Nuclear Plant Journal

An International Publication
Published in the United States

New Plants &
Vendor Advertorial

July-August 2012
Volume 30 No. 4

Oconee, United States

ISSN: 0892-2055


FIELD REPORT #10
Topic
Solar
Location
Worldwide
Experience you can bank on.
A CSP technology that delivers.
Utilities and industrial steam customers need to meet the ever-growing demand for clean, reliable and competitive energy. Thanks to its advanced, superheated Compact Linear Fresnel Reflector technology, AREVA is the perfect concentrated solar power (CSP) supplier to help customers thrive in a dynamic energy market.
AREVA's simple, modular and reliable design results in high-performance with the lowest CSP capital expenditure and energy costs:
- Locally sourced, standard materials minimizes costs and supply constraints;
- Onsite manufacturing and simple construction saves time for faster returns;
- Land-efficient, water-wise solution simplifies permitting and conserves natural resources.
This makes AREVA's solar steam generators ideal for large-scale CSP plants, as an add-on to existing fossil-fired plants, or for industrial process steam facilities — and its solar steam generators are backed by AREVA performance guarantees.
Find out how AREVA is helping power and industrial steam companies meet their clean energy goals.
Return on Experience
LOCAL ADDED VALUE, RELIABLE POWER QUALITY
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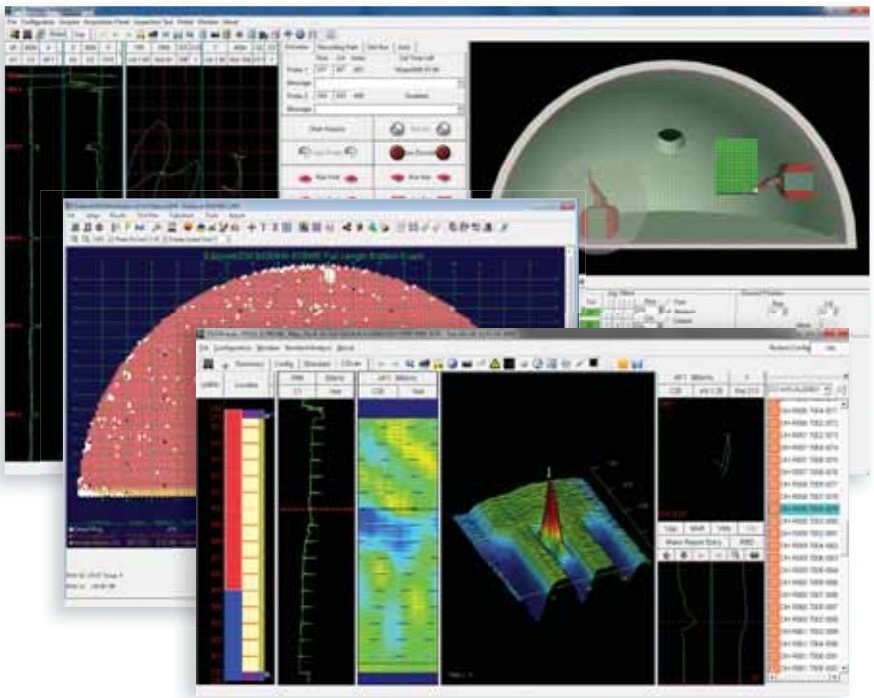
Energy is our future, don't waste it! - © Copyright: AREVA - June 2013

Eddynet PC Software

FOR ACQUISITION, DATA MANAGEMENT AND ANALYSIS

Features & Benefits

- Familiar Eddynet functionality in an updated Windows® PC platform for easy transition from EddynetSuite
- Individually licensed programs for maximum deployment flexibility
- Leverages familiar Windows® PC operating system for simplified utilities and administration
- Full integration between applications to ensure best practices for steam generator inspections



The Original Just Got Better

From the world leader in eddy current steam generator inspection software comes Eddynet on the Windows PC platform. Eddynet now has the flexibility to be operated from a wider array of hardware choices. A new licensing methodology allows users to select from separately licensed acquisition, data management, and analysis modules for ultimate flexibility to match their specific inspection needs.

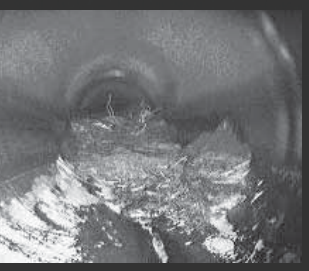
Familiar EddynetSuite features and modules are available from the Eddynet PC software making an easy transition for experienced users. In addition, Eddynet PC products utilize the underlying Windows OS to make the task of network administration, file utilities, and printing much simpler.

Eddynet Just Does It Better

www.zetec.com

HOW WELL DO YOU UNDERSTAND NUCLEAR BURIED PIPE INSPECTION?

Diakont is an expert. Trust us to guide your plant through the new NEI 09-14 requirements.



Inspection without Excavation

New guidelines for the inspection of nuclear power plant underground and buried piping is a critical issue facing the industry. Complex pipe geometries, contamination, or location under plant structures can make piping virtually impossible to inspect. Diakont's inspection teams use robots equipped with ultrasonic and laser NDE technologies, and the ability to traverse piping with diameter changes, tight bends, valves and vertical sections.

Call Diakont today to receive information on the most comprehensive nuclear buried pipe inspection services in the industry.

DIAKONT

DIAKONT SPECIALIZES IN...

- Rad-Tolerant Cameras and CCTV Systems
- Custom Robotics
- Nuclear I&C Systems
- Fuel Handling Equipment
- Buried Pipe Inspection

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Nuclear Plant Journal®

July-August 2012, Volume 30 No. 4

30th Year of Publication

New Plants & Vendor Advertorial Issue

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The subscription rate for non-qualified readers in the United States is $150.00 for six issues per year. The additional air mail cost for non-U.S. readers is $30.00. Payment may be made by American Express®, Master Card®, VISA® or check and should accompany the order. Checks may be made payable to "EQES, Inc." Checks not drawn on a United States bank should include an additional $45.00 service fee. All inquiries should be addressed to *Nuclear Plant Journal*, 1400 Opus Place, Suite 904, Downers Grove, IL 60515; Phone: (630) 858-6161, ext. 103; Fax: (630) 852-8787, email: NPJ@goinfo.com.

Last 29 year Journal issues are now available online through the Journal website www. NuclearPlantJournal.com (search box on the right-top) for a nominal fee of $25 per issue. Contact: Anu Agnihotri, email: anu@goinfo.com

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Utilities:	2,904

*All circulation information is subject to BPA Worldwide, Business audit

Articles & Reports

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On The Cover

The RPS/ESPS upgrades were implemented on unit 1 during the plant's spring 2011 refueling outage, making Oconee the first plant in the nation to move the systems from analog to digital. Units 2 and 3 will receive the upgrades during 2012 and 2013. See page 77 for a profile.

Mailing Identification Statement

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Nuclear Plant Journal Rapid Response Fax Form

July-August 2012

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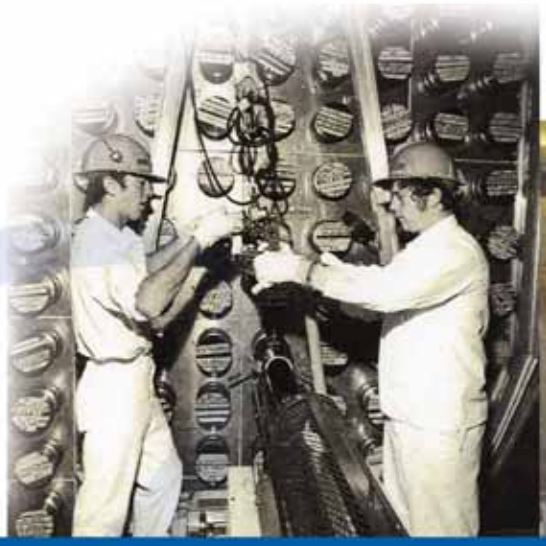

GENERATING SUCCESS—FOR 100 YEARS

Kinectrics is celebrating 100 years of success in providing advanced technical expertise to the electricity generation industry.

For nuclear, our unique engineering and testing capabilities include complete outage support, inspection and equipment qualification, nuclear plant chemistry and many other industry-accredited services.

- Life Cycle Management and Plant Life Extension
- Genuine Nuclear Parts and Equipment Qualification
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- Materials Characterization and Forensic Analysis
- Plant Chemistry and Nuclear Waste Management
- Regulatory Affairs and Licensing

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New Energy

Czech Republic

On July 3, 2012, **ČEZ** opened bids for the public contract for completing the Temelín Nuclear Power Plant in the presence of the bidders- Areva, a consortium of the Westinghouse Electric Company, LLC and WESTINGHOUSE ELECTRIC ČR, and a consortium of ŠKODA JS, Atomstroyexport, and Gidropress. A team of experts will thoroughly examine, evaluate, and discuss the bids with the bidders in order to achieve their optimization.

During the evaluation process, the technical specifications of the plans and design documentation will be analyzed together with the security and license aspects thereof; another fifty percent of the criteria value will be the financial part of the bid, i.e. the price and commercial terms and conditions, such as the terms of warranty and payment. All of the company's requirements for the subject matter of the public contract, i.e., the supply of two complete units for the Temelín Nuclear Power Plant on a turn-key basis, including sets of fuel rods for nine years of operation, were specified in the document.

Contact: Marek Svitak, telephone: 420 381 102 328, email: marek.svitak@cez.cz.

ESBWR

GE Hitachi Nuclear Energy (GEH) continues to work with Nuclear Power Corporation of India Limited (NPCIL) to bring the ESBWR to India.

GEH has been engaged in commercial discussions with NPCIL since signing a memorandum of understanding (MOU) in 2009. Significant progress has been made and another major milestone, an early works agreement, is expected to be completed soon.

Site preparation for the ESBWR units is underway near Kovvada in the state of Andhra Pradesh.

Contact: Christopher White, telephone: (910) 819-6121, email: christopher1.white@ge.com.

International Deals

Nigeria signed a cooperation accord with Russia towards the construction of its first nuclear power plant on June 7, 2012 at the AtomExpo event in Moscow. Bangladesh and South Africa also agreed to extend their nuclear cooperation with Russia.

Rosatom chief, Sergei Kiriyenko signed a memorandum of understanding with the chairman of the Nigerian Atomic Energy Commission, Franklin Erepamo Osaisai. Its terms will see the two countries "prepare a comprehensive program of building nuclear power plants in Nigeria," including the development of infrastructure and a framework and system of regulation for nuclear and radiation safety.

It was noted that one of the most important areas for cooperation was to establish the proper educational structure for Nigerian professional skills in nuclear physics and energy. The country is seen as one of the most serious and promising to be exploring the future use of nuclear energy. In 2010 Nigeria said it aimed to have 1000 MWe of nuclear generation in place by 2019 with another 4000 MWe online by 2030. Increasing power production is a major priority in order to end the unreliability of power supply that millions of people suffer, while adding non-fossil generation also would allow Nigeria to capitalise on exports of liquified natural gas.

Another country that has been cooperating with Russia on its road to employing nuclear power is Bangladesh and Kiriyenko also used AtomExpo as the public event to announce two new memorandums with that country. One concerned the setting-up of a public information centre in Bangladesh which it is hoped will raise the profile of nuclear work in civil society and among young people; the other was a mutual agreement on nuclear training that included sending a 'pilot group' of Bangladeshi students to Russian institutions. Signing both of these for Bangladesh was the minister for science and technology, Yafesh Osman.

Another country in discussions with Russia about its nuclear future is South Africa, which is developing plans for a build programme of about 9.6 GWe of new nuclear capacity starting from 2024.

Contact: Sergey Novikov, telephone: 7 499 949 44 12, fax: 7 499 949 27 22, email: press@rosatom.ru.

Russia

The government of the Sverdlovsk region of Russia has approved the construction of the country's first BN-1200 fast reactor at the Beloyarsk nuclear power plant.

The government said that the planned 1200 MWe unit will produce around 9 billion kilowatt-hours of electricity annually and help avoid the emission of "millions of tonnes" of carbon dioxide. In addition, it would completely remove the region's need to import fossil fuels. With a 60-year operating life, the reactor is expected to have an annual capacity factor of at least 90%.

The technical design of the BN-1200 is scheduled for completion by 2013, while the manufacture of equipment will start in 2014. Construction of the Beloyarsk unit is set to begin in 2015.

According to the Sverdlovsk Department of Energy and Housing, the BN-1200 reactor would be built to replace the existing smaller BN-600 reactor at unit 3 of the Beloyarsk plant. That unit, which began operating in 1981, is scheduled to be decommissioned by 2020. A BN-800 reactor is currently under construction as the fourth unit at Beloyarsk, which is expected to enter commercial operation in 2015.

*Contact: Sergey Novikov, **Rosatom**, telephone: 7 499 949 44 12, fax: 7 499 949 27 22, email: press@rosatom.ru.*

Ohi Restart

The Japanese government has announced it will be able to scale back energy saving targets in some areas thanks to the restart of Kansai Electric's Ohi 3.

The 1180 MWe unit reached full capacity on July 9, 2012, becoming the first Japanese reactor to restart following suspension for periodic inspection since the March 2011 Fukushima Daiichi nuclear accident. Its sister unit, Ohi 4, is expected to follow later in July, 2012.

Source: World Nuclear News. ■

Utility, Industry & Corporation

Utility

Merger

Duke Energy Corporation confirmed the closing of its previously announced merger with Progress Energy Inc., effective July 2, 2012.

The new company will be known as Duke Energy and will remain headquartered in Charlotte, with substantial operations in Raleigh, N.C. Duke Energy will trade on the New York Stock Exchange under the symbol DUK.

In accordance with the terms of the merger agreement, Progress Energy Inc. has become a wholly owned direct subsidiary of Duke Energy, creating the country's largest electric utility as measured by enterprise value, market capitalization, generation assets, customers and numerous other criteria.

Contact: Tom Williams, telephone: (800) 559-3853.

Next Generation

By 2016 approximately 40 percent of the nation's nuclear power plant workers are expected to reach retirement age. **Entergy Nuclear** is collaborating with Excelsior College to mitigate this potential workforce shortage and accelerate its staffing pipeline.

Under the collaborative agreement, Entergy employees and their spouses can pursue higher education at reduced tuition rates. The facility will put a particular focus on the new associate in science in nuclear technology, which is designed for students pursuing careers as nuclear plant equipment operators. The curriculum adheres to the Nuclear Energy Institute's Nuclear Uniform Curriculum Program (NUCP). Through Excelsior College, this curriculum is delivered entirely online.

The NUCP provides a framework within which potential plant staff can obtain the foundational knowledge of core nuclear industry topics required by the National Academy for Nuclear Training. Graduates of the program will receive a certificate, allowing them to bypass selected industry training requirements.

Contact: Margie Jepson, telephone: (601) 368-5460, email: mpjepson@entergy.com.

Industry

Nuclear Future

Increased global reliance on nuclear energy will maintain the U.S. capability to build new nuclear energy facilities when the need for accelerated expansion arises in America, the chairman of the **Nuclear Energy Institute** predicted.

"I am confident that the need for new nuclear power plants will emerge beyond 2020 because the long-term fundamentals for nuclear energy remain sound," said William Johnson, chairman, president and chief executive officer of Progress Energy. Johnson also serves as NEI chairman.

Johnson reminded industry leaders at the NEI's annual conference that the International Energy Agency reported that the world's electricity production from nuclear energy facilities must nearly double by 2025 to help meet greenhouse gas reduction targets.

"Significant growth in global nuclear development continues to open markets for U.S. suppliers and vendors," Johnson said. "Our commercial reactor supply chain continues to grow and add thousands of jobs due to the export of reactor technology, components and services. According to the Bureau of Labor Statistics, the nuclear energy sector accounted for 54 percent of all 'green' jobs in the electric sector in 2010."

Contact: telephone: (202) 739-8000.

New Chairman

Dr. Allison M. Macfarlane was sworn in as chairman of the **Nuclear Regulatory Commission** July 9, 2012. She was nominated by President Obama and confirmed by the Senate to a term expiring June 30, 2013.

Macfarlane, an expert on nuclear waste issues, holds a doctorate in geology from the Massachusetts Institute of Technology and a bachelor of science degree in geology from the University of Rochester. Prior to beginning her term as the NRC's 15th chairman, Macfarlane was an associate professor of environmental science and policy at George Mason University in Fairfax, Va.

From 2010 to 2012 she served on the Blue Ribbon Commission on America's Nuclear Future, created by the Obama Administration to make recommendations about a national strategy for dealing with the nation's high-level nuclear waste. Her research has focused on environmental policy and international security issues associated with nuclear energy, especially the back-end of the nuclear fuel cycle. In 2006 MIT Press published a book she co-edited, Uncertainty Underground: Yucca Mountain and the Nation's High-Level Nuclear Waste, which explored technical issues at the proposed waste disposal facility at Yucca Mountain, Nevada.

Contact: telephone: (301) 415-1750, email: chairman@nrc.gov.

Corporation

Excellence Award

Chatham Steel Corporation's nuclear division was awarded the GE Hitachi Supplier Fulfillment Excellence Award, which is based on Chatham's 100% on-time delivery performance and accurate documentation of all safety-critical materials and processing. Only one award of this nature is given out each year. GE Hitachi maintains vendor relationships with over 300 suppliers internationally.

Chatham Steel Corporation, serving industry since 1915, provides metal products and processing services to a wide variety of industrial markets including the nuclear industry. Chatham is a member of

(Continued on page 12)

Chatham Steel: A story of excellence spanning nearly a century.

For nearly a century, Chatham Steel has built a reputation for excellence in quality, service and responsiveness. In that time, they have also developed a highly efficient network that includes service centers from Ohio throughout the southeast.

Chatham maintains an extensive inventory of products, giving customers immediate access to carbon, alloy, stainless steel, and aluminum. Inventory includes plate, bar, sheet, tube, pipe, beams, channels, angles, grating and specialty products. Through their many alliances across the country, Chatham also has reliable access to even the most difficult-to-find products and materials. Because of the company's large inventory and processing capabilities, it is able to help many of its customers reduce their costs of operation by processing and delivering products on an as-needed basis.

With industry needs constantly changing and evolving, Chatham has continued to invest in facilities, products, state-of-the-art processing equipment and information systems to serve all of its customers' needs. The company's culture emphasizes training, teamwork and continuous improvement. With advanced equipment, technology, creativity and expertise, Chatham is able to deliver customized solutions on time and on budget, something that is rare in the nuclear industry.

Chatham Steel's collaborative relationships help its partners meet their unique challenges. The company prides itself on being a RARE partner to all of its nuclear customers. Chatham defines RARE as:

- Responsible – A company that believes outstanding service should co-exist with adherence to the most stringent safety and quality standards. A partner that delivers safety-critical materials on time and within budget.
- Accountable –A single-source supplier that provides complete documentation and unparalleled accountability.
- Reliable –A proven track record of almost 100 years of reliable service.
- Effective –A partner that offers exceptional quality and service, and provides the most effective solutions. Chatham understands and adheres to the safety-critical standards of the nuclear industry. As part of the Chatham commitment to quality assurance and safety, the company has attained the following: ISO 9001:2008; Member of NIAC, audited and compliant to ASME; NQA-1,10CFR50 Appendix B and 10CFR Part 21; ASME Section III, NCA 3800; Quality System Certificate (QSC #665, Durham Division); Value added operations (burning, forming, drilling, sawing) are certified under ASME QSC/MO.

Chatham Steel has proven that it is the nuclear industry's new and better option for supplying safety-critical materials.

For more information on Chatham Steel, visit them online at **www.chathamsteel.com** or call **1-800-869-2762** and ask for one of their nuclear sales specialists.

Responsive, Accountable, Reliable, Effective

RARE refinement.

Providing safety-critical steel products to the nuclear industry.

Within the nuclear industry, there's a new and rare alternative for safety-critical needs...Chatham Steel. With 97 years of business behind our name, we don't deliver anything short of responsive, accountable, reliable and effective service for our customers. It's what has earned us our reputation for excellence in the metals service industry. That is what we believe to be refinement at its best.

For more information on our extensive inventory of steel products and processing services, call **1-800-869-2762** and ask for a nuclear sales specialist, email us at **nuclear@chathamsteel.com** or visit us online at **www.chathamsteel.com.**

Chatham Steel
corporation
CARBON • STAINLESS • ALLOY

ASME Quality System Certificate (QSC) applies to Chatham Steel's Durham, North Carolina location. ISO 9001:2008 accreditation applies to all Chatham Steel locations except Ironton, Ohio, which is scheduled for certification in 2012.
Safety-critical steel products provided to the nuclear industry come from our Durham, North Carolina and Savannah, Georgia locations.
A member of the Reliance Steel and Aluminum family of companies.

Quality System Certificate | NIAC | SGS

Corporation...

Continued from page 10

the Reliance Steel and Aluminum family of companies.

Contact: Sherri Black, Black Box Incorporated, telephone: (502) 625-3030, email: sblack@blackboxincorporated.com.

