases, the control rods may be discharged only after the sixth or seventh fuel cycle. Replacement of control rods may also become necessary due to issues such as potential swelling of the neutron absorber material Boron Carbide (B4C) and cracking of the cladding material.

Irradiated CRBs present a difficult problem as a result of their high radiation level and a waste category classification (in US) as Greater Than Class C (GTCC) per 10 CFR Part 61.55, thus, exceeding the activity limitations for near surface disposal. Predominant radionuclides in irradiated CRBs include Co-60, Fe-55, Ni-59, and Ni-63. Several other radionuclides are present to a lesser degree. Currently, no disposal site in the U.S. is available for such waste. The GTCC waste will need to be stored and managed until its eventual disposal in a geologic repository or transfer to a government extended storage facility. No government storage facility is available and the situation is unlikely to change in near future.

Disposal Facility

Under the 1982 Nuclear Waste Policy Act (NWPA, and amendment in 1987) the Federal government (Department of Energy, DOE) is responsible for ensuring the availability of facilities for the safe disposal of spent nuclear fuel (SNF) and high-level waste (HLW). Under the Act, the DOE was also to build monitored retrievable storage (MRS) facilities, for storing wastes 50 to 100 years or more before being removed for permanent disposal. However, the DOE has not developed any disposal site for SNF or HLW or any storage or disposal facilities for commercial GTCC. The DOE has also not accepted SNF or GTCC waste from the industry. Nearly all of the existing SNF is being stored at the reactor sites where it was generated, in SFPs and in dry casks above ground.

The Waste Isolation Pilot Plant (WIPP) facility in New Mexico accepts only defense related transuranic waste (TRU). Initially, it was expected that the DOE will accept the GTCC at the Yucca Mountain repository along with the spent fuel. However, as is well known, Yucca Mountain, despite having spent approximately $15 billion, is no where close to becoming a geologic repository for nuclear waste. In 2009, the current administration announced

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Freeing Up...

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suspension of further work and in 2010 DOE moved to withdraw the application for a construction license. Funding for the Yucca Mountain project was eliminated in the 2011 Federal budget. A Blue Ribbon Commission was formed in 2011 to conduct a comprehensive review of policies for managing SNF and recommend a new plan for developing repositories.

The Low Level Radioactive Waste Policy Act of 1980 (as amended in 1985) encouraged states to form compacts and develop regional disposal sites for the low level radioactive waste (LLW). Thirty years later no new disposal sites have been developed. The existing three sites are: Barnwell, South Carolina (EnergySolutions); Clive, Utah (EnergySolutions); and Richland, Washington (U.S. Ecology). The Clive site only accepts Class A waste. The Richland site accepts waste (Class A, B, and C) only from the Northwest Interstate Compact or from DOE sources. The Barnwell site (for Class A, B, and C) is currently not accepting any waste. A site (for Class A, B, and C) in Andrews County Texas has been licensed by the state (to be built and operated by Waste Control Specialists) but is not under operation yet. It will accept waste from the Texas Compact (Texas and Vermont) and the Federal government. Thus, the nuclear industry continues to face challenges both for the LLW disposal as well as for the SNF and the GTCC waste.

Innovative Solutions

Given the prolonged situation with the disposal issue of waste such as the CRBs and faced with the need to free up space in the fuel pools, the industry has developed innovative solutions in the form of dry storage of non-fuel materials. The waste is stored in sealed casks and stored on concrete pads similar to the Independent Spent Fuel Storage Installations (ISFSIs) common at many nuclear stations.

To plan and develop such storage facilities, a number of factors must be evaluated, including: licensing and regulatory requirements, current and projected non-fuel waste volume, cask system selection (including Certificate of Compliance), site location, handling equipment, construction costs, and long-term surveillance and security.

For a plant site that has an existing ISFSI facility, it may be possible to utilize it to store CRB waste but the Safety Analysis Report section addressing ISFSI operations would require change. However, since ISFSI cask space is costly and NRC approval to store GTCC in ISFSI is required many utilities are evaluating alternate storage pads, systems and facilities. For example, three of the relevant US storage systems are:

- Holtec's HI-SAFE™ Storage System,
- AREVA/Transnucear's NUHOWS® Modules,
- EnergySolution's Fully Shielded Overpack SystemTM (FSOS™).

The Holtec HI-SAFE™ Non-Fuel Waste Storage System is designed to be fully compatible with Holtec's HI-STORM™ Dry Storage Systems for spent nuclear fuel, allowing current

users to take advantage of existing ancillary equipment and infrastructure. The Non-Fuel Waste Canister provides permanent (welded) enclosure of the radioactive waste, allowing seamless

HI-SAFE™ 100 Storage System for Non-Fuel Waste (courtesy of Holtec International)

integration of the storage, transfer, and transport operations of non-fuel waste (such as crushed CRBs) with the spent fuel management program. The system provides for a long term storage solution and HI-SAFE 100 (above ground model) can be placed either at an ISFSI alongside HI-STORMs or on separate storage pads. The casks are stored vertically.

AREVA/Transnuclear - NUHOWS® Rad Waste Container (RWC) is similar to the NUHOMS® Dry Storage Canister for SNF and the system is designed for the long term interim storage. Similar to NUHOMS® it also utilizes the concrete Horizontal Storage Module (HSM). The RWC internal design allows loading flexibility with internal configuration suited to the type of irradiated components. The large size of RWC allows packaging of material without significant processing and the design features also allow the intermittent loading campaigns.

The EnergySolutions FSOS™ system is comprised of standard components, including a reinforced concrete body, which is cast in two segments, a lid with bolt-on plug assembly, six lifting/tiedown assembly saddles and a concrete inner shield. The fully-shielded overpack components can be delivered to the plant site and bolted together. A liner loaded with irradiated material is moved into the FSOS™ using a transfer cask. The loaded overpacks are stored vertically on a storage pad.

Other Developments

It should be noted that the current designs of control rod assemblies have an outstanding safety record. Nevertheless, the industry is looking for improvements with respect to minimizing the CRB waste through developments such as:

- Use of low cobalt stainless steel tubes with reduced surface area and volume of stainless steel in the irradiation zone.
- Enhanced mechanical integrity and longer control rod operational life, reducing the number of rods that must be replaced.

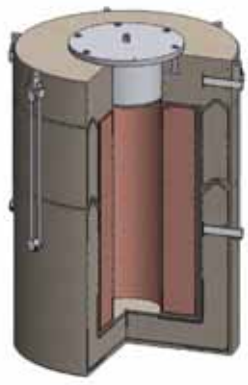
Radioactive Waste Container Positioned in a NUHOWS® Horizontal Storage Module (courtesy of Areva/ Transnuclear)

- Better segregation of control rods that exceed Class C limits.
- Better segregation of hardware that is not GTCC from the CRBs. Since the rods are inserted from the bottom of the reactor pressure vessel by a control drive mechanism, located outside the vessel, only the material irradiated in the core is highly radioactive.
- Compaction to reduce volume.

Several recent developments on the national scene are also worth noting.

- The DOE issued a Draft Environmental Impact Statement (EIS) for the Disposal of GTCC waste (Draft EIS, DOE/EIS-0375D) in February 2011 and has held public hearings on the draft EIS. Several disposal concepts are being considered and several DOE sites including WIPP are being considered.
- The Blue Ribbon Commission issued its report in January 2012. The recommendations, among others, include amendments to NWPA authorizing a new process for selecting and evaluating sites, development of multiple interim waste storage facilities, and creation of a new government-chartered agency solely focused on SNF and HLW.
- The NRC may revise the LLW classification system by risk-informing the 10 CFR Part 61, which is nearly 30 years old. The Blue Ribbon Commission in its report also endorses the efforts of NRC in this regard.

As a final note, Sargent & Lundy (S&L) continues to provide industry leadership in the design and engineering of dry storage facilities based on our experience of having performed studies and detailed engineering required to develop approximately one third of the ISFSI projects in the U.S. S&L has also assisted clients to develop and evaluate options for the dry storage of non-fuel materials.