Motor Refurbishment

Curtiss-Wright Corporation announced that its Flow Control business segment's Electro-Mechanical Division (EMD) business unit and Westinghouse Electric Company LLC have signed a strategic alliance to jointly pursue and develop business opportunities for the refurbishment of large motors for commercial nuclear power applications in North America and to collaborate on new technology development.

The alliance will enable both companies, as well as their customers, to benefit from the combined capabilities and resources of two very experienced nuclear energy organizations. Curtiss-Wright and Westinghouse have several ongoing business agreements in support of operating nuclear plants around the world and AP1000(R) units under construction in China and the United States.

Contact: Jim Ryan, telephone: (973) 541-3766.

Inline Inspection

Diakont announced that a Memorandum of Understanding (MoU) has been signed with Structural Integrity Associates, Inc., a leader in prevention and control of structural and mechanical failures for buried piping.

The MoU leverages Structural Integrity's engineering expertise in buried piping and flaw assessment with Diakont's robotic inline inspection equipment to offer a comprehensive in-field inspection of buried and underground piping to help nuclear power plants meet the inspection requirements of NEI 09-14 (Guideline for the Management of Underground Piping and Tank Integrity). Through the relationship, nuclear power plants will benefit from a turnkey solution that includes field inspection, data interpretation, flaw criteria and disposition support, and complete data management support back into the site's BPWORKS™ 2.0 and MAPProView© software for later use in trending and risk analysis.

Contact: Aaron Huber, telephone: (858) 551-5551.

Technical Knowledge

GE Hitachi Nuclear Energy (GEH) signed a memorandum of understanding (MOU) with The University of Manchester. The university will provide GEH with expert technical knowledge and input to the potential deployment of GEH's innovative PRISM reactor, designed to dispose of the U.K.'s growing plutonium stockpile while at the same time generating 600 megawatts of low-carbon electricity.

The MOU follows the announcement last month at a nuclear industry conference that GEH and the National Nuclear Laboratory intend to collaborate. With more than 100 attendees, the conference was held in West Cumbria on April 4, 2012, exploring the support of potential U.K. business partners to deploy PRISM technology at Sellafield.

The University of Manchester recently won a Queen's Anniversary Prize for its internationally renowned nuclear research and skills development for the nuclear industry, making it an ideal partner to work with GEH in the potential deployment of PRISM.

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

Small Business Award

HukariAscendent has been selected as the Department of Energy's Service Disabled Veteran Owned Small Business of the Year for 2011. This award recognizes the exceptional performance of a Service-Disabled, Veteran-Owned small business directly facilitating the advancement of core DOE mission objectives and requirements. The award was presented to Ken Hukari, Owner and CEO of **Hukari**Ascendent, on June 27th , 2012 during a ceremony at DOE Headquarters in Washington, DC.

HukariAscendent provides specialized engineering, technical, and professional support services to government and commercial clients in nuclear power, science and technology industries.

Contact: 4251 Kipling Street, Suite 400, Wheat Ridge, Colorado 80033, telephone: (303) 384-9079, website: www.hukari.com.

Simulator Update

L-3 MAPPS will proceed with two projects to update the full scope simulator at Axpo's Beznau nuclear power plant located in Döttingen, Switzerland. The projects involve NEXIS and AUTANOVE updates being performed on the plant's two operating units. The simulator updates are expected to enter service in the fall of 2013.

Under the NEXIS project, the plant is replacing its existing WDPF-based plant information system with an advanced Ovation-based system from Westinghouse. For the AUTANOVE project, the existing remote emergency power supply is being replaced with two on-site diesel generators for each operating unit. To properly train Beznau operators on the impact and behavior of these significant plant modifications, the updated simulator must be operational well in advance of the actual plant modifications going into service.

Contact: Sean Bradley, telephone: (514) 787-4953.

Nozzle Weld Overlays

Aquilex WSI, LLC (WSI) and **Structural Integrity Associates** (SI) (together as W(SI)^2) announce the recent successful installation of full structural weld overlays on three steam generator hot leg nozzles at Dominion Virginia Power's North Anna Power Station Unit 1. North Anna is a two-unit site located in Mineral, Virginia with three-loop, Westinghouse-designed PWRs. North Anna 1 is the

only PWR in the U.S. with Alloy 82/182 (600) dissimilar welds joining the low alloy steel steam generator nozzles to the stainless steel primary piping.

Dominion Virginia Power prepared the area for work, including insulation removal and scaffolding erection, and conducted pre-weld overlay examinations of the Alloy 600 welds. The W(SI)^2 scope of work consisted of design and analysis, repair licensing, mockup testing and qualification, on-site implementation and post-mitigation NDE UT of the weld overlays. Although W(SI)^2 has performed hundreds of weld overlays at both domestic and foreign nuclear sites in its history, the North Anna project involved the largest Alloy 600 nozzle weld yet (41" OD) to be mitigated with weld overlay. Due to the thickness of the dissimilar metal weld, approximately 20% of base material thickness was removed prior to installing the overlay for UT inspection purposes. Through this preparatory machining, the project uncovered and repaired two through-wall cracks in one of the nozzle welds. In spite of this complication, all safety, schedule, quality and dose expectations for the project were satisfactorily completed.

Contact: Vicki Douglass, telephone: (877) 474-7693, email: info@structint.com.

Early Works Agreement

Westinghouse Electric Company LLC and Nuclear Power Company of India Limited (NPCIL) signed a Memorandum of Understanding (MOU) on June 13, 2012 agreeing to negotiate an Early Works Agreement (EWA) supporting future construction of AP1000® nuclear power plants at the Mithivirdi site in Gujarat.

The agreement represents significant progress toward the realization of the India – U.S. Civil Nuclear Agreement signed in 2008. The Early Works Agreement will include preliminary licensing and site development work.

Contact: Vaughn Gilbert, email: gilberhv@westinghouse.com. ■

Siempelkamp

Products and Services for Nuclear Power Plants

Power generation utilising nuclear power plants is experiencing a worldwide renaissance. Countries such as Finland, China, Russia, Great Britain, France and the USA already count on nuclear power and will increasingly secure their energy demand through a new generation of low CO2 emission nuclear power stations. Siempelkamp Nuclear Technology, Inc. headquartered in Walnut Creek, CA, and its subsidiary Siempelkamp Nuclear Services provide comprehensive support to the nuclear power sector.

High quality and field-proven technology

Siempelkamp business units supply customers with products and services that ensure the secure operation of nuclear facilities. With our highly qualified and experienced engineers and project managers Siempelkamp is well equipped to deliver to the exacting requirements of customers providing solutions to new challenges. Customer confidence is reinforced by our world class delivery record that continuously demonstrates our attention to safety and quality and to the provision of effective field-proven technology operated by highly experienced staff.

Nuclear portfolio

The supply and operation of components and equipment around the reactor are a core competence of our business. Furthermore, Siempelkamp are setting new milestones in the extension of the service life of nuclear power plants through analyses and calculations together with the retro-fitting of components and equipment. Last but not least, decommissioning of nuclear facilities provides confidence of the ability to successfully manage the complete nuclear power lifecycle. Our employees supporting nuclear facility decommissioning are the most experienced specialists in the dismantling and disassembling of nuclear reactor vessels and internals worldwide. Their innovative ideas combined with practical and cost effective equipment designs for reliable mechanical segmentation guarantee exceeding customer requirements and meeting the highest levels in safety and quality.

New and Operating Plants

- Engineering
- Refuelling Bridges
- Cranes incl. Polar
- Multi-purpose Lift Rigs
- Core Catcher Cooling Elements
- Stud Turning and Tensioning Tooling
- Sealing Heads
- Waste Handling Facilities

Life-time Support

Information Technology
- Process Information Systems
- Turbine Generator Diagnostic Systems

Consulting
- Nuclear Physics

Operational Support
- Engineering
- Modernization of Components
- Assembly, Start up
- Services

Decommissioning / Waste Management

Decontamination / Decommissioning
- Project Management
- Engineering

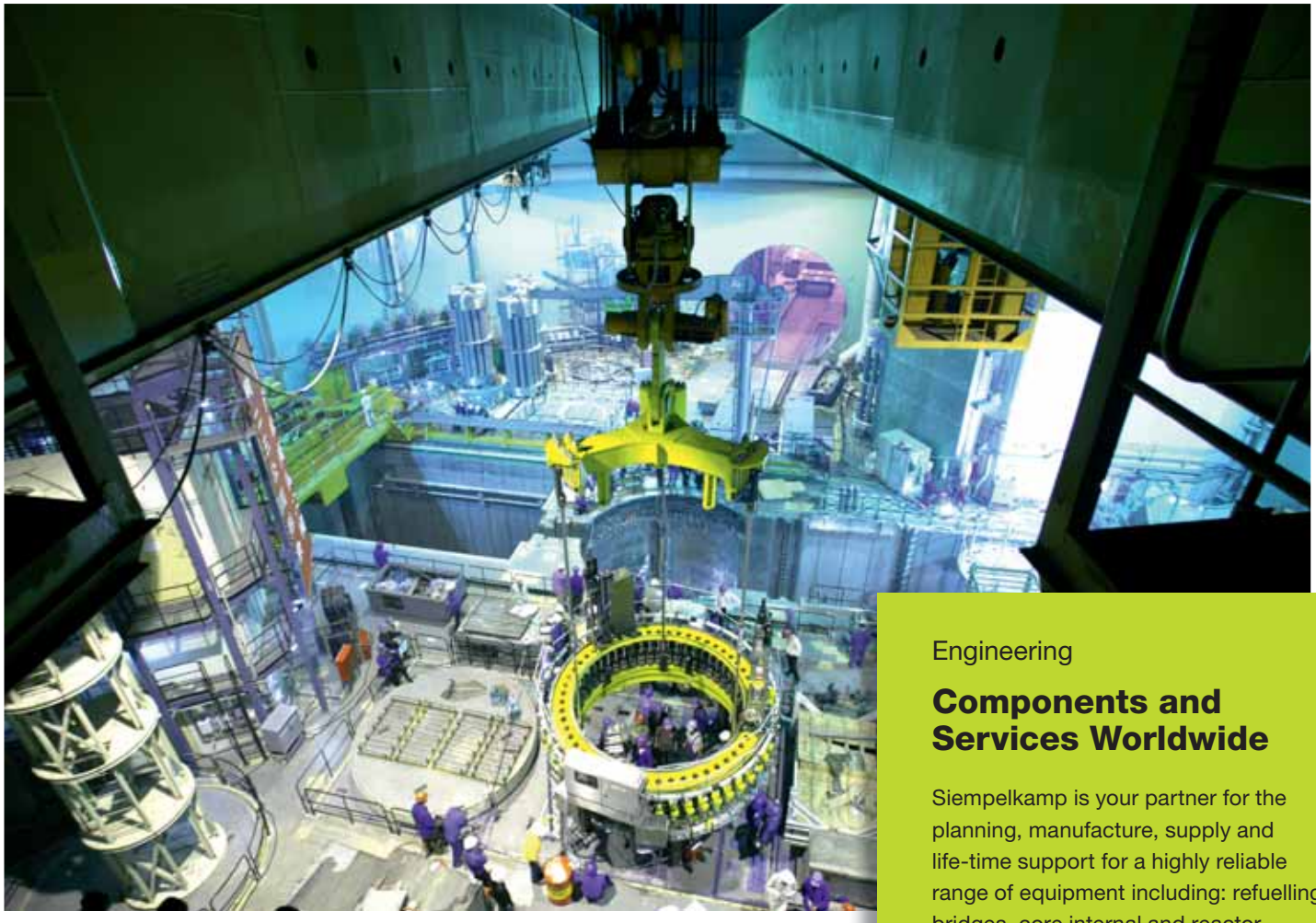
- Specialty Mechanical Segmentation Tooling
- Planning and Cost Estimating

Equipment for Waste Handling
- Hot Cell Technology
- Remote controlled Handling Equipment

Contact us and learn more about:

Siempelkamp Nuclear Technology, Inc.
1990 North California Boulevard,
Suite 1070
Walnut Creek, CA 94596
Phone: 925.932.4000
Fax: 925.932.4010
john.mageski@siempelkamp.com
www.siempelkamp.com

Siempelkamp Nuclear Services, Inc.
3229 Sunset Boulevard
West Columbia, SC 29169
Phone: 803.796.2727
Fax: 803.939.1083
steve.garner@siempelkamp-sns.com
www.siempelkamp-sns.com



Engineering

Components and Services Worldwide

Siempelkamp is your partner for the planning, manufacture, supply and life-time support for a highly reliable range of equipment including: refuelling bridges, core internal and reactor head lifting devices, stud turning and tensioning tooling, cranes incl. polar, sealing heads, fuel element storage racks, core catcher cooling elements, waste handling facilities etc. for operating plants and new build.

Products and Services for Nuclear Power Plants

Compliance with the highest requirements in safety and quality in the nuclear sector is our business. We supply services, equipment and life-time support within the nuclear power industry. Our extensive know-how and experience over many years forms the basis for our successful delivery.

Get more information about our innovative nuclear technology:

John Mageski
T: 925.932.4000
C: 510.816.3762
john.mageski@siempelkamp.com

www.siempelkamp.com

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New Products

Containment Vent

GE Hitachi Nuclear Energy's containment hardened vent provides a GEN III and Gen III+ leveraged design for post-accident containment overpressure protection. The standardized design provides plant independent component specifications and overall system design specifications leveraging state-of-the-art methodology scalable to specific containment and plant types. Through the use of GEH's NRC approved TRACG family of codes the standard specifications can be readily made plant specific.

Contact: Michael Tetuan, email: Michael.Tetuan@ge.com.

LED Light

Remote Ocean Systems has introduced a revolutionary High Performance LED Light for Nuclear Pools. The HP LED Ultra High-Intensity White LED Array is 4 times brighter than standard pool lighting. In addition, this new technology LED light is significantly more cost efficient because it uses 50% less energy and lasts more than three years.

The brilliant 40,000 Lumen "White Light" illumination of the ROS HP LED will enhance the ability to detect and prevent Foreign Material Exclusion (FME) problems and increase operational safety at the same time.

The rugged, stainless steel design is shock and vibration proof, contains no mercury and installs quickly and easily in the same locations with no tooling needed.

Contact: telephone: (858) 565-8500, website: rosys.com.

Multi-D Technology

Rosatom is developing Multi-D technology for engineering and construction of NPPs. This technology enables carrying out detailed modeling of construction and installation processes based on 3D-object models, which significantly increases quality and speed of work performance.

Multi-D object models enable visualizing construction processes and training personnel based on this model before going to site. This technology enables testing various scenarios of work performance and correcting the sequence of work performance promptly, informed General Director of Rosatom engineering company OAO NIAEP – ZAO Atomstroyexport Valery Limarenko in Nizhny Novgorod at the international theoretical and practical forum dedicated to life cycle management of complex engineering objects.

This technology is already in use at sites in Russia where OAO NIAEP – ZAO ASE operates. Presently NPP life cycle management at engineering and construction stages is carried out by means of Multi-D technology. Furthermore currently Multi-D is being prepared to be used at the next NPP life cycle stage – decommissioning.

Contact: telephone: 7 495 730 0873, email: lvadybov@rosatom.ru.

Services

Consulting & Analytical

AMEC's projects have spanned the entire lifecycle of complex nuclear assets; from building and refurbishing nuclear assets, reactor operational support to clean-up decommissioning and waste management.

From locations in the UK and Canada, they consult and support the nuclear industry, working with asset owners worldwide, including Sellafield Limited, Bruce Power, AWE, Rolls Royce, and EDF Energy which now incorporates British Energy. AMEC also provides technological and analytical services to customers and their subcontractors through NIRAS radiochemistry laboratories. Their expertise crosses borders into the US, Central and Eastern Europe, South Africa, Lithuania, Ukraine, Armenia and Russia.

Contact: Abdy Khanpour, telephone; (770) 688-2943, email: abdy.khanpour@amec.com.

Seismic Analysis

Burns and Roe is proactive in the areas of seismic analysis, consistently reassessing civil, structural and architectural capabilities to ensure constant enhancement of skills and capabilities.

Recently Burns and Roe has teamed with Barge Waggoner Sumner & Dannon, Inc. (BWSC) to offer clients top-notch hydrologic/hydraulic modeling and flooding assessments to assist with the constant challenge of managing, protecting, and conserving water resources to meet future needs.

Contact: Don Flood, telephone: (201) 986-4623, email: dflood@roe.com.

Cranes

Konecranes Nuclear Equipment & Services LLC supplies lifting equipment for nuclear applications.

Konecranes is a full service supplier, offering all types of nuclear cranes and related lifting solutions. They offer services and equipment that boost business effectiveness and value.

Konecranes services their own products and products from other manufacturers. Konecranes nuclear crane safety related quality control program meets quality standards of the nuclear industry, such as the 10CFR50 Appendix B.

Konecranes is a member of advisory and regulatory groups like the ASME NOG-1 committee, which sets regulations for the development of nuclear industry cranes. All necessary engineering is done by in-house employees such as regulatory compliance validation, complex seismic evaluation, and safety analysis reports.

Contact: David Schaeffer, telephone: (610) 368-8389, email: david.schaeffer@konecranes.com.

Plant Siting Studies

Paul C. Rizzo Associates, Inc. has extensive experience in performing the necessary first steps of identifying potential sites through site characterization for a Nuclear Power Plant (NPP) in accordance with a number of U.S. and International Regulations and guidance.

RIZZO's approach to conducting a detailed siting study or analysis utilizes published guidance but is customized to fit locales where background information

(Continued on page 19)

VALUE YOU CAN HANG YOUR HAT ON

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In the 21st century, the power sector finds itself facing unprecedented operational pressures, shifting priorities, and increasing regulatory scrutiny. With our comprehensive industry experience and seasoned professional staff, Day & Zimmermann is uniquely positioned to partner with our customers to deliver the value-added solutions they require in order to thrive in this environment.

Our field-focused operations teams have delivered industry best-practices and continuous improvement innovations in every phase of project delivery. Safety is our number-one core value, and it permeates everything we do in optimizing the performance of our customers' plant assets. You can depend on us to be your trusted value partner.

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1. Features

1.1 Nuclear Plant Journal's annual Product & Service Directory is a source of information on resources for more than 3,000 different products and services used in the nuclear power industry. Up to **five** (5) listings plus supplier's complete contact information are included cost-free for all organizations.

Organizations that are not advertising in the Directory may purchase additional listings at a cost of **$9.00 per listing.**

2. Circulation Highlights

2.1 Worldwide Distribution

The Directory reaches more than 12,000 professionals in the nuclear power industry worldwide, including 4,000 managers, supervisors, engineers and other personnel at nuclear power utilities.

2.2 Year-Round Bonus Circulation

Complimentary copies of the Directory 2013 will be distributed to the attendees at several nuclear industry meetings and conferences throughout the year.

Go to www.NuclearPlantJournal.com and click on "Directories" and then "Printed Directory-2013" for complete listing information.

Important Dates

Ad Reservation Deadline: November 9, 2012
Input Form Deadline: November 2, 2012
Ad Materials Deadline: November 16, 2012
Directory 2013 Published: December, 2012

Contact:
QingQing Zhu
Nuclear Plant Journal
1400 Opus Place, Suite 904
Downers Grove, IL 60515 USA
Phone: (630) 858-6161, ext. 106
Fax: (630) 852-8787
E-mail: QingQing@goinfo.com

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Services...

Continued from page 16

can be limited. During this process they identify geotechnical/hydrological and environmentally preferable sites for the construction and operation of an NPP.

Contact: Jill Redd, telephone: (412) 825-2053, email: jill.reed@rizzoassoc.com.

Contracts

Fuel Assemblies

AREVA has signed three contracts with the German utilities RWE and EnBW for the supply of fuel assemblies.

The first two contracts signed with RWE cover the manufacture and the supply of ATRIUM™ and HTP™ fuel assemblies, respectively for Gundremmingen (Bavaria) and Emsland (Lower Saxony) nuclear power plants, until late 2015.

AREVA has also concluded a contract with EnBW regarding the manufacture and the delivery of HTP™ fuel assemblies for the reactor 2 of Philippsburg (Baden-Württemberg) nuclear power plant, between 2014 and 2017.

These fuel assemblies will be manufactured by AREVA on its Lingen site located in Germany.

Contact: Patricia Marie, telephone: 33 0 1 34 96 12 15, email: press@areva.com.

Safety Grade Cables

Habia Cable, the Swedish high-end cable manufacturer, is maintaining its leading position in the Korean nuclear market with another new contract. The company recently signed a contract with Korea Hydro & Nuclear Power (KHNP) to supply nuclear safety grade cables to the new Shin-Ulchin 1&2 (APR 1400) nuclear power plants on the Korean east coast. Deliveries are planned to take place through an 18-month period starting 2014.

Habiatron Q class cables have been installed in all new nuclear power plants built in Korea since the construction of Younggwang 5&6 in the late 1990s, a total of approximately ten installations.

Contact: Irene Ohmnan, telephone: 46 0 70 256 12 54, email: Irene.ohman@habia.com. ■

New Documents

EPRI

1.*Summary of the EPRI Early Event Analysis of the Fukushima Daiichi Spent Fuel Pools Following the March 11, 2011 Earthquake and Tsunami in Japan.* Product ID: 1025058. Published: May, 2012.