Fully Shielded Overpack System™ (courtesy of EnergySolutions)

Contact: Jas Devgun, Sargent & Lundy LLC, 55 East Monroe St., Chicago IL 60603; telephone: 312-269-2283, fax: 312-269-2208, email: jas.s.devgun@sargentlundy.com. ■

Blue Ribbon Commission's Final Report

Introduction

The Blue Ribbon Commission on America's Nuclear Future released its final report on January 26, 2012 to the U.S. Energy Secretary, detailing comprehensive recommendations for creating a safe, long-term solution for managing and disposing of the nation's spent nuclear fuel and high-level radioactive waste.

Recommended Strategy

1. A new, consent-based approach to siting future nuclear waste management facilities.
2. A new organization dedicated solely to implementing the waste management program and empowered with the authority and resources to succeed.
3. Access to the funds nuclear utility ratepayers are providing for the purpose of nuclear waste management.
4. Prompt efforts to develop one or more geologic disposal facilities.
5. Prompt efforts to develop one or more consolidated storage facilities. Prompt efforts to prepare for the eventual large-scale transport of spent nuclear fuel and high-level waste to consolidated storage and disposal facilities when such facilities become available.
7. Support for continued U.S. innovation in nuclear energy technology and for workforce development.
8. Active U.S. leadership in international efforts to address safety, waste management, non-proliferation, and security concerns.

Blue Ribbon Commission's full report is available at www.brc.gov.

Near-Term Actions

The Commission recognizes that it will take time, commitment to action, and new authorizing legislation to implement our most important recommendations, particularly the recommendation to establish a new waste management organization.

Given uncertainty about how long that might take and the fact that under current law DOE remains responsible for the nuclear waste management activities of the federal government, it is important that those steps that do not require the new organization to be in place be initiated as soon as possible. To ensure continued progress, we also urge the Secretary of Energy to task a senior official with sufficient authority to coordinate all of the DOE elements involved in the implementation of the Commission's recommendations.

Financing

- DOE should offer to enter into negotiations with contract holders to revise current contracts to provide a new fee payment option in which payments to the Waste Fund each year would be based on actual appropriations from the Waste Fund, with the remainder of the nuclear waste fee being placed in a third-party escrow account by the contract holder until needed.
- The Administration should work with the appropriate congressional committees and the Congressional Budget Office to reclassify receipts from the nuclear waste fee as discretionary offsetting collections and allow them to be used to offset appropriations for the waste program.
- The Administration, Department of Energy (DOE), and Department of Justice (DOJ) should also work with nuclear utilities and other stakeholders toward a fair resolution of outstanding litigation and damage claims.

New Organization

- The appropriate congressional committees should begin hearings on establishment of an independent waste management organization as soon as practicable. The Commission recognizes that there are many details that need to be worked out in creating a new institution, and believes that the sooner the process of obtaining the views of interested parties and developing a detailed legislative proposal can begin, the better.

Storage

- Using existing authority in the National Waste Policy Act (NWPA), DOE should begin laying the groundwork for implementing consolidated storage and for improving the overall integration of storage as a planned part of the waste management system without further delay. Specific steps that DOE could take in the near term include:
  1. Performing the systems analyses and design studies needed to develop a conceptual design for a highly flexible, initial federal spent fuel storage facility.
  2. Preparing to respond to requests for information from communities, states, or tribes that might be interested in learning more about hosting a consolidated storage facility.
  3. Working with nuclear utilities, the nuclear industry, and other stakeholders to promote the better integration of storage into the waste management system, including standardization of dry cask storage systems. This effort should include development of the systems analyses needed to provide quantitative

estimates of the system benefits of utility actions such as the use of standardized storage systems or agreements to deliver fuel outside the current Oldest Fuel First (OFF) priority ranking. (These analyses would be needed to support the provision of incentives to utilities to undertake actions such as using standardized storage systems or renegotiating fuel acceptance contracts.)