As part of its Fukushima response, EPRI collaborated with experts from nuclear utilities, vendors, and national laboratories to evaluate the key theories and available data in support of EPRI's larger effort to provide timely information to the Tokyo Electric Power Company (TEPCO) and other member utilities on issues relevant to the safe management of spent nuclear fuel. Early products included assessments of the following: 1) re-criticality risk upon reflooding of a dry pool; 2) fuel pool evolution following loss of cooling; 3) likelihood of localized voiding within individual fuel assembly channels, leading to cladding heat-up and oxidation with release of hydrogen gas; and 4) potential significance of hydrogen from radiolysis in a boiling fuel pool.

2. *Program on Technology Innovation: Nondestructive Evaluation Inspection of Concrete Structures Subjected to Corrosion – State of the Art, Reliability, and Future Trends.* Product ID: 1025627. Published: May, 2012.

This report confirms the difficultly in assessing the corrosion rate (that is, the rate of steel loss), using linear polarization, as a result of large uncertainties associated with the polarization area and the variability of the resistivity in the concrete cover when drying. Therefore, there is a strong industrial need to develop a technique that can reliably measure the current loss in steel embedded in concrete. This report mentions the use of microwave holography, for which a preliminary research project has commenced at EPRI.

3. *Seismic Walkdown Guidance: For Resolution of Fukushima Near-Term Task Force Recommendation 2.3: Seismic.* Product ID: 1025286. Published: June, 2012.

The objective of the work reported in this document is to provide guidance on the performance of plant seismic walkdowns to satisfy the requirements of Near-Term Task Force Recommendation 2.3: Seismic.

4. *EDF Implements U.S. Technologies and Lessons Learned to Optimize Nuclear Decommissioning Projects.* Product ID: 1025663. Published: June, 2012.

EPRI reports and software support EDF's long-term strategy to mitigate risks, manage costs, and ensure safety of complex demolition projects.

5. *Losses of Offsite Power at U.S. Nuclear Power Plants - 2011.* Product ID: 1025749. Published: June, 2012.

This report describes the loss of offsite power experience at U.S. nuclear power plants during the year 2011 and provides insights into the causes of offsite power losses during the period 2002–2011.

6. *Program on Technology Innovation: Volume Reduction Methods and Waste Form Changes for High-Activity Spent Resin.* Product ID: 1025303. Published: June, 2012.

This report studies the opportunities to reduce the volume of Class B resin waste sent for disposal from both pressurized water reactor and boiling water reactor plants. During reactor power operation, ion exchange resins are used on site for a number of purposes, for example, reactor water cleanup, fuel pool cleanup, boron recycling, and condensate polishing systems. These operations give rise to the accumulation of spent ion exchange resin with a wide range of chemical and radiochemical loading; some of which are Class B/C in nature or perhaps intermediate level waste in international settings.

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

Nuclear Regulatory Commission

SECY

1. SECY-12-0081, Risk-Informed Regulatory Framework for New Reactors. Published: June, 2012.

The SRM on SECY-10-0121 directed the staff to continue to use the existing risk-informed framework, including current regulatory guidance, for licensing and oversight activities for new plants, pending additional analysis. Specifically, the SRM directed the staff to engage with external stakeholders in a series of tabletop exercises to test various realistic performance deficiencies, events, modifications, and licensing bases changes against current U.S. Nuclear Regulatory Commission (NRC) policy, regulations, guidance and all other requirements (e.g., technical specifications (TS), license conditions, code requirements) that are or will be relevant to the licensing bases of new reactors. The purpose of the tabletop exercises was to either confirm the adequacy of those regulatory tools (and make the NRC aware of these potential scenarios such that commensurate regulatory oversight can be applied) or identify areas for improvement, such as potential adjustments to the Reactor Oversight Process (ROP).

2. SECY-12-0084, Status Report on Power Uprates. Published: June, 2012.

This information paper summarizes the power uprate program accomplishments and challenges since the last update in SECY-11-0071, "Status Report on Power Uprates," dated May 25, 2011. This paper does not address any new commitments or resource implications.

The above NRC documents can be obtained from the NRC Public Document Room, telephone: (301) 415-4737, fax: (301) 415-3548, website: www.nrc.gov/reading-rm/pdr.html. ■

Meeting & Training Calendar

1. Topfuel 2012, September 2-6, 2012, Manchester, United Kingdom. Contact: Kirsten Epskamp, **European Nuclear Society**, email: enc2012@euronuclear.o9rg, website: www.euronuclear.org/events/enc.enc2012.

2. 12th International Conference on Radiation Shielding and 17th Topical Meeting of the Radiation Protection and Shielding Division of ANS, September 2-7, 2012, Nara, Japan. Contact: **Atomic Energy Society of Japan**, email: office@icrs12.

3. 6th Annual RadWaste Summit, September 4-7, 2012, Las Vegas, Nevada. Contact: **Exchange Monitor,** telephone: (877) 303-7367.

4. 21st International Conference on Nuclear Energy for New Europe, September 5-7, 2012, Ljubljana, Slovenia. Contact: **Nuclear Society of Slovenia**, telephone: 386 7 491 02 01, email: ljubljana2012@gen-energija.si.

5. OECD/NEA and IAEA Joint Workshop: CFD4NRS-4, September 10-12, 2012, Daejeon, Korea. Contact: Chul-Hwa Song, **Korea Atomic Energy Research Institute**: telephone: 82 42 868 8876, email: chsong@kaeri.re.kr, website: http://thsr.kaeri.re.kr.

6. 37th **World Nuclear Association** Annual Symposium, September 12-14, 2012, Central Hall, Westminster, London. Contact: telephone: 44 0 20 7451 1520, fax: 44 0 20 7839 1501.

7. **American Nuclear Society/Institute of Nuclear Materials Management** 9th International Conference on Facility Operations- Safeguards Interface, September 23-28, 2012, Savannah, Georgia. Contact: website: http://icfo-9.org/index.html.

8. Nuclear Plant Chemistry Conference, September 24-28, 2012, Paris, France. Contact: Patricia Hamel-Bloch, **French Nuclear Society**, email: phamel-bloch@sfen.fr.

9. Licensing Forum, October 10-11, 2012, Hyatt Regency Bethesda, Bethesda, Maryland. Contact: Linda Wells, **Nuclear Energy Institute**, telephone: (202) 739-8039, email: ljw@nei.org.

10. **Bulgarian Nuclear Society** International Conference: Nuclear Power for the People, Nuclear Renaissance and Fukushima, October 10-13, 2012, Hissar, Bulgaria. Contact: Boryana Atanasova, telephone: 3 59 2 979 5583, email: b_atanasova@inrne.bas.bg.

11. International Uranium Fuel Seminar, October 14-17, 2012, The Grand Sandestin Hotel, Destin, Florida. Contact: Linda Wells, **Nuclear Energy Institute**, telephone: (202) 739-8039, email: ljw@nei.org.

12. NuMat 2012: The Nuclear Materials Conference. October 22-25, 2012, Osaka, Japan. Contact: Pamela Liang, **Elsevier**, email: p.liang@elsevier.com.

13. **Electric Power Research Institute** International Decommissioning and Radioactive Waste Management Workshop, October 23-25, 2012, Rome, Italy. Contact: Linda Nelson, telephone: (518) 374-8190, email: Lnelson@toplanahead.com.

14. Web-Based Radiation Course, November 5, 2012, Contact: Anu Agnihotri, **Nuclear Plant Journal**, telephone: (630) 858-6161 x 101, email: anu@goinfo.com.

15. 2012 **American Nuclear Society** Winter Meeting, November 11-15, 2012, Town & Country Hotel & Resort, San Diego, California. Contact: website: www.new.ans.org/meetings.

16. European Nuclear Conference, December 9-12, 2012, Manchester, United Kingdom. Contact: Kirsten Epskamp, **European Nuclear Society**, email: enc2012@euronuclear.o9rg, website: www.euronuclear.org/events/enc.enc2012.

17. IV International Forum-Exhibition of Nuclear Industry Suppliers ATOMEX 2012, December 12-14, 2012, Moscow, Russia. Contact: Maria Lisovskaya, ATOMEXPO, email: malisovskaya@atomexpo.com.

18. **Waste Management Symposia 2013**, February 24-28, 2013, Phoenix Convention Center, Phoenix, Arizona. Contact: Mary Young, telephone: (480) 968-7559, email: mary@wmarizona.org.

19. Decommissioning Challenges Conference, April 7-11, 2013, Avignon Pope's Palace, France. Contact: JG Nokhamzon, **French Nuclear Energy Society**, email: jean-guy.nokhamzon@cea.fr.

20. 2013 **International Congress on Advances in Nuclear Power Plants**, April 14-18, 2013, Jeju Island, Korea. Contact: telephone: 82 2 538 2042 3, fax: 82 2 538 1540, email: info@icapp2012.org, website: www.icapp2013.org.

21. The International Topical Conference on Probabilistic Safety Assessment in Tokyo, April 15-17, 2013, Tokyo, Japan. Contact: Hidetaka Ishikawa**, Nuclear Safety Research Association**, fax: 81 3 5470 1991, email: info@psam2012.org, website: www.psam2012.org. ■

Research & Development

Zinc Injection

Increased application of zinc injection to reduce plant radiation fields has resulted in several instances of tenacious crud formation on fuel cladding surfaces. At one plant, these formations have led to fuel failures. EPRI fuel surveillance and testing in recent years has advanced understanding of the role of zinc in crud formation and its impact on fuel performance. These results have been incorporated into EPRI's water chemistry and fuel reliability guidelines to provide recommendations on how to reduce crud deposition. Nuclear industry implementation of this guidance has reduced the occurrence of thick and tenacious crud, thereby lowering challenges to fuel integrity.

The beneficial effect of zinc injection on plant dose rates is believed to result from two factors: (1) Zinc deposits on stainless steel piping surfaces, reducing the deposition of cobalt and the resulting accumulation of gamma-emitting Co-60; and (2) Zinc preferentially deposits on fuel rod surfaces to create more stable fuel deposits, which prevent activated corrosion products from being released into the reactor water.

Contact: Aylin Kucuk, telephone: (650) 855-2124, email: akucuk@epri.com.

Predictive Methods

New predictive capabilities will help plant personnel optimize operating and maintenance practices and extend lifetime after pitting damage is discovered in steam turbine blades.

EPRI is on the threshold of introducing the first practical methodology for predicting and managing early stages of corrosion-fatigue in the steam turbine blades of nuclear and fossil power plants. For the first time, plant personnel will have the ability to apply inspection and operations data to predict damage progression, estimate remaining life, and assess the risk of continued operations. Preventing a single serious failure could avoid equipment damage, personal injury, and potentially several million dollars in productivity losses and repair costs.

Life-limiting blade fatigue cracks, which represent an increasing concern in aging turbines, often initiate in corrosion pits. According to work sponsored by EPRI and other organizations, corrosion begins and pitting damage accumulates during water-steam chemistry excursions caused by condenser leaks or by improper layup and shutdown conditions.

An EPRI report to be published by fall 2012 will present an updated version of the methodology benchmarked against inservice experience with 403/410SS components. The report will include initial guidance for extending the methodology to 17%Cr-4%Ni stainless steel (17-4PH) and other materials. Laboratory experiments to quantify the pit-to-crack transition in 17-4PH samples are under way.

Contact: David Gandy, telephone: (704) 595-2695, email: davgandy@epri.com.

Acoustic Mouse

The Phased-Array Acoustic Mouse for hand-held ultrasonic inspection is a manual inspection system offering real-time 3-D imaging, improving inspection accuracy, component reliability, and plant safety while eliminating unnecessary maintenance tasks.

More commonly applied manual ultrasonic testing methods may lead to overly conservative interventions. EPRI is creating an advanced, hand-held system that could revolutionize nondestructive evaluation (NDE) programs by delivering real-time ultrasonic images matching or exceeding the precision provided by automated techniques at a fraction of the expense.

Contact: Brian Schimmoller, email: bschimmoller@epri.com.

Robotic Inspection

Robotic inspection enables condition-based monitoring of transmission lines, enhancing safety, reducing inspection costs, and improving system reliability.

Overhead transmission lines are among the utility industry's most widely distributed assets, traversing tens of thousands of miles, often in remote locations. To expand inspection capabilities and increase cost-effectiveness, EPRI is developing a transmission line inspection robot that can be permanently installed on these lines, and traverse 80 miles of line at least twice a year, collecting high-fidelity information that utilities can act on in real time. AS the robot crawls along the transmission line, it uses various inspection technologies to identify high-risk vegetation and right-of-way encroachment, and to assess component conditions.

Contact: Brian Schimmoller, email: bschimmoller@epri.com.

Sequestration Resins

Novel resins reduce critical-path downtime, decreasing occupational exposure and minimizing radioactive waste volumes.

During nuclear plant maintenance or refueling outages, current ion exchange resins may require several days to reduce concentrations of cobalt and other activated corrosion products to safe levels in reactor coolant streams. This performance limitation often delays key maintenance activities. EPRI's Office of Technology Innovation is developing novel sequestration resins expected to provide at least a three-fold increase in removal capacity for transition-metal impurities in light water reactor coolants. They also offer the potential for higher overall removal efficiencies, which would reduce occupational exposures and waste management costs.

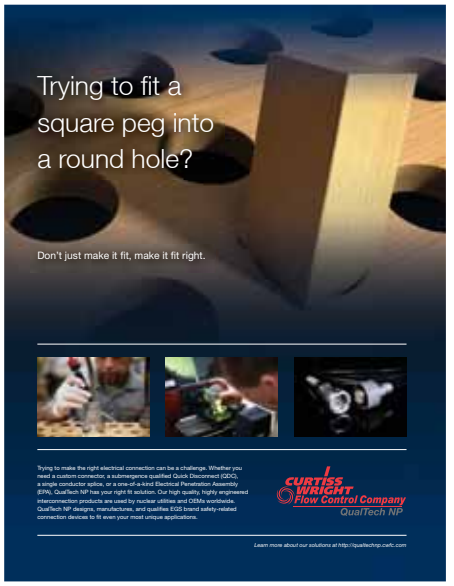
Contact: Brian Schimmoller, email: bschimmoller@epri.com.

Air-Operated Valves

Digital delivery of maintenance guide on air-operated valves provides real-time, in-plant access to key component information.

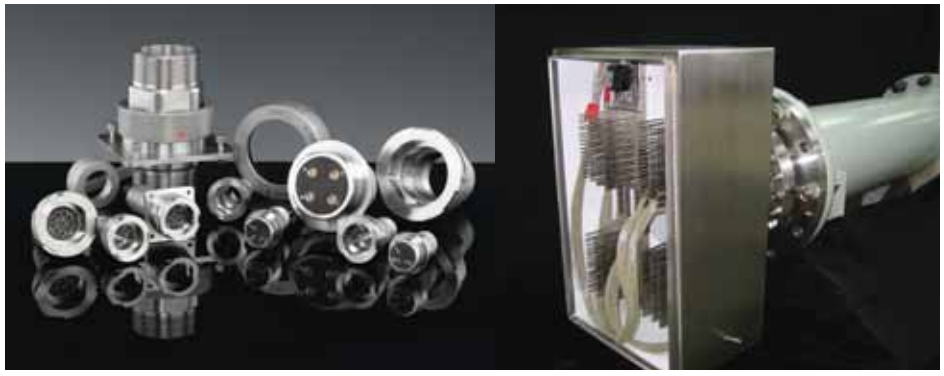
An increased awareness of the importance of air-operated valves (AOVs) has led to progressively more sophisticated maintenance practices in both nuclear and fossil power plants. EPRI is developing a knowledge transfer "app" for mobile and tablet devices that will enable nuclear maintenance workers to access a visually-based, content-rich tool to support AOV maintenance activities. Digital delivery of the EPRI maintenance guide will enable nuclear plants to train and evaluate new personnel, refresh personnel on infrequently performed activities, replace face-to-face training workshops, and reduce staff travel.

Contact: Brian Schimmoller, email: bschimmoller@epri.com. ■



Safety-Related and Enviromentally Qualified Electrical Connection Products

Equipment Qualification and Maintenance Solutions for Nuclear Power Plant Applications



QualTech NP, a business unit of Curtiss-Wright Flow Control Company, is a nuclear industry premier supplier of high quality, highly engineered safety-related and environmentally qualified electrical connection products. Our EGS brand products reduce human performance errors, improve equipment EQ performance and help achieve ALARA goals. For over 25 years QualTech NP has designed, qualified, and manufactured EGS connector products used by nuclear utilities and OEMs worldwide.

Reactor Cable Assemblies

QualTech NP can supply pre-fabricated cable assemblies utilizing the EGS QDC or other manufacturers' connectors to mate with existing plant configurations. Assemblies can be supplied to upgrade NSSS or A/E supplied cable assemblies and can be Class 1E or non-1E for inside or outside of containment. Assemblies can be qualified to specific or generic EQ and seismic requirements.

Quick Disconnect (QDC)

The EGS QDC is designed to provide an environmental seal for electrical connections or equipment interfaces while also allowing for connect and reconnect functionality for ease of maintenance. Each EGS QDC is manufactured to the customer's specific requirements and once installed, becomes an integral part of the host equipment. The QDC improves the equipment's ability to withstand harsh environments while reducing the maintenance time requirements at the device.

Electrical Penetration Assemblies (EPAs)

Our custom fabricated EPAs provide design flexibility to overcome situations, constraints and requirements unique to the Nuclear Power industry. QualTech NP's EPAs are configured as a bulkhead mounted flange with individual feed through modules. Both flange aperture and modules are supplied with redundant seals and internal nitrogen gas containment leakage monitoring. EPAs are available for low and medium voltage, power, control, instrumentation, coaxial and triaxial applications.

Quality Standards

- ASME NPT, Class 1, 2, 3, CS, MC & CC
- ASME NQA-1
- IEEE 323, 344, 382, 383, 572
- 10CFR21
- 10CFR50, Appendix B
- 10CFR50.49
- ANSI 45.2
- TSSA Certified, Category A, C, E & H fittings
- CSA B51
- CSA Registered
- TSSA Registered
- NUPIC Audited

GRAYBOOT Splice Series

This reusable splice connector is a single conductor, quick-disconnect, sealed device whose performance is equivalent to nuclear grade heat shrink tubing or uninterrupted nuclear grade wire with regard to insulation resistance and leakage current. The connector features gold or silver plated contacts crimped to the user's field wiring and inserted into the connector body.

The GRAYBOOT series is a compact, easy-to-install reusable splice that eliminates costly splice removal and replacement and maintains lead wire lengths. They are qualified for power, control and instrumentation circuits in harsh environments.

CURTISS WRIGHT
Flow Control Company
QualTech NP

Cincinnati, OH 513.528.7900
Huntsville, AL 256.722.8500
ddeist@curtisswright.com
http://qualtechnp.cwfc.com

Stamp of Approval

Aecon certified for Nuclear Fabrication

After more than two years of laborious, meticulous work compiling 50-plus detailed manufacturing procedures, the Aecon Nuclear N-Stamp team patiently waited outside the boardroom with nervous anticipation. Everything rested on what was happening during the next two days on the other side of those doors. Inside, three auditors from the American Society of Mechanical Engineers (ASME) were pouring over two thick manuals of manufacturing procedures. Resting in the balance was Aecon Nuclear's N-Stamp accreditation for the design and construction of equipment for nuclear power plants.

"Waiting for the ASME verdict was like waiting for your report card," says Eric Dyke, Aecon's Manager of Nuclear Fabrication. "We had taken the course, done all the work and spent more than our share of nights and weekends cramming. Now it was out of our hands. We knew it wasn't a sure thing; only about half the applicants get their N-Stamp on the first try."

Any doubts the team had turned out to be misplaced. Aecon had a comprehensive nuclear fabrication quality program that met all ASME requirements.

"If we are going to be a major player in the global nuclear market, having that stamp of approval was absolutely necessary," says Macit Cobanoglu, Vice President of Aecon Nuclear. "An N-Stamp provides assurance that design, fabrication and construction for nuclear power plants comply with the American Society of Mechanical Engineers' strict specifications." And with that, he says, the door opens for manufacturing and shipping products to the United States and other markets.

Aecon is no stranger to nuclear fabrication projects. The company recently completed Ontario Power Generation's Fiberglass Reinforced Piping (FRP) Project, as part of the nuclear generating station's Vacuum Building Outage. This project involved the removal and replacement of 14 FRP Risers, two FRP Upper Down Comers, one section of the Main Spray Header and installation of weirs around each of the 14 UDC's.

One of Aecon Nuclear's current ventures, the Single Fuel Channel Replacement (SFCR) project for the Bruce Power Nuclear Generating Station, involves tool assessment, refurbishment, configuration management recovery, prerequisite work, and execution. Aecon recently revamped its nuclear fabrication facility in preparation for the project.

"Our newly-renovated Cambridge nuclear facility not only allows us to train staff, but to also conduct full dress rehearsals and mobilize our personnel, prior to the execution of our onsite work," says Macit. "This ensures our team has the experience to complete the job right the *first* time, to the highest standards of safety and quality."