- The Administration should request, and Congress should provide funding for, the National Academy of Sciences to conduct an independent investigation of the events at Fukushima and their implications for safety and security requirements at SNF and HLW storage sites in the United States.
- DOE, NRC and industry should continue a vigorous research and regulatory oversight effort in areas such as spent fuel and storage system degradation phenomena, vulnerability to sabotage and terrorism, and others.

Transportation

- DOE should complete the development of procedures and regulations for providing technical assistance and funds (pursuant to section 180 (c) of the NWPA), and begin providing funding, for working with states and regional state-government groups and training local and tribal officials in areas likely to be traversed by spent fuel shipments, in preparation for movement of spent fuel from shutdown reactor sites to consolidated storage.
- DOE and other federal agencies should reexamine and address those recommendations from the 2006 National Academy of Sciences (NAS) Going the Distance study that have not yet been implemented. As a part of this reexamination, the NRC should reassess its plans for the Package Performance Study without regard to the status of the Yucca Mountain project, and if it is found to have independent value, funding should be provided from the Nuclear Waste Fund so that the NRC can update these plans and proceed with those tests.

Disposal

- DOE should keep a repository program moving forward through valuable, non-site specific activities, including R&D on geological media, work to design improved engineered barriers, and work on the disposal requirements for advanced fuel cycles. The work of the Used Fuel Disposition Campaign of DOE's Office of Used Nuclear Fuel Disposition Research and Development in this area should be continued.
- DOE should develop an RD&D plan and roadmap for taking the borehole disposal concept to the point of a licensed demonstration.

Facility Siting

- To ensure that future siting efforts are informed by past experience, DOE should build a data base of the experience that has been gained and relevant documentation produced in efforts to site nuclear waste facilities, in the United States and abroad. This would include storage facility and repository siting efforts under the NWPA by both DOE and the Nuclear Waste Negotiator.

Regulatory Actions

- EPA and the NRC should work together to define an appropriate process (with opportunity for public input) for developing a generic safety standard for geologic disposal sites. The implementation of this standard setting process should be coordinated with the aim of developing draft regulations for mined repositories and deep borehole facilities.
- The NRC should continue efforts to review and potentially revise the existing waste classification system.
- A portion of federal nuclear energy Research Development & Demonstration (RD&D) resources should be directed to the NRC to accelerate the development of a regulatory framework and to support anticipatory research for novel components

(Continued on page 49)

Approved Tier 1 & Tier 2 NRC Recommendations

The Nuclear Regulatory Commission has approved the agency staff's prioritization of the Near-Term Task Force (NTTF) recommendations on lessons learned from Fukushimi Dai-ichi nuclear incident and support action on the Tier 1 and Tier 2 recommendations. Given below are the recommendations.

Tier 1

The first tier consists of those NTTF recommendations which the staff determined should be started without unnecessary delay and for which sufficient resource flexibility, including availability of critical skill sets, exists. This tier includes all the actions identified in SECY-11-0124 (*Recommended Actions To Be Taken Without Delay From the Near-Term Task Force Report*) and two additional items. The additional items are the following: (1) the inclusion of Mark II containments in the staff's recommendation for reliable hardened vents associated with NTTF Recommendation 5.1, and (2) the implementation of spent fuel pool (SFP) instrumentation proposed in Recommendation 7.1. After submitting SECY-11-0124, the staff continued its review of these recommendations. This review led the staff to conclude that resolution of the reliable hardened vents issues for Mark I and II containments should be undertaken concurrently. The staff also concluded that installation of SFP instrumentation should be initiated without delay.

2.1

The Task Force recommends the NRC require licensees to reevaluate and upgrade as necessary the design-basis seismic and flooding protection of structures, systems, and components (SSCs) for each operating reactor.

Order licensees to reevaluate the seismic and flooding hazards at their sites against current NRC requirements and guidance, and if necessary, update the design basis and Systems, Structures, and Components (SSCs) important to safety to protect against the updated hazards.

2.3

The Task Force recommends that the NRC require licensees to reevaluate and upgrade as necessary the design-basis seismic and flooding protection of SSCs for each operating reactor.