These are just two examples of countless Canadian nuclear projects Aecon has executed during the past 40 years. So it seemed a natural progression for the company to prepare for nuclear fabrication work in the U.S. and international markets.

On January 24, 2012, Aecon's ASME certification, along with four N-stamps, arrived in Cambridge. The N-Stamps (N, NPT, NA and NS) are now securely stored in a locked cabinet.

"We were elated to pass the first time," says Aecon Nuclear's Quality Director Dennis Lattanzi. "It was like going to the championship and winning. We put a really good team together and then knocked it out of the park."

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A Lot of Work Ahead

By Vladimir Asmolov, Rosenergoatom.

Vladimir Asmolov

Vladimir Asmolov graduated in 1970 from Moscow Power Engineering Institute, with specialization in "Thermal Physics". In April 2006 he was appointed First Deputy General Director - Director for Science and Technology Policy, JSC "Concern Rosenergoatom".

He is the Chairman of the Scientific and Technical Council (STC) #1 of the State Corporation "Rosatom", the Chairman of the Scientific and Technical Council "Rosenergoatom", the Chief Editor of the journal "Rosenergoatom". He is also a member of the editorial board of the journals "Thermal physics of High Temperature" and "Nuclear Engineering & Design". He is a member of the dissertation councils STC "Kurchatov Institute", Moscow Power Engineering Institute and a board member of the Nuclear Society of Russia.

In 1997 he won the Order of Valor for the participation in the liquidation of the consequences of the Chernobyl accident. In 1999 he won- The sign "Veteran of nuclear energy and industry."

This article is based on concluding comments by Vladimir Asmolov, the event moderator, at the Special WANO Session at the Atomexpo 2012 Conference in Moscow, Russia on June 4, 2012 . A Q&A by Newal Agnihotri, editor Nuclear Plant Journal at Atomexpo in Moscow on June 5, 2012 follows the article.

We have discussed the world's situation after the Fukushima Daiichi accident not only in the eyes of the operators but from the designer and regulator points of view. As concerns me personally, the question that was raised on the 11th of March, 2011 as a result of the accidents in the Fukushima four units. It was about the future of the nuclear power. It has an absolutely clear answer – yes, and those fourteen months after the accident have proven that.

The nuclear power did not stop its movement; it missed a blow like a boxer but it was not knocked down – it swayed and went on moving. This opinion was proven by our discussions during today's event.

What were we talking about today?

First, we talked about the absolute responsibility of the operator for the nuclear plant safety, about the requirement towards the operating organization to be permanently ready for any accident and be guided by the main defense-in-depth principles, i.e. accident prevention and management, which, as was demonstrated by the Fukushima accident, are of equal priority.

Secondly, there were people thinking that it is a designer who develops a nuclear power plant, and it is an operating organization who operates it. Life shows that it is not true. The features of each new power unit must meet the operator's request being based on the operator's operational experience and knowledge. This is dictated by the operating organization's responsibility. Continuous improvement of the plant safety design features on the basis of new knowledge and on the basis of the operational experience is a fundamental and paramount everyday challenge to the operating organization.

It cannot be tolerated that nothing is being done during the 30-year operation of the plant and that it is supposed that people of the mid-60s foresaw all the possibilities in the design in order to provide the safety. In 1971 the designer of Fukushima, i.e. General Electric, handed over their responsibility to the operator. And this responsibility should have rested with the operator during all the period of the plant operation.

Thirdly, today we were discussing one more important issue, an issue of the lessons to be learnt by the operating organization, which is a paramount task. This is not just the accident-related lessons, which is obligatory. This means the dissemination of the best practices the operators demonstrate; the continuous analysis of the on-site situation; the publication of the internal reports to review the emergency events. These assessments should be absolutely open, and the knowledge should be disseminated among all the involved stakeholders and the public. This is a prerequisite for the existence of the nuclear power.

Then, I fully agree with Yukka Laaksonen who said that the self-complacency is perhaps the worst thing.

Today it was said we had resolved the hydrogen explosion problem by installing passive recombiners.

We could say: it is good that we did it; but we could also say in case of high hydrogen concentrations the hydrogen safety system would not operate and this is absolutely clear from the results of the performed experiments. Resolution of the above issue requires immediate joint efforts of all the concerned specialists from both the operators and the regulators.

During twenty five years we were investigating a probability of the steam explosion. .On one hand, we could say it is very good that we have an answer: according to the experiments at FARO and CROTOS test facilities one steam explosion is probable per one thousand core meltdowns. But I do not know whether it is good or not, and there is no answer to this question so far. It means that those activities being under way today in the framework of the new steam-explosion programmes are extremely important and necessary, too.

At last, with regard to the containment filtration Noël Camarcat from EDF informed us that all the French plants are equipped with the filtration facilities. But Rolf Janke from AREVA showed in his presentation that these filtration facilities have no elementary or

(Continued on page 30)

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HITACHI

A Lot of Work...

Continued from page 26

organic iodine retention filters. They retain molecular iodine and aerosols but we don't need any iodine in the environment – neither elementary nor organic. This is why the activities on improving the filter element third stage are again our common business.

Generally, there is not and cannot be any reason for self-complacency! Today our operation experience with our nuclear fleet is about 20 thousand reactor-years. If we just calculate directly the core melting frequency, so hated by me, then we will get 10^{-4}. All the designers show their CMF; the most shy show 10^{-5}, the more advanced speak of $10^{-6,}$ and the most advanced speak even of the values like 10^{-7} or 10^{-8}. It is high time to stop juggling with the probabilistic figures. The safety level of our reactor installations were and will never in our life be measured by probabilistic figures. In case of a severe accident we should assess the plant safety, and measure time available for the operator to eliminate the accident, by deterministic methods.

Probabilistic methods could be applied for the comparison of safety analysis results for a specific plant only: for example, when new safety systems are to be introduced in the course of the upgradings, or when some systems are to be taken out for maintenance; then it is possible to relatively assess how much better or worse it becomes.

Colleagues, there is a lot of work ahead. I am absolutely sure that the source of energy we have shall serve for the good of people, and it is our gift for them. And only our laborious everyday work aimed at enhancing nuclear safety will make this gift a true one.

1. *How is Russia cooperating with Japan in sharing its knowledge on low-dose radiation and other issues, common to Fukushima and Chernobyl?*

Last year, 2011, we decided together with our Japanese colleagues to arrange a so-called coordinated committee and the responsibility of this committee was coordination between Japanese and Russian organizations which dealt with all aspects of consequences of the Fukushima event. There is great experience in Russia in different areas of Chernobyl. I mean the agriculture, health effects; also we have great experience with dismantlement of destroyed radioactive materials. We arranged five groups. Russia and Japan, joint groups. Two coordinators: from the Japanese side, it's Hattori-san, President, Japan Atomic Industrial Forum, and from the Russian side, it's me.

Between Russian scientists, we shared all written knowledge with our Japanese colleagues. The idea was after the first presentation, we will move to direct cooperation which is decontamination of soil, trying to predict the health effects after radiation after Fukushima and so on. But we discussed this point with Hattori-san and unfortunately there's no progress so far. Exchange of information is completed. The next step is to arrange the real activity using Russian forces and Japanese teams. We are ready to openly support and to assist our Japanese friends.

It was a very polite response from Hattori-san with respect to the Japanese government and with respect to the Japanese embassy. As far as I understand, there is some political barrier between Russia and Japan and the Japanese government appears to have decided to use a system from a different country, not from Russia. They decided to arrange the exchange of information without direct contractual understanding.

Thirty fuel assemblies were destroyed in the Paks Nuclear Power Plant in Hungary. It was a great example how Russians removed all of this very quickly with low-dose received and it was a great activity and we proposed to arrange this kind of activity at the Fukushima site.

We have some great robots which we use in our plants and cameras which are protected from radiation, but they concluded some agreement with Areva and now Areva has asked us to sell them our cameras. In this case, my personal decision, we will stop maybe for a week, maybe for a month, but because of the new political decision, it's impossible to walk using one-way road from Russia to Japan. The road must be in both directions.

The people in Japan don't trust the government, the nuclear society, and the industry, and it needs time and good action from the government and the nuclear society of Japan.

Our experience in Chernobyl area, when we were trying to evacuate thousands of people from contaminated areas, we overestimated the radiation risk. In this case, the health risk is from some psychological risk after evacuation, it's much, much higher than the radiation risk. In this case, we are ready to share with our Japanese colleagues our investigation. Not only the investigation of how to remove the psychological stress. Everything will depend on the desire of our Japanese colleagues.

2. *How will the international nuclear community ensure safety of nuclear power plants; especially, in "new build" not having an existing infrastructure?*

This is the real problem; I'm a member of INSAG, International Nuclear Safety Group. It published a document two years ago, INSAG 22, "Nuclear Safety Infrastructure for a National Nuclear Power Programme Supported by the IAEA Fundamental Safety Principles". It's very detailed, we describe the procedure how a country must meet nuclear power obligations.- what's the first step, what's the second step, what's the third step, preparatory activity. The independence of a regulatory body is not enough. Much more important is the competence of the regulatory body - the level of knowledge, responsibility, and also, the preparation of an operating organization is also very important. Emergency preparedness of the country, some technical support organization which is ready to help with accidents, if this happened is also important. The same discussion was in the frame of WANO, but WANO is not the organization responsible for the newcomers. For us, it's much more important to overcome the position of some utilities because we established this position last year during the Shenzhen, China WANO conference. I would like to promote all these ideas, and now, there's some resistance from Japan and Korea. Compare the activity of the Atlanta Center, Moscow Center, and Paris Center. It's practically similar preparatory stage, similar activity. The thinking is also the same. In the case of the Tokyo center, it's different. Currently; there is no independent position of the Tokyo center.

3. *How we control a nuclear regulatory body of a specific country, if they are not doing their job right in ensuring safety of their nuclear power plants?*

International Nuclear Regulators Association, INRA is the organization of regulatory authorities of Europe. It's like collaboration for European regulators. Another organization also in the frame of Europe under European parliament, is ENSREG, "European Nuclear Safety Regulators Group"

ENSREG, and other organizations developed procedures and methodology for the stress tests, it was a lot of discussion in the frame of both organizations on the procedure of its implementation. Our people from Rosenergoatom from Russia participated in some of the meetings and finally we practically completed all our evaluation of defense in-depth, we ordered some design changes in our design, but those regulatory people and European utility were waiting for a request from their regulatory body in Europe. We decided not to continue because our action practically was completely performed and introduced in practice. We decided Russia will present everything - all open reports about our regulation, all reports about our action, national report to the IAEA convention conference, but we are not going to be under supervision of those organizations. We agreed with the requirements of the Russian regulatory body and using these requirements, we provided them for examination all our actions. Afterwards, the Russian regulatory body will contact the European one and maybe we will exchange the information. Again, open, transparent, but decision-making processes will be our own processes nationally.

4. *Concluding comments.*

We have very close connection with Électricité de France - a really close connection, a very practical, very useful connection. We arranged a joint workshop last year. They put on the table their action and the methodology, we put on the table our action and methodology. After two days of discussions, we decided it's possible to make a mix, absolutely similar approaches, absolutely similar understanding of the real phenomenon which we're involved, and action harmonization. ■

Profitable Nuclear Power Generation

By Jukka Laaksonen, Rusatom Overseas.

Jukka Laaksonen

Jukka Laaksonen is the Vice President, Rusatom Overseas. Laaksonen worked in nuclear regulation for 38 years and the last 15 years of that as chief regulator in Finland. In 1981-82, he worked for 14 months with the U.S.NRC and in 1987-89 for two years with the IAEA. He was the Chairman of the Committee for Nuclear Regulatory Activities, one of the standing OECD/NEA Committees from 1999-2007, and in 2009-2011 he was Chairman of WENRA, Western European Nuclear Regulators' Association.

This article is based on a presentation by Jukka Laaksonen at the Special WANO Session at the Atomexpo 2012 Conference in Moscow, Russia on June 4, 2012.

IAEA's CNS sets clear obligations to operators

The Convention on Nuclear Safety (CNS), adopted in 1994, is the one and only document that has legal power in the nuclear safety area in all countries with operating NPPs.

Article 9 of the CNS states: "Each Contracting Party shall ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant license and shall take the appropriate steps to ensure that each such license holder meets its responsibility." Article 10 requires that all organizations engaged in nuclear power production establish policies that give due priority to nuclear safety. Article 16 obliges to establish on-site emergency plans that cover the activities to be carried out in the event of an emergency and are routinely tested. Article 19 emphasizes the importance of analyzing the operating experiences and requires that the results obtained and the conclusions drawn are acted upon.

In the regional level, the Council of the European Union Directive that was issued in 2009 and has been ratified to the legislation of all EU countries is consistent with the CNS. In addition, it states in Article 6, the following: "Member States shall ensure that the national framework in place requires license holders, under the supervision of the competent regulatory authority, to regularly assess and verify, and continuously improve, as far as reasonably achievable, the nuclear safety of their nuclear installations in a systematic and verifiable manner." Thus it confirms what the European heads of the national nuclear safety authorities, members of Western European Nuclear Regulator's Association (WENRA), agreed already in 2005: "we commit ourselves to a continuous improvement of nuclear safety in our respective countries".

The common position adopted by the regulators in Europe, i.e. emphasis on the importance of continuous improvement of both NPP safety and regulatory effectiveness was not equally evident in countries outside Europe. However, after the accident in Fukushima the idea of continuous improvement seems to be recognized more widely. My conclusion from the recent international discussions among the regulators is that no complacency is accepted and no operator should claim that it has achieved such an adequate level of safety, which does not require any more efforts for its enhancement.

High level of safety is a cornerstone for profitable nuclear power generation

In many countries there are nuclear power plants that have demonstrated an exemplary way of producing power and have achieved trust of the general public in their neighborhood. These plants have the following attributes of successful operation:

- competitive production costs,
- power available when it is most needed,
- no harmful impact to the environment,
- low worker doses,
- infrequent abnormal events, not causing significant production losses, and
- small accident risk, and also perceived like that by the general public.

Healthy cost structure of a successful plant covers not only direct operating, maintenance, fuel and waste management costs. Adequate funds have to be allocated in annual budgets also to:

- regular equipment modernization,
- safety backfits,
- ensuring adequate knowledge and skills of the staff, and
- safety research maintaining and improving knowledge base.

Financing these costs is achievable without endangering the competitiveness when the operator has established a positive feedback loop: steadily high capacity factor permits adequate

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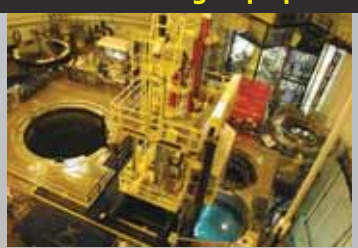

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B&W's mPower SMR program is expected to create thousands of new jobs over the next decade and stimulate high-technology American manufacturing, providing long-term benefits to our economy and enhancing American leadership in global clean energy solutions. Focused on developing and delivering advanced energy technology, B&W is helping our country meet the challenges of our world – today and tomorrow.

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Profitable Nuclear...

Continued from page 32

investments in the safe and reliable operation. As experiences at many plants have shown, striving towards good performance is in the long term always better than short term savings achieved by cutting maintenance and operating costs.

It should go without saying that good management practices are necessary for safe and profitable production. These should include:

- motivating each individual to responsible work with self-imposed quality goals and professional pride,
- thorough planning and detailed scheduling of outages, supported by pre-exercised conduct of the most demanding works,
- continuous and determined development of work methods, procedures and staff qualifications, and
- maintaining wide technical knowledge and skills within the operating organization.

Safety Culture needs to show up in daily life

The arrangements and measures by the operators shall reflect their understanding that they bear the ultimate responsibility for safety.

Strive for excellence, rather than just fulfillment of regulatory rules, shall be self evident in any operating organization. The operators following this line set their own performance standards for activities they find most important to ensure reliable and thus safe operations. Striving for excellence also means that the operator has a steady investment pro-gram. Such a program is needed to keep the material condition of the facility at least at the same level it used to be after the first start up, and to improve reliability and safety.

Safety and quality must have higher priority than costs and schedule. This message has to be very clear and transmitted by the operator's management to all levels of the organization and also to all contractor organizations working for the operator. Management's acts and decisions have to be consistent with the message. The critical moments demonstrating real management attitude are situations when a decision has to be made on whether to continue production when some problem in the plant equipment has appeared or whether to shutdown and fix the problem. Another situation is when new lessons on risks have been learned from operating experience or research: are some actions needed to evaluate the risks at own plant and to possibly act upon them?

Major differences in investments to safety of operating NPPs

International peer reviews have given a good opportunity to compare both regulatory policies and the policies of operators in different countries. The IAEA has since 1982 arranged OSART missions to NPPs and since the end of 1990's also the activities of national regulators have been assessed on the IRRS missions. In the past one year, there was an extensive European peer review as part of targeted safety re-assessments ("stress tests") that were conducted in the aftermath of Fukushima accident. I have attended a number of those reviews and have noted major differences between the countries and the NPP's.

As I stated above, the policy in Europe promoted by WENRA and now also required by the European Nuclear Safety Directive is to continuously improve nuclear safety. However, a consistent implementation of that policy has not yet been commonly achieved at the plant level. Some operators have followed this practice pro-actively already since 1980's. As a basis for safety enhancement, the operators have used their own living PSA's that always provide a "top ten" list of risks that could be reduced. Other operators have been more in a reactive mode and have taken actions only when some major events have been reported worldwide and have generally led to corrective measures. The recent report on the European "stress tests" very clearly pointed out areas, where some operators have conducted major backfits of the plants, while others have done no changes in the plant hardware to address the same safety issues. The accident in Fukushima has now influenced the attitudes and policies of operators, and I expect to see a more harmonized approach in the entire Europe.

In Russia, the shortcomings in safety systems of the operating facilities were recognized already after the accident in Chernobyl, and this prompted planning of large upgrade programs at all plants. Planning of these Russian programs was supported by the IAEA that organized in the early 1990's several design review missions to Russian plants. After these missions, a set of IAEA reports often called "issue books" were written separately for each type of plant as a joint effort between the Russian and international experts. These gave practical guidance for safety upgrades, and the implementation of the recommendations took place at the end of 1990's when the economic situation at the Russian facilities had significantly improved and the necessary investments could be made. The spirit of continuous improvement has prevailed recently, as I have seen on safety evaluation missions that I have conducted together with my Finnish colleagues and the Russian regulators to some of the Russian NPPs.

As concerns the situation in the USA, the policy question on whether to require maintaining or continuously upgrading the safety has been discussed for years between regulators in connection with the OECD/NEA co-operation. In the report of the International Regulatory Review Service (IRRS) mission that in October 2010 reviewed the U.S.NRC activities in regulating the operating reactors, a paragraph in the Executive Summary stated the common view of the international regulators' team is as follows: "The NRC has a strong drive for continuous improvement in its own performance and has well achieved its goals. Industry performance has also shown improvements as demonstrated

by improved operational performance and reductions in risk profiles. However, there are indications that licensees have not been as proactive in making voluntary measures to upgrade systems, structures, and components with improved technology as many foreign countries have been doing to enhance safety. It is important that the licensees not rely solely on the NRC's regulations, generic communications, and inspections, but demonstrate on their own, initiatives and high standards of work quality." This sentence was formulated carefully and in a diplomatic IAEA style but in my remarks as the IRRS team leader, I asked more clearly: "What could be the NRC's leverage to encourage proactive measures by licensees?"

Concerning Japan, it was noted already before the Fukushima accident on the IAEA missions that the Japanese have built and operated the plants very much following the U.S. model. For the seismic hazards there was a solid regulatory basis in the USA at the time when the first Japanese plants were built, and consequently also the Japanese plants have a robust seismic design with large safety margins. On the other hand, the risks addressed by the designers of the U.S. plants did not emphasize the site specific risk factors such as tsunamis that were much more serious in Japan. Also during the operating stage, it seems that the Japanese operators have not made plant modifications that would go beyond the modest changes that have been made in the USA at similar plants.

Fukushima has changed the attitudes: "never again such a catastrophe"

The accident of Fukushima was a heavy blow on all of us who work in the field of nuclear power. However, it was encouraging that the political decision makers and the general public in most countries did not lose their trust on our promise on safety. It is also assuring to see that many operators throughout the world have clearly expressed their will to make their plants even safer than they are today.

Safety reassessments, similar to European "stress tests", have been conducted in all countries with operating NPP's and many ideas have been generated on means to enhance safety. The innovative thinking of many operators has shown that we have not yet exhausted all means to make nuclear power safer, and even with reasonable costs. In this process there has been no need to wait for regulatory requirements because the operators know best their facilities and are in the best position to look at potential areas where improvements could be made.

The European wide "stress tests" were completed in April, 2012 and the country specific reports on peer reviews that were made publicly available on the website http://www.ensreg.eu provide a large variety of examples from the initiatives taken by the European operators. Some of those measures are already in the implementation phase, and it is good to note that many safety enhancement projects were actually initiated before the accident in Fukushima. Many actions are adapted to specific plants but getting acquainted to the country specific peer review reports gives a good overview of the general trends and also concrete ideas for consideration at each plant.