Order licensees to perform seismic and flood protection walkdowns to identify and address plant-specific vulnerabilities and verify the adequacy of monitoring and maintenance for protection features such as watertight barriers and seals in the interim period until longer-term actions are completed to update the design basis for external events.

4.1

The Task Force recommends that the NRC strengthen station blackout (SBO) mitigation capability at all operating and new reactors for design-basis and beyond-design-basis external events.

4.1 Initiate rulemaking to revise 10 CFR 50.63 to require each operating and new reactor licensee to: (1) establish a minimum coping time of 8 hours for a loss of all alternating current (ac) power, (2) establish the equipment, procedures, and training necessary to implement an "extended loss of all ac" coping time of 72 hours for core and spent fuel pool cooling and for reactor coolant system and primary containment integrity as needed, and (3) preplan and prestage offsite resources to support uninterrupted core and spent fuel pool cooling, and reactor coolant system and containment integrity as needed, including the ability to deliver the equipment to the site in the time period allowed for extended coping, under conditions involving significant degradation of offsite transportation infrastructure associated with significant natural disasters.

4.2

The Task Force recommends that the NRC strengthen SBO mitigation capability at all operating and new reactors for design-basis and beyond-design-basis external events.

4.2 Order licensees to provide reasonable protection for equipment currently provided, pursuant to 10 CFR 50.54(hh)(2) from the effects of design-basis external events and to add equipment as needed to address multiunit events while other requirements are being revised and implemented.

5.1

The Task Force recommends requiring reliable hardened vent designs in Boiling Water Reactor (BWR) reactor facilities with Mark I and Mark II containments.

5.1 Order licensees to include a reliable hardened vent in BWR Mark I and Mark II containments.

- This order should include performance objectives for the design of hardened vents to ensure reliable operation and ease of use (both opening and closing) during a prolonged SBO.

7.1

The Task Force recommends enhancing instrumentation for the spent fuel pool (SFP).

7.1 Order licensees to provide sufficient safety-related instrumentation, able to withstand design-basis natural phenomena, to monitor key SFP parameters (i.e., water level, temperature, and area radiation levels) from the control room.

For complete document refer to U.S. Nuclear Regulatory Commission's SCEY-11-0137, Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned dated October 3, 2011.

8

The Task Force recommends strengthening and integrating onsite emergency response capabilities such as emergency operating procedures (EOPs), severe accident management guidelines (SAMGs), and extensive damage mitigation guidelines (EDMGs).

8.1 Order licensees to modify the EOP technical guidelines (required by Supplement 1, "Requirements for Emergency Response Capability," to NUREG-0737, issued January 1983 (GL 82-33), to (1) include EOPs, SAMGs, and EDMGs in an integrated manner, (2) specify clear command and control strategies for their implementation, and (3) stipulate appropriate qualification and training for those who make decisions during emergencies.

- The Task Force strongly advises that the NRC encourage plant owners groups to undertake this activity rather than have each licensee develop its own approach. In addition, the Task Force encourages the use of the established NRC practice of publishing RGs (rather than NUREGs, supplements to NUREGs, or Generic Letters (GLs)) for endorsing any acceptable approaches submitted by the industry.

8.2 Modify Section 5.0, "Administrative Controls," of the Standard Technical Specifications for each operating reactor design to reference the approved EOP technical guidelines for that plant design.

8.3 Order licensees to modify each plant's technical specifications to conform to the above changes.

8.4 Initiate rulemaking to require more realistic, hands-on training and exercises on SAMGs and EDMGs for all staff expected to implement the strategies and those licensee staff expected to make decisions during emergencies, including emergency coordinators and emergency directors.

9.3

The Task Force recommends that the NRC require that facility emergency plans address prolonged SBO and multiunit events.

9.3 Order licensees to do the following until rulemaking is complete:

- Determine and implement the required staff to fill all necessary positions for response to a multi-unit event.
- Provide a means to power communications equipment needed to communicate onsite (e.g., radios for response teams and between facilities) and offsite (e.g., cellular telephones and satellite telephones) during a prolonged SBO.