I am aware that operators in other countries have started more or less similar safety upgrades as those in Europe. I want to highlight here the ambitious work conducted by the Japanese industry and operators in a joint project coordinated by Japan Nuclear Technology Institute (JANTI). The final report issued April 3rd, 2012 is on website http://www.gengikyo.jp/english/ , and it demonstrates well the new very responsible attitude of the Japanese industry and operators.

JANTI project started with evaluation of the course of accident at all four units. Based on that they made a systematic fault tree analysis on what went wrong and where the course of accident had been possible to turn if proper systems, resources, or emergency plans had been available. After that they identified subject areas for careful engineering examination. Not surprisingly, these were:

- Preparation for earthquake and tsunami (natural hazards)
- Preparation of power sources
- Responsiveness to heat sink loss
- Countermeasures against hydrogen
- Preparation for emergency events

From each of the above areas they examined in detail five to ten subjects and elaborated potential countermeasures on how the respective failures could have been avoided. These countermeasures went beyond regulatory requirements, and gave a good "shopping list" for analysis, development and possibly implementation. The study addressed even a potential combination of events that have not happened but would be conceivable: a major fire connected with flood, earthquake, or tsunami.

WANO's Post-Fukushima Commission has made recommendations that a regulator can strongly support

As I noted above, after Chernobyl accident an extensive international review of all Soviet designed NPP's was conducted, and a systematic safety enhancement programme was based on its results. We should recognize that a similar program would be equally important for all other NPPs as well. I have understood that the scope of WANO programs now suggested is being expanded to review also the features and facilities for accident response and mitigation, as well as implementation of design safety fundamentals. This is an important and good move that I can warmly support.

Contact: Jukka Laaksonen, Rusatom Overseas, email: YTLaaksonen@rosatom.ru. ■

Nuclear Power After Fukushima

By David Farr, The World Association of Nuclear Operators.

David Farr

David Farr is the Director of WANO-Atlanta Centre. Mr. Farr also serves as the Vice President of the International Division for the Institute of Nuclear Power Operations (INPO) in Atlanta, Georgia. He has held these positions since January 2009.

In his current position, Mr. Farr is responsible for conducting peer reviews and providing support for 131 operating nuclear units in the Atlanta Centre.

Mr. Farr joined INPO in January 2000 and has served as Vice President of Plant and Corporate Evaluations, manager of engineering and as a team manager. Prior to joining INPO, he was employed by Commonwealth Edison Company.

He is a graduate of the Georgia Institute of Technology, he holds a bachelor's degree in nuclear engineering. Mr. Farr also holds a master's degree in management from Northwestern University.

This article is based on a presentation by David Farr at the Special WANO Session at the Atomexpo 2012 Conference in Moscow, Russia on June 4, 2012.

The public's view of nuclear power has certainly changed since Fukushima. Not only has the public's view changed, but utility operators are looking at their nuclear operations through a different set of lenses today.

Overview

This article provides an update on what the US industry has been doing in response to the Fukushima accident.

Our response represents a new perspective. We call it "The Way Forward." INPO joined with US Nuclear Utilities, EPRI (the Electric Power Research Institute) and NEI (the Nuclear Energy Institute) developed an integrated response to the accident for the United States. The response resulted in some near term actions and the establishment of a "diverse and flexible mitigation capability." I will provide these in more detail in this article.

The US is also working on developing an emergency response plan for providing not only technical support, but also equipment and materiel support. This plan is envisioned to integrate federal, state and local governments with the NRC and Utility response capability.

Finally, I would like to provide briefly about the Fukushima Forum. This was a meeting jointly hosted by INPO and WANO in November of 2011. Over 120 participants from more than 20 countries participated to share their approach in response to the accident.

A New Perspective

The US industry gained a new perspective as a result of the Fukushima accident. Historically, our view had been that the best way to prevent a tragic event like Fukushima was to work to ensure our plants achieved and maintained high levels of operational excellence. After Fukushima we learned that because of beyond design basis scenarios, just guaranteeing operational excellence wouldn't necessarily prevent a tragic event. Today we believe that Nuclear Excellence is the sum of two things: operational excellence and emergency response excellence.

As an industry we must be ready for the unimaginable. Events can occur that will overwhelm even the largest, most capable company.

Emergency response must be robust, and ready to address multiple units, extreme external event, or the loss of infrastructure

A US Industry Response

The foundation of the US response is to confirm what we have and prepare for the beyond design basis event. We must build on what has been done to date including:

- Lessons from Three Mile Island –EOPs
- Lessons from Chernobyl-SAMGs
- Lessons of Terrorist attack – B.5.b
- Safety Culture

INPO is working to verify conditions for station blackout (SBO), severe accident management guidelines (SAMGs,) the security order B.5.b., flooding, and fire protection.

Previous Nuclear Accident Response

Our nuclear response strategy before Fukushima was focused heavily on prevention, a minor focus on mitigation, a somewhat stronger focus on response and then finally stabilization or recovery.

Future Nuclear Accident Response

The Electric Power Research Institute (EPRI) is playing a vital and critical role in the US response. Specifically EPRI is leading projects in the following areas:

- Updating Bases for Severe Accident Guidelines in collaboration with the PWR and BWR Owners Groups, GE-Hitachi, Westinghouse, Areva, the Nuclear Energy Institute, and INPO,
- Developing guidelines to better characterize and assess risk to a broad range of external events, commencing

(Continued on page 42)

NEA
NUCLEAR ENERGY AGENCY

OECD
BETTER POLICIES FOR BETTER LIVES

OECD NUCLEAR ENERGY AGENCY (NEA)

The Nuclear Energy Agency (NEA) is a specialised agency within the Organisation for Economic Co-operation and Development (OECD), an intergovernmental organisation of industrialised countries, based in Paris, France. The OECD is a unique forum where the governments of 34 democracies work together to address the economic, social and environmental challenges of globalisation.

The mission of the NEA is to assist its member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal bases required for the safe, environmentally friendly and economical use of nuclear energy for peaceful purposes.

The NEA's current membership consists of 30 countries: Austria, Australia, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, the Netherlands, Norway, Poland, Portugal, the Republic of Korea, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. Russian accession to the NEA will be effective on 1 January 2013. Together these countries account for approximately 90% of the world's installed nuclear capacity. Currently, nuclear power accounts for roughly one-fifth of the electricity produced in NEA member countries.

NEA areas of work cover nuclear safety and regulation; radioactive waste management; radiological protection; nuclear science; nuclear energy development and the fuel cycle; nuclear law and liability; nuclear data; and information and communication.

NEA strengths are manifold. It is a non-partisan source of information, data and analyses, drawing on one of the best international networks of technical experts. Its system of standing technical committees enables the Agency to be both flexible and responsive. All NEA committees are now mobilised to identify lessons learnt from the Fukushima Daiichi accident and to contribute to making nuclear safety, radiological protection and emergency management systems stronger.

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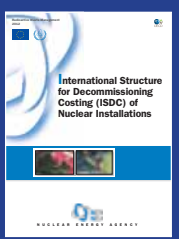

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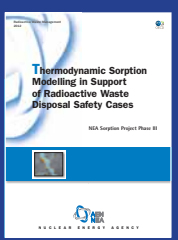

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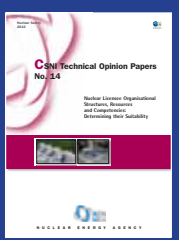

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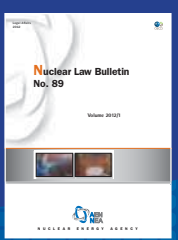

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Trends towards Sustainability in the Nuclear Fuel Cycle

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Unmatched Capabilities. Uncompromised Quality. Unparalleled Growth.

If you knew NLI well five or so years ago, you might not even recognize NLI today. We've doubled in size (a couple times), quadrupled our square footage, and were recently acquired by an electrical products manufacturer, AZZ incorporated.

Following two decades of consistent growth, NLI was acquired by AZZ incorporated, an electrical equipment manufacturer and supplier founded in 1956. NLI moved into its new 200,000 square foot facility three years ago, quadrupling its space and enabling nearly a 50 percent increase in staff, and a significant increase in sales. The recent acquisition will enable us to take another quantum leap forward.

NLI is often described as a third-party dedicator, and yes, NLI does do that. At one time it was a major part of NLI's business. But despite being one of the industry's largest providers of third-party dedication services, this is actually a very small part of NLI's business today.

NLI was founded as an engineering firm in 1991 and was soon approached by GNB. GNB no longer wanted to deal with nuclear industry requirements on the batteries they supplied to roughly half the US fleet. NLI stepped in and this began the transition from pure engineering to the supply of equipment. NLI still supplies GNB batteries today.

Around the time of NLI's 10th anniversary the company was well established, primarily in the area of electrical products such as breakers and motor control centers. In 2004, NLI became ASME III N-Stamp certified—this was a game changer. Today NLI supplies a near even mix of electrical and mechanical products, plus instrumentation and control, and HVAC. NLI's product mix is also well diversified between operating and new construction, domestic and international, and some DOE.

NLI's main facility in Fort Worth, Texas

NLI is very well known in the nuclear industry, but at some recent conferences some new people have stared at our booth and asked, "What is it that you do?" After rattling off a long list of equipment types a few times, we began answering, "We supply everything except fuel." The first few times we said this in jest, but quickly realized this statement was close to the truth. Of course, NLI hasn't yet supplied *everything* in a nuclear plant, but we have provided many things that might surprise even those people familiar with NLI.

NLI is very well known for switchgear, low-voltage breakers, motor control centers, stationary batteries and chargers; NLI supplies more of this equipment than any other nuclear industry supplier. NLI is also a leading supplier of chillers and HVAC equipment as well as valves, actuators and a long list of I&C equipment. But NLI has also recently qualified and supplied an emergency diesel generator.

The next time you need equipment for your plant—especially equipment that is hard to get—give NLI a call. You'll find out why we're really your single source.

AZZ | NLI™

Engineered Solutions

Everything Except Fuel.

Nuclear equipment: we provide it. This is not an overstatement. At NLI, we specialize in supplying our clients with the products they need. We are problem solvers. We do not simply react to plants' needs; we anticipate those needs and actively seek and develop new solutions before they become crises. Utilizing the finest partners, engineers, and technicians, our long list of products and services not only address current nuclear requirements, but will stay reliable and effective for years to come while increasing the bottom line. That defines our solid guarantee of service, standard-setting craftsmanship, and quality. **And that's why we're your single source.**

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Nuclear Power...

Continued from page 38

with flood and seismic and then expanding to broader areas including high winds, low temperatures, and loss of ultimate heat sink.

- Development of models and analytical methods for thermo hydraulic issues with the spent fuel pool (boil-off time, condensation effects, uncovered fuel, dose modeling, and other analyses) to develop SAMGs for spent fuel pools.
- Characterization of the radiological releases for use in improving emergency response.

Verify Readiness for Known Conditions

The first step of the US response was to verify readiness for known or potential conditions. Our goal was to verify:

- Station Black out strategies
- B.5.b. security order
- SAMG equipment
- Flooding Protective Functions
- Flooding/Fire Impacted by Seismic

We also performed a review of preventive maintenance strategies, configuration control, training, and inspections and established additional operational controls for spent fuel pools.

Improve Countermeasures

Guidance was developed to address an extended loss of all AC power. We wanted to understand the challenges and establish measures to extend critical safety functions.

The US industry also adapted a diverse and flexible coping strategy. We call this "FLEX." Flex provides an additional layer of defense in depth for beyond design basis accidents.

Our goal is that the new Industry Event Response will become an efficient leverage of industry capabilities to aid the affected station.

Guidance for loss of power

We established guidance for a given set of conditions- total loss of AC power for > 24 hours with a focus to:

- Retain distribution
- Retain DC

The US industry is working with EPRI to develop a study with action that can be implemented while awaiting a longer-term solution. The study includes:

- Determine limiting conditions
- Determine next steps to extend coping time
- Determine how other similar plants differ in approach

Procedural strategies are being developed for the critical safety and to maintain functions. This leads into the Diverse/Flexible coping strategy.

Diverse Flexible Response Strategy

Flex is a long-term strategy designed to protect core cooling, spent fuel pool cooling and containment inventory. We recognize, we cannot predict all means that can challenge critical safety functions, but we can develop strategies to preserve critical safety functions and support monitoring.

Flex relies on diverse equipment protected from hazards. It's a flexible strategy recognizing variability in the initiating event. The FLEX approach has three phases,

- Each site performs site analysis for site specific hazards
- Specifications for equipment procurement are developed,
- Periodic surveillance for quality, maintenance, and testing are provided.

Three Phase Approach for FLEX

Phase 1 relies on the use of already installed equipment. Phase 2 involves the use of installed and on-site portable equipment such as generators, extra batteries, low head pumps. Finally, phase 3 involves the use of offsite equipment, transported from remote storage facilities located in different regions of the United States. These will add diversity and continuity of critical safety functions.

Equipment Acquisitions

Nearly 400 equipment purchases have been made or arranged. All US utilities have committed to order equipment by March 2012 that will be compatible with the future implementation of FLEX. About 40% of identified equipment is on-site and 82% will be on-site by the end of 2012.

Off-site Equipment Support

The US industry is moving forward to establish off-site centers for staging of equipment for emergency response. This phase is looking to:

- Define equipment
- Logistics
- Government support, as necessary
- Central accountability for the line of sight support.

The key objective is to extend critical safety functions indefinitely.

Industry Technical Support

In order to provide industry technical support during severe accidents, the US industry plans to have experts in multiple areas designated by name. We have learned from our experiences during the first week after the Fukushima accident with the utility TEPCO. The US industry established a team at TEPCO with a shadow team in Atlanta at the WANO/INPO offices. We handled several hundred requests over a 9 month period. However, it took too long to be effective in light of the required time frame.

Our goal under FLEX is to setup a comprehensive emergency response organization within 24 hours, including:

- NRC interaction
- Utility support
- Vendor support
- National lab support

Implementation Status

Nearly 190 man-years have been applied to responding to the Fukushima accident.

We now have a US Industry response strategy approved and in place. Equipment acquisitions, plant modifications, procedure changes are

underway currently. All is planned to be in place by the end of 2012.

Conclusion

We believe "The Way Forward" which is the US response to severe accident scenarios is consistent with NRC orders, includes the key elements of an industry response plan, and will deliver a flexible response capability.

Fukushima Forum

We hosted a meeting with INPO in November 2011. It was called the "Fukushima Forum." Its purpose was to share international approaches taken in response to the Fukushima Daiichi event.

Scope

The forum reviewed the final stress test reports from several countries. These included Spain, France, England, Sweden, Belgium, Czech Republic, and the Netherlands.

The forum also gathered similar information from Brazil and Canada.

A comparative table of attributes from the stress tests was developed.

Insights

A number of insights were gained from the forum. For example, a loss of control room lighting, HVAC, and communications systems can have a dramatic negative impact on accident response and must be considered as part of a mitigation strategy.

A number of gaps were identified in SAMGs as currently written.

There is no standard "coping time" for loss of AC power that plants evaluate, and plant-specific design differences make generic coping studies difficult to conduct. Limiting factors are as diverse as battery life, control room habitability, condensate storage tank volume, isolation condenser or reactor core isolation cooling containment conditions.

Filtered venting can prevent containment overpressure, reduce the challenge to the containment barrier, minimize overall radioactive releases, and potentially preclude the need for evacuation of the nearby population.

One severe accident aspect not often considered is wastewater. In the case of Fukushima Daiichi, this became the biggest problem once an injection flow path of water for core cooling was established.

Specific Actions

Participating plants committed to several specific actions during the Forum.

Next Forum

The November 2011 meeting was very useful and provided great insight into various approaches in dealing with severe accidents around the world. The US industry gained much from hosting this meeting.

We would like to hold a follow-up meeting, October 3-5, 2012 to provide the industry with an update on progress. We will post the information on the INPO and WANO websites.

Contact: David Farr, World Association of Nuclear Operators, Atlanta Center, Suite 100, 700 Galleria Parkway, SE, Atlanta, Georgia 30339, telephone; (770) 644-8432, fax: (770) 644-8505, email: farrdm@wano.org. ■

First Learning from Fukushima: An Area of Focus – Improvement in Severe Accident Containment Integrity of Nuclear Power Plants

By Mr. Thomas Fink, General Manager of the Nuclear Safety Division at SCHOTT Electronic Packaging

The severe accidents, which exceeded the in-place safety levels at the Fukushima Daiichi nuclear power plant in March 2011, have created a worldwide re-evaluation into severe accident safety. Significant information is now in on the events that lead to the hydrogen explosions.

The Tokyo Electric Power Company (TEPCO), the operator of the facility in Fukushima, reconstructed the accident and found that the temperature inside the containment structure rose to four times the normal operating temperature, while the design pressure was exceeded by more than twofold. The extreme temperature and pressure levels overstrained the epoxy seals of some Electrical Penetration Assemblies (EPAs) at Fukushima and likely led to leakage of explosive hydrogen outside of the containment vessel. Once outside of the containment vessel, the hydrogen built up to an explosive concentration, which ignited with devastating effects.

Japan's Ministry of Economy, Trade and Industry (METI) provided corroborating evidence. In a presentation at the International Atomic Energy Agency (IAEA) summit in Vienna, Austria, in March 2012, METI reported the likelihood of containment damage due to over-pressurization or over-heating, or both, stating that "it is highly possible that the leakages were caused by deterioration of the organic [epoxy] sealing as a result of high temperatures by thermal radiation directly from the pressure vessel…[the] possible location of leakage was top flange, penetration of the containment vessel, and/or equipment hatches."

Containment leakage through epoxy EPAs under severe accident conditions was not unanticipated. Nearly 30 years ago, the U.S. Nuclear Regulatory Commission raised concerns about use of polymer (such as epoxy) seals on EPAs because of its vulnerability to heat and radiation. A 1982 severe accident analysis by Oak Ridge National Laboratory based on the Browns Ferry Unit 1 reactor (MK1 containment design)[1] concluded that "CEPA (Containment Electric Penetration Assembly) over-temperature constitutes an important containment failure mode during degraded core accidents. For those accident sequences in which containment failure would be caused by over-pressurization, failure would most likely also occur in the CEPA seals.

Since the design of CEPAs is similar for all nuclear power plants, results of this study are applicable to other boiling water reactors and pressurized water reactor containments."

EPAs are the vital conduit for power, control and instrumentation circuits within nuclear power plants. Their performance is critical to running vital functions within the reactor, and their seals must be strong enough to maintain the pressure boundary integrity of the containment vessel. While organic polymers, such as epoxy, meet the current design basis specifications for EPAs in first- and second-generation NPPs, nuclear experts have voiced concern that the effects of severe accidents which exceed the design basis conditions could compromise the integrity of the seal and therefore result in leakage.

Fortunately there are better seal technologies available for EPAs. One of the better seal technologies is the Glass-to-Metal Seal (GTMS) technology. Although just one part of the design mix, GTMS offers a number of safety advantages over organic sealants to ensure the integrity of EPA seals and containment vessels. GTMS technology is an inorganic, non-aging glass seal with significant heat- and radiation-resistant properties. GTMS sealed EPAs have been maintenance-free for 60 years of use.

The performance range of GTMS EPAs is staggering having achieved over 400 bar (5,800 psi) and 400 °C (752 °F).

Glass-to-Metal Sealed Compression

Compression glass-to-metal sealed feedthroughs comprise a metal housing, a glass sealant and metal conductors. The preassembled component is heated to a temperature where the glass melts to the metal. During the cooling process, the metal housing contracts at a rate much higher than that of the glass. This compression creates a highly pressure-resistant and hermetically sealed unit that offers the highest safety.

In his paper,[2] "Electrical Penetration Assemblies for Nuclear Power Plants," nuclear safety consultant James Gleason (Longenecker & Associates) concluded, "Modern EPA qualification programmes must include qualification of the seals and the interfaces to field cables. EPAs with GTMS seals and high-performance interfaces would have technical advantages over epoxy-based EPA designs."

For the last 40 to 50 years the containment vessel has been one of the most important safety features in nuclear power plants. The accident at Chernobyl, which had no containment, was an environmental catastrophe. Nuclear plants without containments have been taken out of service. Containment vessel performance during the accident at Three Mile Island avoided harm to the public and environment. The importance of the integrity of the containment vessel is the difference between an accident and a catastrophe.

The nuclear industry is ever mindful of its role in environmental stewardship and improvements in containment integrity are common nuclear management goals. The advent of EPAs with GTMS technology makes another stride forward to improved safety goals and can provide improved severe accident performance.

EPAs with GTMS technology have been replacing first generation penetrations. Naval reactors have been using GTMS EPA technology since the early 1960's. At nuclear power plants, a steady increase in use of GTMS EPAs by nuclear designers has occurred for many reasons, such as replacements for aging epoxy EPAs, plant betterment projects, license upgrades, digital and fiber optical circuit additions, and reliability improvement programs.