Tier 2

7.2, 7.3, 7.4, and 7.5

The Task Force recommends enhancing SFP makeup capability and instrumentation.

7.2 Order licensees to provide safety-related AC electrical power for the SFP makeup system.

7.3 Order licensees to revise their technical specifications to address requirements to have one train of onsite emergency electrical power operable for SFP makeup and spent fuel pool instrumentation when there is irradiated fuel in the SFP, regardless of the operational mode of the reactor.

7.4 Order licensees to have an installed seismically qualified means to spray water into the spent fuel pools, including an easily accessible connection to supply the water (e.g., using a portable pump or pumper truck) at grade outside the building.

7.5 Initiate rulemaking or licensing activities or both to require the actions related to the SFP described in Recommendations 7.1-7.4.

9.3

The Task Force recommends that the NRC require that facility emergency plans address prolonged SBO and multiunit events.

9.3 Order licensees to do the following until rulemaking is complete:

- Add guidance to the emergency plan that documents how to perform a multiunit dose assessment (including releases from spent fuel pools) using the licensee's sitespecific dose assessment software and approach.
- Conduct periodic training and exercises for multiunit and prolonged SBO scenarios. Practice (simulate) the identification and acquisition of offsite resources, to the extent possible.
- Ensure that EP equipment and facilities are sufficient for dealing with multiunit and prolonged SBO scenarios. ■

Enhanced Productivity...

Continued from page 40

- Provides a real, measurable, reoccurring ROI (return on investment). By dramatically reducing tool and asset losses along with the increased efficiencies as described previously, NGS deployment of RFID can have an ROI in as little as one outage. The ROI will continue as long as the system is utilized.
- The RFID systems can interface with Enterprise Management Systems, such as Oracle or SAP, for instance, which enables the efficiencies gained by utilizing RFID to be tracked and measured.
- Many times personnel go to the issue area for an item listed as "in-stock" only to find that it is not there. This causes warehouse personnel to "jump through hoops" to save the day. With the proper RFID solution, an accurate real-time inventory and corresponding system would electronically notify warehouse personnel if something was not in the proper location. Many warehouses spend hours conducting 'Cyclic Inventory'. With proper RFID implementation, one can walk down an aisle and get an instantaneous inventory count along with a printout in less than five minutes, as opposed to two or more hours.

By embracing RFID, NGS are moving from an analog/handwritten system to a state-of-the art new digital platform; where reporting speed and overall communication has been dramatically enhanced and conveyed in seconds instead of minutes, days, or weeks.

An innovative, state-of-the art RFID system can be deployed at FME Zones, Tool Cribs, Warehouses and Armories or anywhere you need to track tools, weapons, equipment, personnel, or other assets. HU issues and radiological exposure to personnel are kept to a minimum by not having to physically look for lost or missing tooling and supplies. Operational efficiencies, particularly in terms of man-hours are reduced, and accountability and visibility are significantly enhanced. Documented ROI's can now be achieved in as little as one outage. The biggest benefit of RFID technology is that once implemented, the system continues to reward those who have implemented it by delivering benefits year after year.

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Blue Ribbon...

Continued from page 45

of advanced nuclear energy systems. An increased degree of confidence that new systems can be successfully licensed is important for lowering barriers to commercial investment.

OSHA Jurisdiction

- The jurisdictions of safety and health agencies should be clarified and aligned. New site-independent safety standards should be developed by the safety and health agencies responsible for protecting nuclear workers through a coordinated joint process that actively engages and solicits input from all relevant constituencies. Efforts to support uniform levels of safety and health in the nuclear industry should be undertaken with federal, industry, and joint labor–management leadership. Safety and health practices in the nuclear construction industry should provide a model for other activities in the nuclear industry.

Workforce Development

- DOE, in cooperation with the U.S. Department of Labor and the Bureau of Labor Statistics, should lead a public–private initiative to develop ongoing labor demand projections and forecast capacity for the nuclear workforce, in areas including science, technology, engineering and mathematics; crafts; and emergency response and hazardous material (HAZMAT). This capacity will help inform expanded federal, joint labor–management, and university based support for critical high-skill, high-performance nuclear workforce development needs, including special attention to the expansion of the emergency response and HAZMAT-trained workforce.

International

- DOE should identify any legislative changes needed to authorize and direct the U.S. waste management program to support countries that pursue nuclear technologies in developing capacity for the safe management of the associated radioactive wastes and to encourage broad adherence to strengthened international norms for safety, security, and non-proliferation for all nuclear infrastructure and materials.

Yucca Mountain's future

1. Part of BRC letter to the US Energy Secretary

You directed that the Commission was not to serve as a siting body. Accordingly, we have not evaluated Yucca Mountain or any other location as a potential site for the storage of spent nuclear fuel or disposal of high level waste, nor have we taken a position on the Administration's request to withdraw the Yucca Mountain license application. What we have endeavored to do is recommend a sound waste management approach that can lead to the resolution of the current impasse; an approach that neither includes nor excludes Yucca Mountain as an option for a repository and can and should be applied regardless of what site or sites are ultimately chosen to serve as the permanent disposal facility for America's spent nuclear fuel and other high-level nuclear wastes.

2. Part of Text from the Executive Summary, item 4

So under current law, the United States will need to find a new disposal site even if Yucca Mountain goes forward. We believe the approach set forth here provides the best strategy for assuring continued progress, regardless of the fate of Yucca Mountain. ■

Bruce Restart

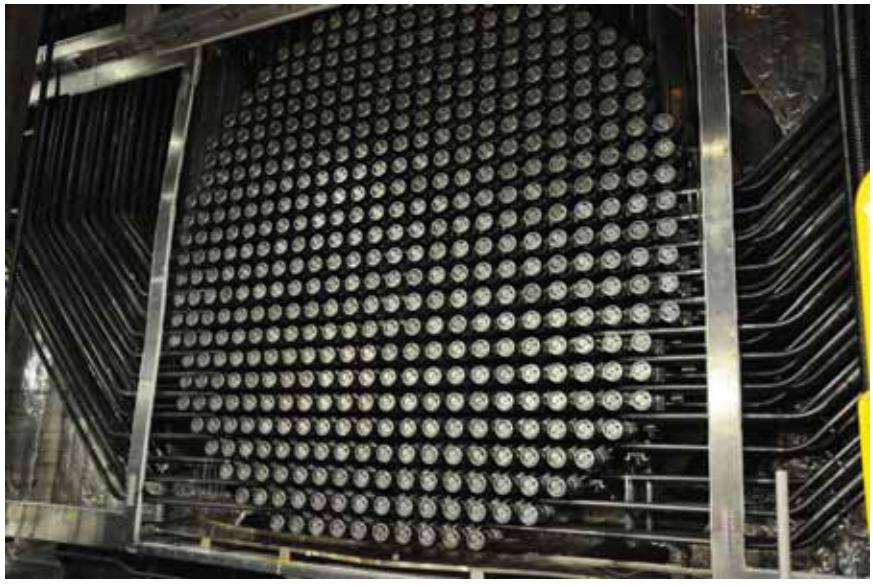
Bruce A and B nuclear generating stations are located on the eastern shore of Lake Huron in Ontario, Canada. Each station has four CANDU PHWRs. Bruce A's reactors came into service in 1977 (Units 1 and 2), 1978 (Unit 3) and 1979 (Unit 4) and are rated at 750MW. Bruce B reactors entered service between 1984 and 1987. In the late 1990's Ontario Hydro, owners of the stations at that time, made a business decision to temporarily lay-up all of Bruce A's units to concentrate resources on other reactors in Ontario Hydro's fleet. Unit 2 was removed from service in October 1995; Unit 1 was removed from service in December 1997; Unit 4 was removed from service in January 1998; and Unit 3 was removed from service in April 1998. Bruce B unites continued in service.