Glass-to-Metal Sealed Penetrations: Stable, Proven and Reliable

- *Inorganic and non-aging material with virtually unlimited lifespan at the pressure boundary*
- *Highest safety and performance standards*
- *Most robust sealing technology for high-temperature and pressure applications (e.g., Gen III+, HTR conditions)*
- *Proven and standard technology in harsh environments:*
  - *Nuclear submarines*
  - *Automotive safety systems (air bags)*
  - *Oil and gas*
  - *High-pressure and extreme temperature application, e.g., Liquefied Natural Gas (LNG) vessels*

The benefits of GTMS EPAs include less age sensitivity, improved radiation resistance, and because GTMS EPAs are compact and rigid, better seismic performance.

New passive plant designers and small modular reactor designers have been specifying GTMS EPAs because of their resistance to aging and higher environmental capabilities.

Construction engineers like the flexibility that GTMS EPAs provide. Modern GTMS EPAs can be converted to accommodate changes in electrical circuits and can be installed early or late in the construction schedule thus providing advantages in scheduling and modular construction.

The new emphasis on severe accident performance due to the Fukushima accidents has created another strong justification for GTMS EPAs.

SCHOTT is a multinational, technology based group developing and manufacturing special materials, components and systems for more than 125 years to improve how people live and work. As a business unit of SCHOTT, Electronic Packaging is a leading manufacturer of electrical penetration assemblies for harsh environment applications such as LNG vessels, terminals and nuclear power plants. These hermetic feedthroughs are based on the company's proprietary glass-to-metal sealing technology – deemed to be the safest technology available today.

For more information please contact:

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www.us.schott.com/epackaging

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Contribution to the Post Fukushima Efforts

By Judy Sneeden, GE Hitachi Nuclear Energy.

Judy Sneeden

Judy Sneeden is the Commercialization Leader for the GE Hitachi Nuclear Energy Safety Enhancement Services business and is currently acting General Manager. She has been with GE for 23 years, 8 of them in the company's nuclear business.

Her diverse experiences include leadership roles within the GEH Nuclear Services business, Global Nuclear Fuels Americas, and GE Aviation including product line management, new product introduction, business integration, quality, and inventory control. She is Six Sigma and Lean certified with a Bachelor of Science from UNC-Wilmington.

An Interview by Newal Agnihotri, Editor of Nuclear Plant Journal at the Nuclear Energy Assembly in Charlotte, North Carolina, on May 23, 2012.

There was an initial discussion on the 3 USNRC orders for clarification. The following dialogue belongs with that discussion versus a specific question.

One order EA-12-049 is Mitigating Strategy for Beyond Design Basis Event. What the industry has brought forth as a solution to that is the FLEX program. This order has three phases:

There's an initial phase where the utility has to use whatever they have installed to maintain their coping time/ cooling functionality. The transition phase is where the utility can use whatever portable equipment they may have onsite. The final phase is more of a long term – possibly 72 hours after any beyond design basis event where they bring in off-site resources. One concept for the final phase is to have regional depots across the US. These would be strategically placed such that equipment can service multiple utilities.

The second order, EA-12-050 Reliable Hardened Containment Vents is initially focusing on Mark 1 and Mark 2 containments.

The third order, EA-12-051 Reliable Spent Fuel Pool Instrumentation is focusing on water level in the Spent Fuel Pool.

Then the NRC issued a 50-54 (Request for Information Pursuant to Title 10 of the Code Of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights From the Fukushima Dai-Ichi Accident) request for information on seismic and flooding. These are the first two external events that the NRC is focusing on. There will be others that follow – tornado, wind, hail, ice, and things of that nature, but right now they're focusing on seismic and flooding. The NRC is asking each utility to perform a walk down on flooding and a separate walk down with a focus on seismic. The utility does its walk downs, ascertains any vulnerabilities it may have with respect to its design basis, and then submits that information to the NRC. Then, based on results of that assessment, the utility may be required to do a margin analysis or a probabilistic risk analysis. Guidance is still to come from the NRC on that.

1. *How has GE Hitachi Nuclear (GEH) supported the utilities in response to the three US NRC orders of March the 12th 2012?*

GEH has developed a portfolio of hardware, software, and design solutions that align to the three NRC orders. In addition, we have personnel with the required critical skill-sets to support our customers in response to the Request for Information (50.54(f)) on seismic and flooding. Aside from generating a portfolio of solutions, we have had on-going Safety Enhancement discussion with our customers across the globe; helping them to assess their current design basis to their regulatory requirements.

2. *How have the utilities in the United States handled the "Stress Tests" similar to those that were done in Europe and other countries?*

Across the globe, each utility is doing a stress test based on requirements defined by a regulator or, for the US, the Institute of Nuclear Power Operation (INPO). Internationally, the stress test consisted of defining "cliff edges." Some questions to answer are: when is it that you experience cooling issues and when is it that you experience core dislocations? In the US, that was defined by INPO (IER 11-4). Also if you had more than one unit at the site, you had to assume that they all experienced the event at the same time. So it wasn't defining "cliff edges," it was defining when you have fallen off the cliff, you have no AC power, no DC power, and you can't take credit for your B5B equipment, unless it's seismically qualified. The utilities did commit to, based on what their vulnerabilities were, to purchase portable equipment and to implementing changes at their site, specific to their needs, by the end of March 2012.

3. *How is GE Hitachi Nuclear helping its clients meet the US NRC's post-Fukushima requirements?*

(Continued on page 50)

An Expert Team / Complete Nuclear Support

The Kinectrics Group

The Kinectrics group of companies comprises expert teams of qualified experienced professionals providing comprehensive, specialized capabilities for the nuclear industry and OEMS supplying the plants.

Kinectrics' Nuclear Products and Engineered Services, Generation Life Cycle Management, Environmental Technologies and Electrical/ Mechanical Testing business areas deliver broad-based services from fully-equipped, accredited facilities and on-site, to help clients improve plant performance and reduce costs.

RIM table for seismic testing

Our technical specialists can assess asset and component condition and remaining life, find, dedicate and qualify replacement parts, and test/qualify , or reverse engineer, components for use in nuclear plants.

Steam test facility

Kinectrics continues to advance and expand its unique engineering, testing and certification services through ongoing capital investment in technical facilities and state-of-the-art equipment, as well as the addition of new commercial alliances worldwide.

Kinectrics Facts

- Over 400 staff in North America
- 30% of staff hold doctorate level degrees
- 60% of staff have a technical, science or engineering degree, many at master's level
- Over 25 independent test facilities and labs and, field inspection services
- Central facilities = 300,000 sq. ft.
- Over 150 clients in North America and worldwide

Kinectrics' subsidiary companies based in Canada specialize in non-destructive evaluation of systems and equipment for generation plant (**Axiom NDT**) and complete nuclear regulatory and licensing services (**Candesco**).

Kinectrics US Inc.

Based in Cincinnati, Ohio, **Kinectrics US Inc.** provides focused support in Equipment Qualification (EQ) and Commercial Grade Dedication (CGD) for the existing nuclear fleet and new build throughout North America, incorporating our team's long-established experience with US standards and regulations. EQ and CGD specialists in the US and at our Canadian head office laboratories have qualified thousands of safety-related electrical and mechanical components.

A History of Excellence

Kinectrics has earned an international reputation for excellence in supporting the commercial nuclear power industry since its introduction over 50 years ago. In 2012, Kinectrics is also celebrating 100 years of service to the electricity generation industry.

Kinectrics US / New Alliances

Kinectrics US has teamed with **Pump & Motor Works (P&MW)** to provide a single convenient resource to qualify and refurbish safety and safety-related pumps and motors. P&MW is the exclusive distributor of Parsons Peebles motors in the USA.

Services are now available from Kinectrics US and **Structural Integrity Associates** in support of cable aging management program development and implementation, including risk ranking, walk down support, prioritization and field testing of cables, as well as trending of results.

Kinectrics US works with **Systems Technology Inc.** to provide specialized services in safety-related breaker refurbishments.

With **Engineered Solutions Inc.** Kinectrics US offers unique capabilities in support of electrical and Instrumentation and Control systems.

KINECTRICS

TAP EXPERIENCE

TO

IMPLEMENT NRC FUKUSHIMA REQUIREMENTS

On March 12, 2012 the Nuclear Regulatory Commission (NRC) issued the first regulatory requirements for the nation's 104 operating reactors based on the lessons learned at the Fukushima Dai-ichi nuclear accident in Japan.

"These new requirements mean operating plants must basically meet the same seismic and flooding standards as new builds do," said Matt Lee, Black & Veatch Director of Operating Plant Projects. "Black & Veatch has the experience and understanding of these criteria thanks to our Construction and Operating License application (COLA) work. Our large, complex project experience means we can help reduce risk in project execution, provide better project management and help you ensure safe, reliable nuclear power for future generations."

To help you meet the new NRC criteria, Black & Veatch conducts seismic and flooding analysis and walkdowns, provides hardened containment vent solutions, along with spent fuel pool instrumentation solutions and extended station black out coping analysis.

"We'll carefully and methodically ensure what needs to be appropriately addressed with the right level of prioritization, while minimizing impacts to plant operations," said Lee.

Black & Veatch is currently supporting GE-Hitachi with an existing hardened vent system on the Lungmen Nuclear Plant in Taiwan, which is designed to U.S. standards. "We'll use this experience to help clients meet the hardened vent order from the NRC, which affects approximately 1/3 of operating plants."

"OUR LARGE, COMPLEX PROJECT EXPERIENCE MEANS WE CAN HELP REDUCE RISK IN PROJECT EXECUTION, PROVIDE BETTER PROJECT MANAGEMENT AND HELP YOU ENSURE SAFE, RELIABLE NUCLEAR POWER FOR FUTURE GENERATIONS."

The Lungmen facility features Advanced Boiling Water Reactor technology, and when both units are completed, will be rated at 2,700 megawatts.

With more than 60 years of experience in the nuclear energy industry, from studies to major plant modification, design to procurement and construction, Black & Veatch is a one-stop shop to meet safety, security, reliability and cost-efficiency requirements.

"With Black & Veatch you get experience and certainty," said Lee. "Your challenging, complex project will be completed on time on budget, with no surprises." ▮

BLACK & VEATCH
Building a world of difference.®

Experience & Certainty

Know the end result is success ... from the start.
From day one, you can expect your challenging nuclear project to be completed on time, on budget, with no surprises. Black & Veatch delivers the most complex projects – both operating plants and new build – with reliable, disciplined, tested processes that have earned clients' vote of confidence, time and time again.

We're building a world of difference. Together.

BLACK & VEATCH
Building a world of difference.®

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Contribution to...

Continued from page 46

As a business, we have developed a portfolio of solutions based on the NRC's criteria, which are the original 12 recommendations. Then, GEH works individually with each customer to understand what their gaps are to the Tier 1 items and which are the orders they have to comply with now. We also understand that, although the orders have been issued, the final Interim Staff Guidance (ISG) with the specific criteria is not available until the end of August 2012.

4. *Are GE Hitachi Nuclear's multiple portfolios related to hardware, software, or design?*

Our portfolio includes all of these aspects.

Our hardware portfolio includes solutions to mitigate all phases of EA-12-049 Mitigation Strategies for Beyond Design Basis Events. Examples include: Turbine Water Lubricated pump, which requires no electrical power, no personnel for black-start/operations, minimizes preventive maintenance, and mitigates control system obsolescence of existing systems; Air Cooled Heat Exchanger which provides alternate ultimate heat sink capabilities; and large scale AC generators with both bus and station load capacities.

From a software perspective, GEH has NRC approved methodologies for use in Defense in Depth analysis, margin improvements and licensing support, etc. GEH has the unique expertise of being the BWR OEM and as the performer of many plants' Station Blackout analysis. This coupled with in-depth knowledge of the design basis and available margins for various systems places us in a unique position to provide software and design solutions for our customers.

5. *How GEH interacts with the BWR owners group?*

GEH is a vendor to the BWR Owners Group. We have done a few things for them post-Fukushima, but as a group of owners, they decide what they want to focus on. One of the things they have done post-Fukushima is to create a subcommittee, the Fukushima Steering Committee, which focuses on the post-Fukushima landscape. They have a couple of subcommittees looking at equipment reliability and containment integrity.

6. *What is GEH's involvement in Fukushima Daiichi nuclear power plant?*

Immediately after the earthquake and tsunami, GEH set up a command center at our headquarters in Wilmington. We wanted to support our customer, TEPCO, as well to bring the 42 GEH workers that were performing an outage at Fukushima Daiichi when the events occurred home safely. The command center was staffed 24/7 with our senior leadership, including our top engineers. Also, we had people from all over the world were coming to Wilmington to help us manage the events. TEPCO was in the midst of a significant crisis as they were busy maintaining the event, but we were very quick to offer our assistance to them. So I think it's important to note that from the initial hours after the quake had happened, we were there every step of the way. In fact, Hitachi-GE, our alliance partner, has 200 people on the grounds today at Fukushima helping with cleanup and recovery efforts.

We continue to have on-going safety enhancement discussions with the Japanese utilities understanding where their gaps and vulnerabilities are to complete their stress tests and helping them find correct solutions to close that gap so they can come back online.

7. *What is GE Hitachi's contribution in ensuring hydrogen mitigation and control?*

Hydrogen mitigation and control is one of the elements in the Tier 3 Recommendation from the NRC. The ACRS committee has asked the staff to look at hydrogen mitigation control and consider bringing it to a more near term element however, at this point in time, it is still a Tier 3 item. The industry position is to mitigate – if you can mitigate for core dislocation, then you mitigate hydrogen production and you keep it at a level that's easily controlled by your current preventative measures. That is one positive by-product of implementing the FLEX strategy.

Should the NRC or any other regulatory body go down the path of wanting to look at hydrogen control and mitigation for beyond design basis, GEH is positioned to provide our customers with a design and placement of Passive Hydrogen Recombiners to mitigate this type of beyond design basis event environment.

Contact: Michael Tetuan, GE Hitachi Nuclear Energy; telephone: (910) 819-7055, email: Michael.tetuan@ge.com. ■

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Committed to Nuclear Business

By Thomas Franch, AREVA, Inc.

Thomas Franch

Thomas G. Franch is currently Sr. Vice President of AREVA Inc.'s Reactors & Services Business Group - North America. In this role, he is responsible for the group's business operations overseeing the development of new innovative products and services, customer relationships and overall project delivery for the operating U.S. nuclear fleet and the design and deployment of the next generation Nuclear Plant.

Franch has more than 30 years of power industry experience in various technical, engineering, and executive positions.

Tom holds BS degrees in Civil Engineering and Architecture from the University of Illinois.

An Interview by Newal Agnihotri, Editor of Nuclear Plant Journal at the Nuclear Energy Assembly in Charlotte, North Carolina, on May 22, 2012.

1. *What is AREVA's vertical integrated business?*

Areva has a vertically integrated model - all the way from the mining, conversion, enrichment, and fabrication, which is the entire front end of the fuel cycle, to the design and manufacturing for reactors. Additionally, we not only build nuclear power plants but we also service them. We also have the ability on the backend to provide spent fuel solutions – either for storage or recycling. AREVA has built reprocessing facilities and we also work in the United States on the MOX project. So you can see AREVA covers the entire fuel cycle in our nuclear portfolio offering.

2. How is AREVA implementing US NRC's Post Fukushima Task Force recommendations?

First, we believe in supplying and making sure that the plants are very safe, so we want and need to keep supporting the existing operating fleet. In March 2012 the US NRC issued three orders dealing with spent fuel pool instrumentation, reliable hardened vents, and strategies for mitigation of beyond design basis for external events. They also issued 50.54f letters - requests for information - regarding flooding and seismic concerns, and required that the utilities have to address these requests as well. AREVA is working very close with the industry on what they need to do to respond to the regulations and we have various solutions from hardware to engineering support. As an example, we have some very good technologies in spent or used fuel pool instrumentation. And in that regard we believe we will really help out the industry, our solution is safe, cost effective and very reliable.

3. Does AREVA service Candu reactors as well?

We have an office up in Canada that also services some of the Candu fleet ranging from staff augmentation to engineering services in support of modifications that we execute through our EPC arrangements. We have experience from within AREVA coming together from our global expertise with our German and French technology as well.

4. How does AREVA collaborate globally with its different divisions?

As an example, our German colleagues have developed some robotics for in-vessel examinations. We have actually taken that technology and deployed it here in the States for in-vessel examinations for various utilities. And the technology is excellent, it works magnificently in the vessels and therefore we're able to take a product and service, bring them across and implement them here for the benefit of our customers. And similarly, we have deployed some of our U.S. technology, some of our welding or other expertise, and implemented it on other facilities overseas.

Additionally, we've taken another step, in the engineering space to standardize application of some of our codes and standards - especially for an EPR. By executing this model, we are able to realize the benefits of standardization and deliver a consistent product for all of our customers. Additionally the savings that can be achieved both in schedule and cost can be passed on to our customers.

5. What are AREVA's current activities and challenges in plant life extension?

With plant life extensions, we have a lot of work that Areva has executed. In fact, we have been involved with about 50% of the plant life extension work - this work has occurred in one form or another such as engineering studies, licensing, or

(Continued on page 60)

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A Closer Look at mPower

By Chris Mowry, Babcock & Wilcox mPower, Inc.

Chris Mowry

Christofer M. Mowry is the President of Babcock & Wilcox mPower, Inc., an operating group of The Babcock & Wilcox Company (B&W). Mr. Mowry also serves as President and Chief Executive Officer of Generation mPower LLC, a joint company formed by B&W and Bechtel to design, license and build the next generation of nuclear power plants based on B&W mPower™ reactor technology. Mr. Mowry serves on the Board of Directors of the Nuclear Energy Institute. He holds a Master of Science in Mechanical Engineering from Drexel University in Philadelphia, Pennsylvania. He also earned a Bachelor of Science in Engineering and a Bachelor of Arts in Astronomy from Swarthmore College in Swarthmore, Pennsylvania.

An Interview by Newal Agnihotri, Editor of Nuclear Plant Journal at the Nuclear Energy Assembly in Charlotte, North Carolina, on May 23, 2012.

1. *Give me a global perspective on the B&W mPower™ reactor; especially in developing countries.*

I think one of the basic ideas driving global interest is the scale of SMRs. They are very attractive to developing countries with smaller or weaker transmission grids because you can't have a 1,000-megawatt plant on a 3,000-megawatt transmission grid. Of course, there is also the cost of building a large reactor -- getting financing for a $10-billion project is quite challenging. So, a natural target market for SMRs is developing countries due to the reactors' smaller size and affordability.

2. *Internationally, with which countries have you had dialogue?*

The international interest in the B&W mPower reactor has been tremendous. We have had discussions with Canada, many of the Southeast Asian countries, various countries in Europe as well as in the Middle East and elsewhere.

There's a lot of interest in developing countries. The challenge in these countries is to develop the regulatory infrastructure. From that standpoint, I think it's just going to take a little bit longer for these countries to be in a good position to adopt nuclear.

3. *What is the motivation for countries in the Middle East to order nuclear power plants?*

There are many different drivers in different countries. In the Middle East, we believe they want to use the oil for export and not use it for power. Elsewhere, I understand that Mexico is making a very strong commitment toward climate change regulation, which is another factor that drives interest in SMRs. You have the demand for nuclear for a number of different reasons, and then the question is how do you take the risk out of manufacturing and constructing nuclear plants and then reduce the financing burden. SMRs have major advantages in all those areas.

4. *What's the status of mPower with TVA?*

We're still moving forward with that project at the Clinch River site. We continue to work on the design and the development of the project. Site characterization studies are ongoing, and we're getting ready to do boring at the site later this summer, so things are definitely moving forward.

5. *Do you have design certification from the US NRC?*

No SMRs have yet been certified, although we are in active pre-application discussions with the NRC. We expect that our application for design certification will be submitted for the NRC's review in 2013.

6. *How long will it take for US NRC to issue the design certification for mPower?*

We have assumed a timeline of about three-and-a-half years, although we're optimistic based on feedback from the NRC that this timeframe can be reduced. We have a very active pre-application activity going on with NRC right now. Numerous design documents and submittals and topical reports have already been submitted to the NRC. A final design certification application is scheduled to be submitted next year, but already we've made quite a few submittals of topical reports and have received positive feedback and approvals from the NRC. We're very active with the NRC right now and meet with them at least once a month.

The NRC has decided to take a slightly different approach and use design-specific review standards instead of just the generic standard review plan, NUREG-0800 (Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition), which was developed for evaluating large light water reactors. We've been collaborating with the NRC on that now for almost a year, so hopefully by the end of 2012 or early 2013 that will be in place. That's an important prerequisite for having the design reviewed.

7. *Are you using risk-informed evaluations for mPower for its licensing?*

Yes, we're pursuing a risk-informed licensing process. We're conducting our own probabilistic risk assessment for the B&W mPower reactor, and that has helped to inform our design process and guide the decisions that we're going to make in order to reach our safety target.

We are performing this assessment primarily with internal resources and using some contractors to support us. This is an important part of reaching our goal of 10^{-8} core damage frequency.

8. *When did The Babcock & Wilcox Company start pursuing mPower actively?*

We started to move on this about four years ago, and the program publicly launched in 2009.

9. *When did the original design of mPower evolve?*

The prototype was built in the 1960s -- that's really the first integral reactor that we built for the merchant vessel Otto Hahn. It was a commercial nuclear ship built in the 1960s and operated for about 10 years. Following that, we did some design work over the decades with Department of Energy studies. All of these parts and pieces came together and formed the basis for starting specific work on the B&W mPower reactor program in 2008.

10. *Do the above-described applications alleviate the need for a prototype of mPower?*

We've taken an approach in which we don't need to build a full-size prototype. However, we do have a scaled test facility in Bedford County, Virginia. It is full fidelity, full height, and electrically heated. Because natural circulation, which is driven by gravity, is vital to the safety performance of our design, the vertical aspect can't be scaled. However, volume and power have been scaled to a smaller size. For example, about two megawatts of electrical heating are used to simulate the energy from fuel.

The main purpose of the facility is to validate the codes and methods that we use to predict and model how the plant will behave. The codes we use were originally developed and validated for large 1,000-megawatt class reactors with distributed reactor system architectures. Their direct applicability to an integral reactor design cannot be taken as a given, and to buy down our licensing risk with the NRC, we've made the decision to go forward with this test facility.

11. *Who are the other U.S. organizations, U.S. as well as international, who are collaborating with you in terms of technology?*

Bechtel is participating with us in Generation mPower LLC and is designing the turbine island and will serve as the EPC constructor for B&W mPower plants. We also have some other companies we work with. For example, SPX Corporation's Clyde Union division is working with us on reactor cooling pumps. We're working with General Electric on the turbine generator and Northrop Grumman for instrumentation and controls.

(Continued on page 60)

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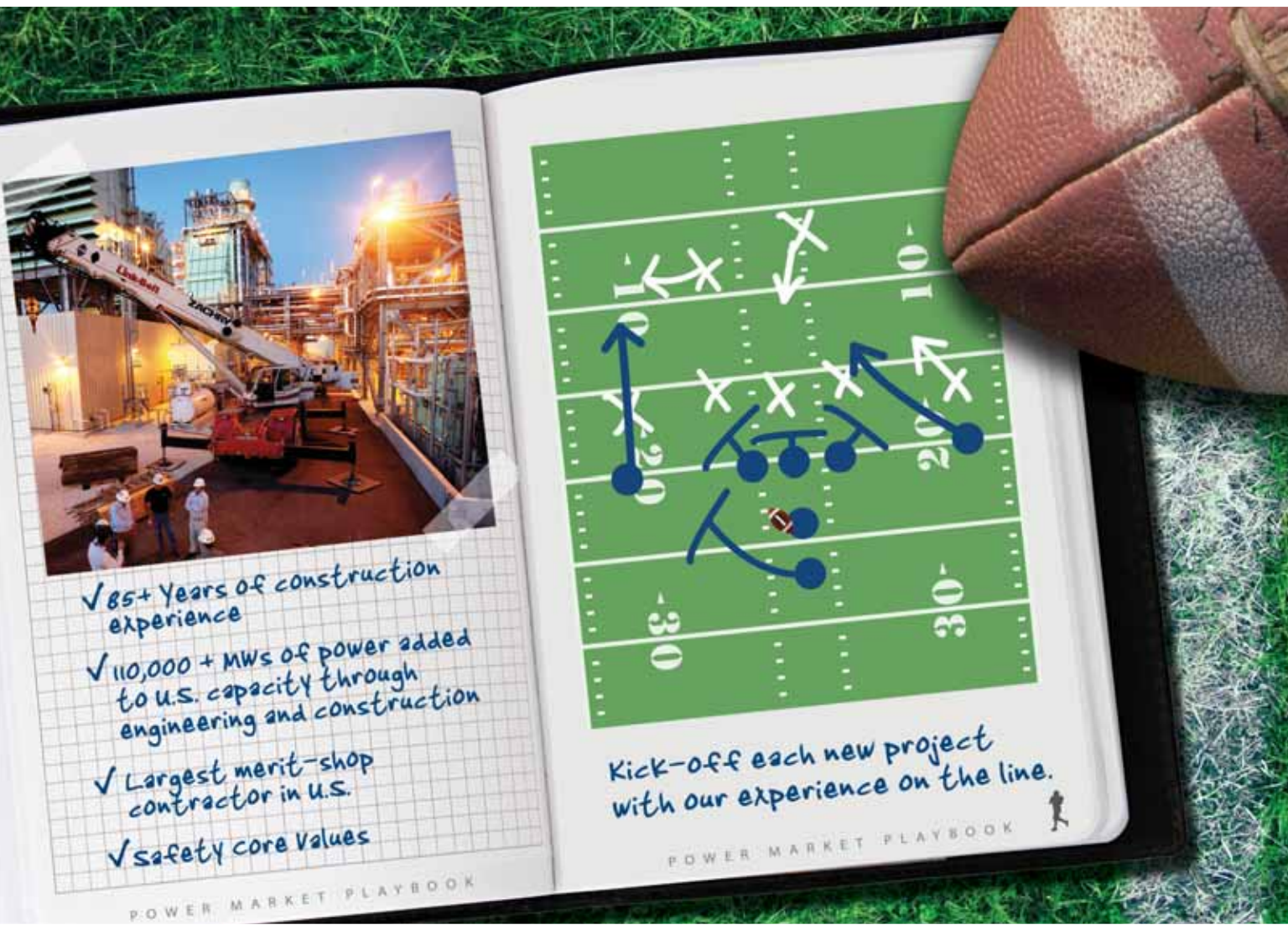

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A Closer Look...

Continued from page 57

12. *What are the passive features in mPower compared to what was in the Otto Hahn?*

Typical of nuclear reactors, the Otto Hahn reactor had the capability to remove residual heat by way of natural circulation, or gravity, for normal cool down. For a pipe break or a leak in the reactor vessel pressure boundary, the Otto Hahn relied on electrically powered pumping systems to inject coolant to continue removing residual heat from the nuclear core. The passive systems supporting the B&W mPower reactor do not rely on such pumping systems. For events such as loss of coolant accidents, steam line breaks, or even station blackout, residual heat removal is achieved for the B&W mPower reactor using specially designed systems that rely only on gravity-powered flow and core cooling.

13. *What are the basic risk management features that mPower has which are new as compared to the current reactors?*

Our primary risk management strategy is to focus on "best in class" technology that is proven and uses those proven features as much as possible. For example, we used B&W's once-through steam generator technology for the steam generator that's internal to the reactor -- that is a major component that we have had good experience with and has been proven. In general, we've only introduced new technology where we have to meet specific cost goals or safety goals for the project.

14. *How many people do you have working on mPower?*

Currently, there are roughly 400 engineers, designers and others working on the project. Most are at B&W's facilities in Lynchburg, Virginia, and Bechtel's facilities in Frederick, Maryland, with additional workers supporting the program in Barberton and Euclid, Ohio, and Charlotte, North Carolina.

15. *Have you submitted an application for the DOE funding?*

We've submitted an application to the Department of Energy to be part of their cost-sharing program. We believe our operational testing and manufacturing facilities, significant design progress, existing strong American supply chain and unparalleled industry partnerships make us a strong contender for receiving one of the awards.

Contact: John Ferrara, Generation mPower; telephone: (704) 625-4912, email: jrferrara@generationmpower.com. ■

Committed to...

Continued from page 54

engineering analyses in support of their applications. In fact, a lot of the plants have already been granted their life extension and they are now evaluating the possibility for a life beyond 60. AREVA is looking at this possibility as well and it is not too soon to start evaluating this prospect. None of the challenges are insurmountable – they just need to be dealt with in a logical and pragmatic approach.

6. What is streamlining unique outage time?

In a few words - outage optimization. We work with various utilities to optimize outages which helps them with planning, helps them with their resources, and it also helps them with their cost. So we have worked with various utilities to minimize the outage and optimize the execution or the schedule.

7. What's your strategy to bring down the outage time?

There is a lot of pre-planning. You basically start well in advance of the actual outage and you make sure you take a look at the outage, what is the required work that you want to get done, what contingency do you need to account for, what is needed from a resource perspective – so you do a lot of planning. I cannot overemphasize the amount of planning that needs to go into an outage. If there are modifications going in, ensuring your modifications are prepared way ahead of time, in other words all your materials are staged appropriately, manpower is planned, etc.

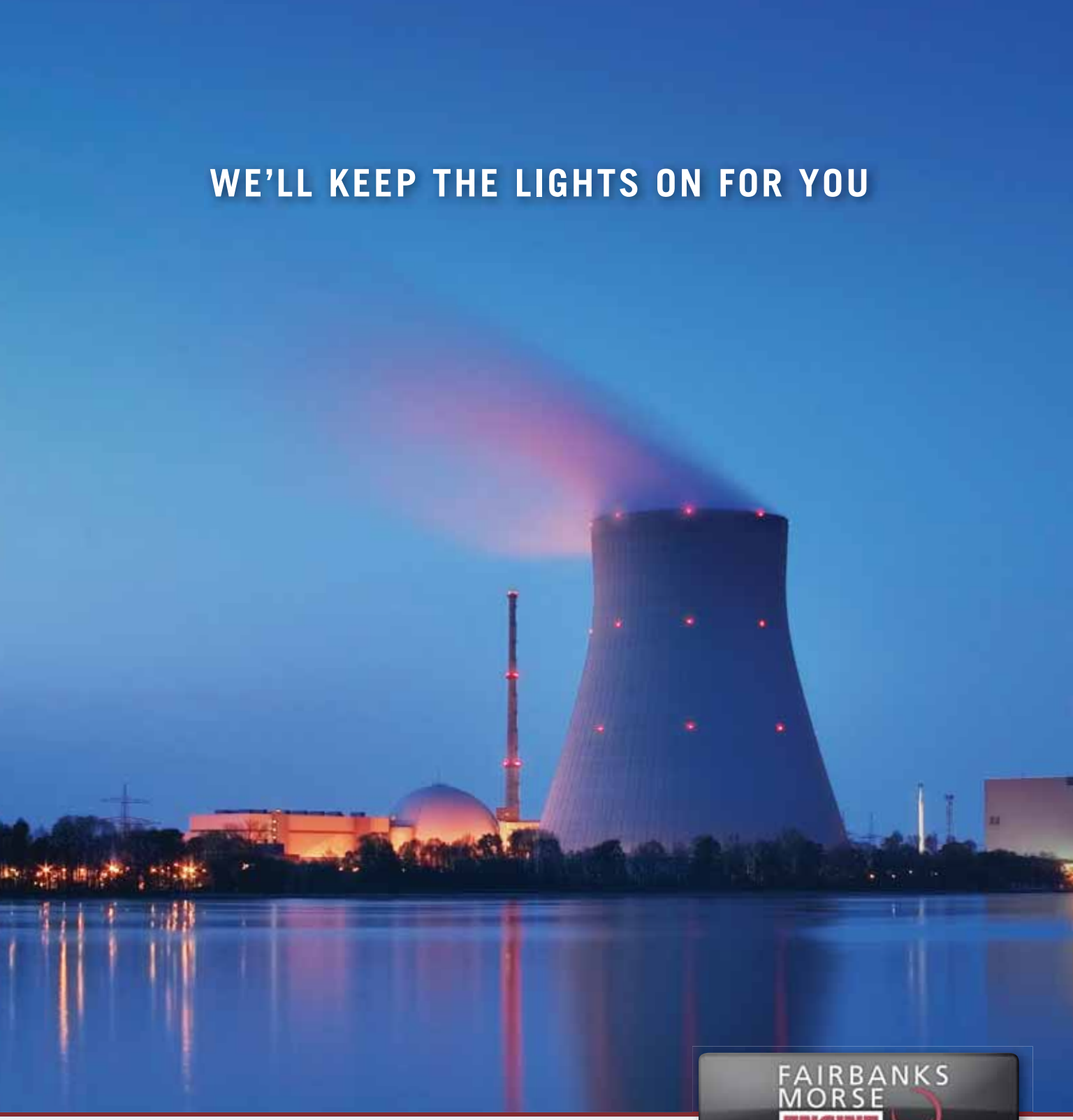
8. Highlight the maintenance practices for steam generators.

This is a very complex question – ranging from chemistry management to inspection to actual physical work performed on the generators. Needless to say, AREVA is very engaged with our customers to assist them in managing the steam generators to get the most performance out of them. This has been and will continue to be one of our service offerings that highlights AREVA's global capabilities – in inspection, tooling, repair, chemistry management, and if needed, replacement.

9. Concluding remarks.

AREVA is pleased to be a leader in the nuclear industry. We are committed to this market as demonstrated by how much of our portfolio is in nuclear today. As such, we are dedicated to the safe, secure, efficient operation of the fleet. We are looking forward to providing products, services, and other technological advancements for many years to come.

Contact: Michael French, AREVA Inc., 4800 Hampden Lane, Suite 1010, Bethesda, Maryland 20814; telephone: (301) 841-17402, email: Michael.french@areva.com. ■



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Japan's Report to IAEA

The investigations of the accident have been under way by an "Investigation Committee on the Accident at the Fukushima Nuclear Power Stations of Tokyo Electric Power Company" (hereinafter referred to as "The Government Investigation Committee"). The interim report was issued in December 2011.

Japan's Nuclear and Industrial Safety Agency (NISA), as the nuclear safety regulatory organization, reflects on the failure to prevent common cause failures due to the tsunami, leading to the loss of total power supply, and a further critical situation, together with insufficient protection against severe accidents. Determining that the lessons learned from the accident should contribute to nuclear safety from now on, NISA has compiled technical knowledge so far available along the accident sequence from its occurrence through various phases. On March 28, 2012, NISA developed 30 safety measures that should be reflected into the future regulations.

It is considered that these efforts helped clarification of the causes and progress of the accident. Verification of the cause and characteristics of the accident has been under way by the National Diet of Japan's Fukushima Nuclear Accident Independent Investigation Commission (hereinafter referred to as the "National Diet Investigation Commission") and other organizations at the time of preparation of this report. These activities will provide new findings in the future. The more detailed investigations on the status of the damaged reactor cores as well as structures, systems and components, which are difficult to access for direct examination due to high radiation doses, will be started, making use of knowledge accumulated both domestically and internationally.

Given the number of nuclear power stations in Japan, it is necessary to confirm their safety immediately. Therefore, based on the safety issues that were gradually identified regarding the accident, NISA directed the operators of the other nuclear power stations to take various safety measures.

First, on March 30, 2011, NISA directed the operators to take measures against flooding and to deploy power supply vehicles and an alternate water injection system to help safety emergency actions that allow stable cooling of the core and other vital equipment even if a tsunami equivalent to that which hit Fukushima Dai-ichi NPS strikes the plant and triggers a station blackout and a loss of the ultimate heat sink function. On May 6, 2011, NISA confirmed the implementation of these precautions.

Second, NISA issued directives in July 2011 to conduct the comprehensive safety assessments, so-called stress tests, on all Japan's nuclear power plants. The assessments consist of two steps.

The primary assessment focused on the nuclear power plants which are under their planned periodic inspections and ready to restart, determines whether the restart of the plants is allowable. It evaluates to what extent the plants can withstand a beyond-design-basis earthquake or tsunami without causing core damage.

The secondary assessment takes into account the implementation status of the stress tests in Europe and examination by the government Investigation Committee, covering all the nuclear power plants including those in operation and those evaluated in the primary assessment. The comprehensive safety assessment is carried out to determine the limit of functionality of radioactive material confinement in the case of core damage, as well as to identify any vulnerability of the entire facility to make continuous improvement, with an aim to determine the continued operation of the plants.

The stress test processes were reviewed by the IAEA mission team consisting of international experts in January 2012.

The stress tests on the nuclear fuel cycle facilities will be evaluated in the future. Reflecting the failure to prevent the accident at Fukushima Dai-ichi NPS (hereinafter referred to as the "Fukushima Dai-ichi accident"), Japan is now in the process of reforming its nuclear safety regulations. Among others, preparation is under way to establish a new regulatory organization responsible for nuclear safety for the purpose of separating nuclear regulation and promotion and integrating the related administrative activities. Examinations had been continuously made at the Advisory Committee for Prevention of Nuclear Accidents by experts in order to also respond to the lessons learned from the Fukushima Dai-ichi accident and the recommendations and suggestions of the Integrated Regulatory Review Service (IRRS) of the IAEA conducted in 2007, and the relevant bill was submitted to the Diet.

After discussions between the government and opposition parties, in order to create further independent nuclear regulatory authority, a new bill was submitted to the Diet and passed on 20th June 2012. The Act was promulgated on 27th June 2012. At the same time, focus will be placed on reforming the safety regulation system including legislation of severe accident measures and the introduction of a backfitting program. Together with this reform, various types of engineering review will be conducted to organizationally make use of the findings obtained from the review results in a new

This report is an excerpt of the detailed National Report (dated July 5, 2012) of Japan for the Second Extraordinary Meeting of the Convention on Nuclear Safety to be Submitted to the IAEA. The full report may be viewed by accessing the website link: http://www.meti.go.jp/english/press/2012/pdf/0705_01b.pdf

system, with the aim of continuously enhancing nuclear safety.

In the nuclear emergency preparedness and response area, the introduction of the Precautionary Action Zone (PAZ) and strengthening of the risk management system will be undertaken.

In recognition that it is our responsibility to provide the international community with accurate information regarding the accident, we have provided national governments and international organizations with accident information and received various IAEA mission teams. In particular, we developed and submitted two reports in June 2011 and in September 2011 to the IAEA, explaining the accident sequence identified up to that time, actions taken to deal with the Fukushima Dai-ichi accident and those affected, and lessons learned from the accident. Since then, we have disseminated additional information on the accident on various occasions including the IAEA International Experts' Meeting held in March 2012. This report explains the actions taken after the accident and is also placed as a part of providing information under the framework of the Convention on Nuclear Safety. We hope this will contribute to enhance nuclear safety all over the world.

We will continuously commit ourselves to deal with the accident and proceeding with investigation and verification of the accident, and will release additional information and the results of analysis on the accident to the world, preparing for "the Fukushima Ministerial Conference on Nuclear Safety" scheduled for December 2012 in Japan.

The major factor that aggravated the accident is that the people involved in nuclear power generation in Japan had not seriously addressed the latest knowledge about tsunami and international standards and best practices for nuclear safety including severe accident measures, and adequate preparation has not been made in the aspects of the systems, organizations, human resources, equipment and operation. We will definitely correct these flaws through the actions mentioned above. In addition, people in all levels involved in nuclear power generation will maintain and improve their technical skills, while maintaining close relations with the international community, and continue to review and enhance nuclear safety to regain trust at home and abroad.

More than one year has passed since the Fukushima Dai-ichi accident occurred. This accident is a very severe one as shown by the facts: electrical systems lost their functions extensively due to the common external event of the earthquake and tsunami; severe accidents of fuel damage and core melts occurred simultaneously at multiple units; the accident affected a large area around the site; and more than 100,000 people are still leading painful lives as evacuees.

The on-site situation is also quite severe. We internationally have no experience in accurately understanding the state inside the severely damaged reactors, taking out damaged fuel from such reactors and taking steps for decommissioning, and it is supposed that it will take several decades to accomplish such work. It is also viewed that new technologies will be required for such works. Besides, many challenges remain in improving the reliability of measures, such as the presence of a large amount of waste and contaminated water, and the fact that many pieces of the equipment for circulation injection cooling system are temporally construction. In addressing these challenges, it is necessary for us to gather international knowledge and utilize it.

There are a number of nuclear facilities in Japan and it is necessary to ensure their safety. Looking back on the accident, although the Fukushima Dai-ichi accident was caused directly by natural disasters, i.e. an earthquake and a tsunami, the assumption of these hazards had been insufficient, and preparations for response to a complex disaster of natural hazards and an accident at a nuclear power station had been not enough either. So far, provisions for a severe accident have been left to operators' voluntary arrangements, and have not been a regulatory requirement. Japan must reflect on these points. In the new regulatory system, measures related to the above-described preparations are included in the regulatory requirements. We must take it seriously that insufficient safety measures taken so far aggravated the accident. Concerning the regulatory system and activities, continuous improvements have to be made, taking new technical knowledge into account. At the same time, operators have to establish a "safety culture" in which safety levels are ceaselessly reviewed. In the process, it is necessary to actively keep up with the best practices in the world by having close interactions with the international community and working closely with them. Japan is determined to surely establish a new organization/structure which will be able to respond to any emergency properly.

This report describes how Japan has responded to and what lessons Japan learned from the accident, and what actions Japan will take in the future, from the aspects of external events, design, severe accident management, domestic organizations, emergency response and international cooperation. Although it will take still long time to clarify the entirety of all aspects of the accident and identify lessons-learned, we will continuously share new knowledge and lessons with the international community at various occasions, such as, under the Convention on Nuclear Safety or the IAEA framework, and contribute to enhancement of nuclear safety in the world. We are also committed to dedicating all our efforts to make the best use of global cutting edge knowledge and technologies in response to accidents in the future. ■

The Quality Nuclear Power Support You Can Count On

Our Quality Commitment

Quality is the centerpiece of the value and service we provide to our clients. It is infused in our people, our programs, our processes, and our practices. We believe that it is the quality of our deliverables that ultimately delivers our projects within budget and on schedule.