In 2001, Bruce Power Limited took over operations of Bruce A and B from Ontario Power Generation (OPG), which is Ontario Hydro's successor, through a long-term lease. All four of the Bruce A units were laid-up at the time. Bruce Power returned Bruce A Units 3 and 4 to service in January 2004 and October 2003, respectively. Since its inception in 2001, Bruce Power focused efforts on improving safety, environmental performance and increasing electricity output at the Bruce Power site (Bruce A and Bruce B). Bruce Power continued meeting ISO 14001 certification requirements, has continually applied a proactive and systematic approach to environmental management and has progressed significantly in its loss control program, which is called following the

International Safety Rating System. In 2003, Bruce Power increased electricity output to 24.5 tetrawatt hours (TWh) compared to 20.5 TWh in 2001. After investing $720 million in restarting Units 3 and 4, Bruce Power plans to generate approximately 34 TWh.

In December of 2004, Bruce Power proposed a return of Bruce A Units 1 and 2 to service from their temporary lay-up. A series of refurbishments, upgrades and enhancements will be required at Bruce A, improving safety while increasing electricity generation capacity and reliability for the extended life of these units. Some of the work to be undertaken prior to the return to service of Units 1 and 2 will include: Pressure tube and calandria tube replacement; steam generator replacement; electrical systems upgrades; main condenser refurbishment; feed water heater refurbishment; shutdown system 2 (SDS2) enhancement; and other significant maintenance on nuclear and balance of plant equipment.

A few of the recently completed activities include: fuel bundles manually loaded before the heat transport system is filled, 12 bundles are loaded into each of the 480 fuel channels for a total of 5,760 bundles in Unit 2's reactor; commencement of refueling of reactor 1; Unit 2's reactor vault is tied with the station's common containment via the central fueling duct; and commissioning commencement on the reactor regulating system in Unit 1. Bruce A's Units 1 and two are scheduled to return to commercial service in 2012.



The Unit 2 reactor at Bruce Power's Bruce A generating station is back together with 480 new fuel channel assemblies, 480 new calandria tubes and 960 new feeder tube segments. Expected to return to service in the first part of 2012, the reactor has been shut down since 1995.

Contact: Bruce Power, P.O. Box 3000, Tiverton, Ontario N0G 2T0, Canada; telephone: (519) 361-6559, email: brucerestart@brucepower.com. ■

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Through the use of advanced-passive safety systems, the **AP1000** reactor is deemed to be 200 times safer than regulations require. Modular design and standardization result in stable and predictable construction, fuel and operating and maintenance costs.

These milestones are vital steps towards bringing the Westinghouse **AP1000** reactor into commercial operation — delivering not just decades of clean and safe power to future generations, but also thousands of high-quality jobs during construction and operation.

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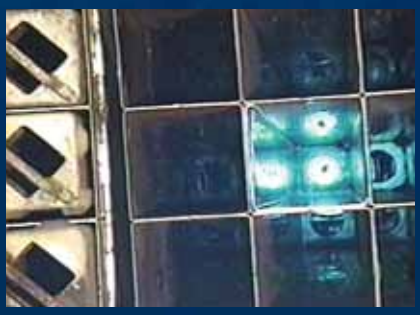

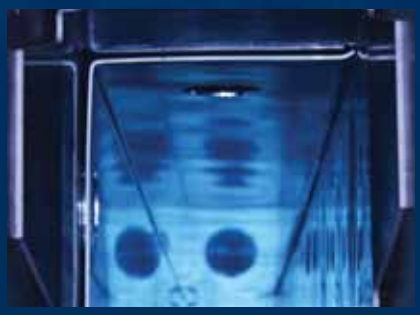

Neutron absorber degradation can make fuel storage a complicated pain in the rack. Use NETCO-SNAP-IN inserts to regain pool capacity and storage flexibility. SNAP-IN inserts are easy to install, become an integral part of the fuel storage rack and are transparent to fuel handling operations. Install SNAP-IN inserts incrementally or in a single campaign. The choice is yours. The SNAP-IN insert is one of a suite of neutron absorber material performance management solutions developed by NETCO.

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