Our Power Focus Commitment

We've been thinking power... exclusively for over 120 years. We think that's a rather firm commitment to maintaining our focus on what we do best.

Our Leading Expertise Commitment

Key to our ability to produce quality deliverables is the leading engineering, design, analysis, and project management know-how that we maintain current through our highly experienced staff and extensive state-of-the-art applications. And, of course, we are the company that always manages to get it done.

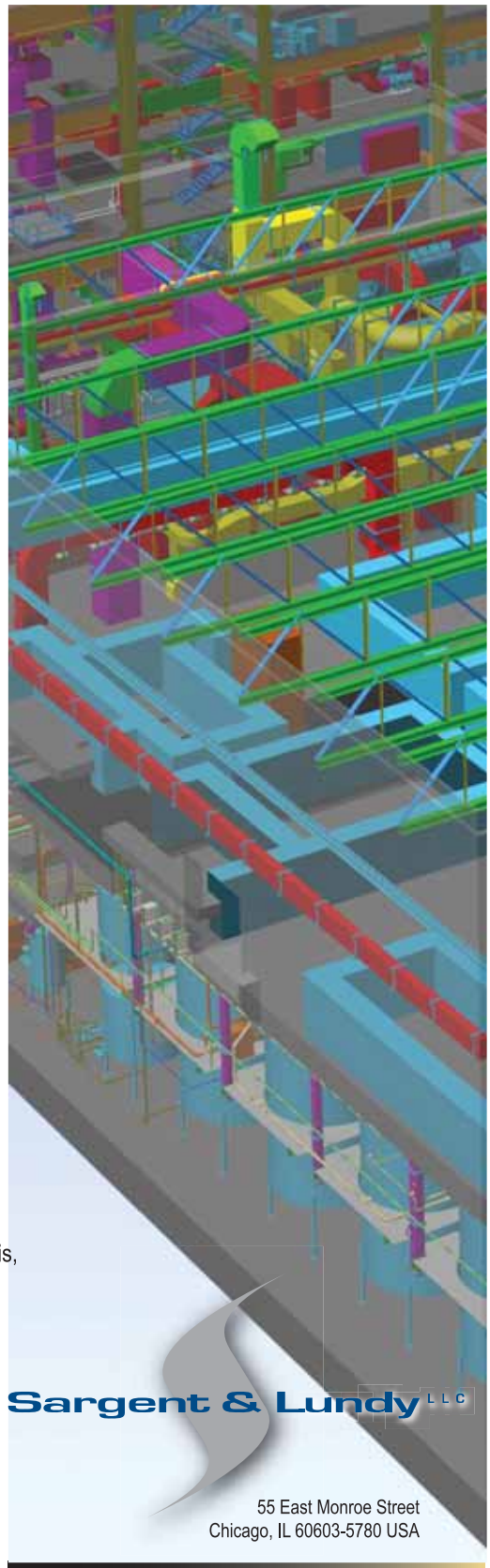
Our Nuclear Commitment

Nuclear power clients have been a primary part of our power focus since 1954, pretty much when it all started. Nuclear clients have good reason to have confidence in our capabilities, not only from our quality, expertise, and focus, but also from knowing we will be here for them when needed with what they need, as we have been for more than 50 years. Owners enlist our broad support as their preferred engineer and rely on our expertise for specialized problem-solving. Our on-going and recent activities encompass emerging issues, leading edge initiatives, and nuclear plant design and licensing activities such as:

- Post-Fukushima assessments and initiatives
- Digital controls and adjustable speed drive replacements
- New plant engineering, Combined Operation License preparation, Owners Engineer, and early site permit preparation
- Design Basis calculation reconstitution, piping systems vibration analysis, and plant/equipment test optimization

That's in addition to our extensive on-going engineering, design, and analysis for nuclear station owners for diverse projects including:

- Modifications and performance improvement
- Outage and restart support



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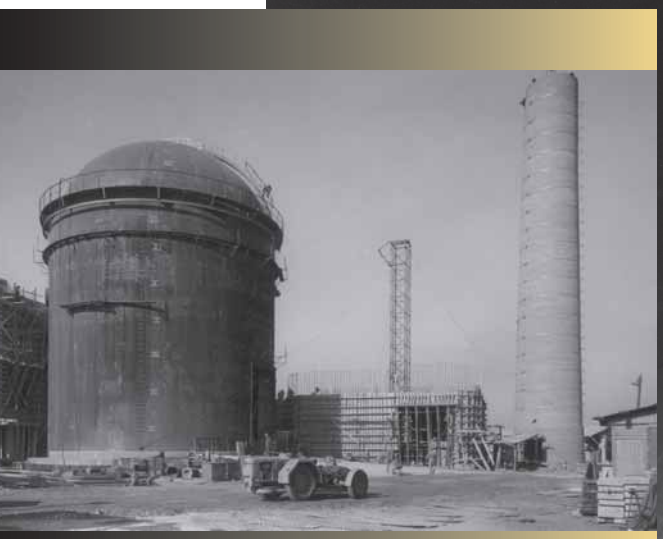

From the First Generation of nuclear power...

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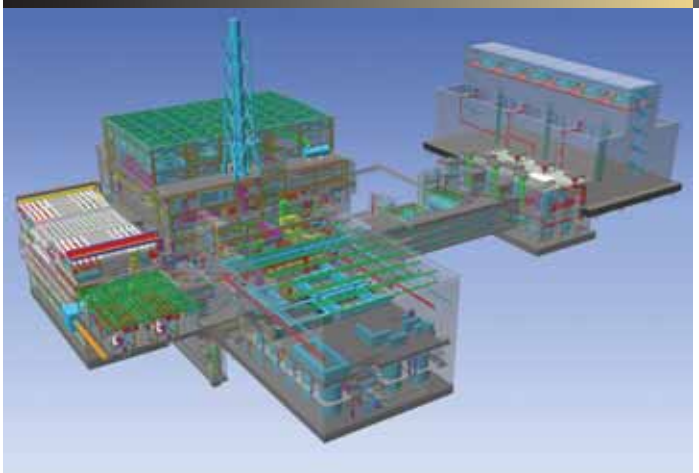


Evolution of Controls for Nuclear-Safety Engine-Generators

By Steve Greuel, PE, Fairbanks Morse Engine.

Steve Greuel

Steve Greuel, PE, is manager of electrical engineering for Fairbanks Morse Engine, Beloit, Wisconsin. Fairbanks Morse provides custom-engineered diesel engines for commercial, military, and nuclear applications.

Objective

Because of changes in the technical and regulatory landscape, nuclear plant owners and engineers are faced with the need—and opportunity—to rethink how they handle controls for their emergency generators.

Introduction

Key electromechanical components used in emergency diesel generators (EDGs) are fast disappearing from the market. The computer-based digital controls that are taking their place introduce a whole new set of benefits and issues that need to be addressed. The upshot is that engineers must change the way controls for EDGs for nuclear plants are designed.

With this change come two major challenges: (1) ensuring the security of such digital control systems, especially as requirements for safety qualification become more demanding, and (2) making optimal use of the wealth of monitoring data that is now routinely available in processor-controlled engine systems. Fairbanks Morse Engine has been designing control systems for nuclear, commercial, and military diesel generators for 40 years and is now working closely with clients to define the new landscape of digital controls. This article reviews some of the ways in which we've been thinking about nuclear EDG control systems.

Analog, Electromechanical Control

By way of background, though, let's take a look at the traditional design, which has served the industry extremely well. For nearly four decades, nuclear EDG systems have relied on analog, electromechanical controls. In the start circuit, with air pressure and station battery power systems aligned, closure of a switch contact allows that power to work through to air-start solenoid valves. In the engine, an electrohydraulic governor actuator controls mechanical-injection fuel pumps. With few variations, this design has remained the mainstay of nuclear EDGs until quite recently. These systems are wonderful workhorses, performing to roughly the same requirements with the same components as they did 40 years ago.

The traditional controls have two major attributes, each of which has its tradeoffs. First of all, such systems are simple; consequently, they're reliable. Both diagnosis of a problem and repair can be done quickly. However, this simplicity means the system has only a limited capability for monitoring its condition. These days, even a very basic commercial system has more monitoring capacity than a traditional-design nuclear EDG.

Second, traditional systems can be calibrated and adjusted in the field by several means, typically by screwdriver adjustments. Among those who keep this equipment operating, such adjustments are a respected art, but in the face of time and personnel turnover, it becomes very hard to track changes; as a result, the state of the system cannot be known precisely nor returned precisely to its default settings.

Fairbanks Morse still designs traditional systems for clients that prefer them, but the design options are becoming quite limited because many of the once-abundant electromechanical components are no longer manufactured. Finding parts that meet the requirements for safety qualification has become a time-consuming task.

A new concern about traditional systems is that, according to reports of which Fairbanks Morse is aware (one published and one pending), aging legacy EDG controls have been identified as a known cause of several documented EDG failures.

Embedded-Processor Controls

While some clients are seeking the time-tested certainty of electromechanics,

(Continued on page 68)

DRS Consolidated Controls Develops New Safety-Related Products

For more than 55 years, DRS Consolidated Controls, Inc. (DRS-CCI) has been committed to the safety of its customers. That commitment, coupled with an overall dedication to excellence, has led DRS-CCI to develop a number of products for safety-related applications at nuclear power plants.

The DRS-CCI Pressure and Differential Pressure Transmitters feature a longer product life, eliminating the need for frequent replacement and reducing the total cost of ownership. These transmitters were created in response to customer requests for products capable of withstanding more stringent environmental qualification tests. Drift and leakage errors are no longer an issue since the transmitters feature an all-welded pressure boundary and no fill fluid. Their design is based on a proven technology that DRS-CCI has been manufacturing for over fifty years.

DRS-CCI offers a number of products to meet the requirements of current and future safety-related Emergency Diesel Generator (EDG) control applications. Together with an EDG, these control systems enable safe and seamless operation of the power plant in the event of loss of offsite power. First, our PLµS 32™ EDG Control System features a modular digital architecture that is compatible with all engine types. It is based on the highly successful PLµS 32™ Distributed Control System that has been performing in safety-related applications at six nuclear power plants for over ten years. Second, our Digital Voltage Regulator and Digital Speed Control offer sophisticated diagnostics, advanced monitoring, and enhanced communications capabilities that are not available in traditional analog voltage regulators and speed controls. DRS-CCI is supplying these safety-related EDGs controls for the Department of Energy's Mixed Oxide Fuel Fabrication Facility.

Our Reactor Coolant Pump Speed and Phase Reference Sensors are safety related components that monitor the rotational speed and direction of the reactor coolant pump. Their all-stainless-steel construction allows these sensors to operate continuously in the most extreme environments. Even though new plant designs often have non safety-related reactor coolant pumps, the specifications usually require safety-related speed sensors. DRS-CCI has been chosen as the exclusive provider of the speed sensors for the Westinghouse AP1000® nuclear power plants in China and the USA.

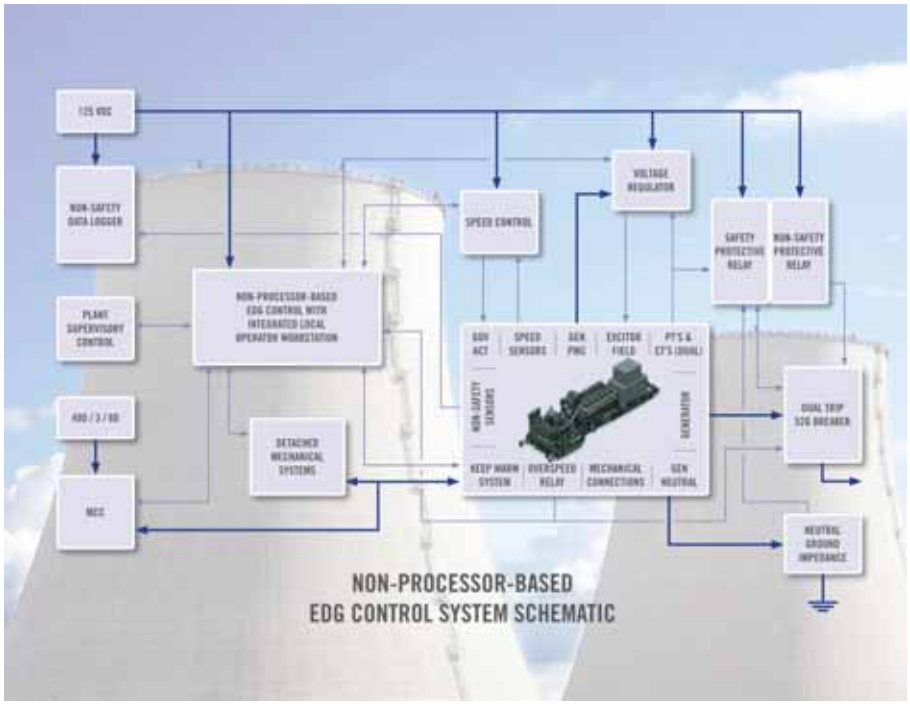
DRS-CCI has long been known for our commitment to safety, proven record of reliability, and long-standing client relationships. Our complete set of safety-related products will ensure your facility's reliability today and tomorrow.

Evolution of...

Continued from page 66

other clients are asking for the other extreme: full computer control. That choice opens a wealth of options: Electronic sensors, operating at a convenient 24 VDC, can monitor bearing temperatures, water and oil pressures with corresponding temperatures, and much more—all of which can be displayed, automatically logged, and acted upon.

In commercial systems, all of this data would be handled by programmable logic controllers (PLCs). However, the very quality that makes PLCs wonderfully suited for nonnuclear commercial applications—their adaptability—makes them equally unsuited to nuclear EDG applications.



NON-PROCESSOR-BASED
EDG CONTROL SYSTEM SCHEMATIC

Fairbanks Morse has been designing PLC-based control systems for commercial engine generators for many years, but the current regulatory requirements, which are prudent, have required us to alter our practice when designing nuclear systems. We now offer EDG control systems that provide full computer control without using a PLC.

Our supplier uses our logic designs to adapt a custom computer control with an embedded processor. While this control unit outwardly resembles a PLC, it satisfies the most exacting interpretations of applicable codes and standards. This approach provides high immunity to tampering or cyber attack. The logic remains the same as in traditional systems.

Challenges

The introduction of digital control opens many exciting possibilities for more flexible control, but let's look first at some of the challenges:

Configuration control

PLCs are well known for lack of configuration control, being subject to impromptu changes to the application program (software), undocumented component changes, and even changes to the manufacturing process for the components. We address this issue by using nonvolatile memory for safety-qualified controls; the firmware and the application software program for the EDG main control, the governor system, and the voltage regulator system are all "burned in." Any changes must be documented and tested and then implemented by physical replacement of a chip on the controller card. There is no means to make an impromptu change to the program.

Cyber threat

The topic of cyber threat is a rapidly evolving new area for controls. In addition to the inherent security of having a burned-in program inside the processor, we use another mitigating measure: The sole digital serial link to connect outside the safety envelope is arranged so that it can only broadcast; it is not capable of listening.

Interpretation of codes and standards

The regulatory codes and standards that encompass designing, testing, and qualifying a system are known. Applying those codes and standards to an application that includes a processor is, arguably, a work in progress. Fairbanks Morse is seeing a variety of interpretations in customer specs—all of which are good designs—and continues to work to clarify this issue with agencies and customers.

Opportunities

The hallmark of current digital designs is their greatly expanded list of control features and the flexibility for changes.

Factory reset

Digital control offers the capability to restore all of the optimization adjustments, such as the proportional-integral-derivative (PID) settings, to

(Continued on page 75)

Specifying digital EDG controls?

Consider these new options and issues:

Do you want a minimalist or a "maximalist" system?

That is, do you want to use processors only where absolutely necessary, or do you want to exploit a full range of sensor capability?

Which data do you want to use and how?

Engines can now report data on bearings, exhaust, air, oil, water, fuel, cooling water, and pneumatics. Generator systems can send data feeds of electrical power parameters; the list goes on!

How will you plan for new regulations?

Requirements for qualification of control equipment may become more demanding in the near future.

DO-Ra

By Vladimir A. Elin, JSC "Intersoft Eurasia", Russia.

Vladimir A. Elin

Vladimir A. Elin graduated magna cum laude with a B.S. in Technical Sciences from the faculty of Instrumentation with specialization in radio electronic systems and devices at the Moscow State Technical University n.a. N.E. Bauman (MSTU) in 1984.

In 1988, Vladimir A. Elin decided to give up scientific research in favour of business, and he went on to create the medical-technology company "Bioteks." 1989-1991 he worked as a director of scientific and technological laboratory "Infotech-Inter", and as a director of the Russian-German joint venture "Shanse". In 1993, together with the partners Vladimir A. Elin established the company "BBB".

In 1995, Vladimir A. Elin and his partners set up a management company - JSC Corporation "EMSTS" - (a unified international system of bonded warehouses).

In 2007, Vladimir A. Elin together with Vladimir A. Afanasenko established a new logistics holding company JSC "Smart Logistic Group".

DO-RA: universal dosimeter in a cellular phone

March 29th, 2011, in the process of working on a column on a situation at Fukushima nuclear power plant, an idea was born. It might be a good idea to have every person in the world own a mobile dosimeter that will be built into a cellular phone or a Smartphone. The idea might have stayed on paper, but for a letter from a nuclear engineer complementing me after the column came out. I revisited the column and realized that a dosimeter in a cellular phone needs to be produced.

I decided to name the future model Do-Ra (from first letters of the phrase dosimeter-radiometer). The future model was prioritised on June 24th 2011 and after a year and a half, a patent was received from the Intellectual Property, Patents and Trademarks Federal agency in Russia. Patent applications were also filed in the US, Japan, China, European Union and Ukraine.

A team of developers from the RFNC- (Russian Federal Nuclear Center, Russian research and development institute for experimental physics) in Sarov city lead by the Doctor of Science Alexei Kibalko as well as a group of professional programmers worked on this project.

DO-RA

The Do-Ra device connects to a Smartphone through an audio jack and works in conjunction with a mobile software DO-RA.Soft, easy to download to any mobile device from the Internet. After clicking on the Do-Ra icon, a software program launches and the Do-Ra device starts to function. Measuring ionizing radiation takes place every 4 seconds and for 60 seconds the Do-Ra device constantly checks the results for accuracy. After 60 seconds, the results with potential accuracy are displayed on the Smartphone screen informing about radioactivity level (dose rate) at the location, of the studied object, food, etc.

The DO-RA.Classic can easily be used as an individual emergency indicator by the personal of nuclear power plants, while the DO-RA.uni with its silicon (Si) sensor is suitable for use as an individual dosimeter and, of course, as an individual emergency indicator of ionizing radiation.

The DO-RA. Classic is designed to:

- periodic or continuous 24-hour recording and indication of equivalent dose of gamma-radiation ("DEP") of its holder;
- periodic or continuous 24-hour recording and indication of ambient equivalent dose of gamma-radiation ("DP") of its holder;
- measurement of period of accumulation of DP gamma-radiation of its holder;
- digital transfer of the accumulated and stored data in the memory of the device thorough an audio channel to the smartphone processor for subsequent display or transmission through a mobile service provider to the center of the radiation situation monitoring.

The DO-RA.Classic can be used to assess the radiation environment and alarm the user of any radiation risk (above threshold), as well as to identify areas of contamination or radioactive sources of gamma radiation.

At present, the current configuration of the DO-RA.Classic allows it to be used as a detection device, not as a measuring tool. For this reason, its readings cannot be used in official reports.

To ensure accurate interpretation of the results generated by the DO-RA. Classic, users are recommended to contact professional organizations.

The DO-RA.Classic is best operated in the following conditions:

- ambient air temperature from-20° C to + 55° C;
- relative air humidity up to 95% at temperature of + 40° C.

The DO-RA software also allows users to photograph the source of ionizing radiation. This can be done using the

(Continued on page 72)

ThermoFisher SCIENTIFIC

The Best Camera for Many Applications…..
The Only Camera for Some!

Thermo Scientific – CIDTEC is the preeminent supplier of radiation hardened and high dynamic range scientific cameras incorporating proprietary Charge Injection Device (CID) technology for use in the most demanding imaging applications.

The Thermo Scientific **MegaRAD** series of cameras are capable of operating in high-dose radiation environments such as nuclear reactors, fuel inspection, hot cell monitoring, remediation, surveillance, and X-ray imaging applications.

These extremely resilient and compact video cameras are available in either monochrome or color formats with remote head cable lengths of up to 150-meters. Imagers are available in RS-170, progressive scan, and CCIR formats.

Thermo Scientific also offers intensified versions of the MegaRAD cameras for extremely low light level imaging, UV signal enhancement, and for the gating of high-speed events.

The **SpectraCAM** scientific camera series offers unprecedented dynamic range, exceeding 26-bits in some applications. These cameras exhibit low noise, excellent native UV responsivity, non-destructive readout capabilities, and user-programmable windowing capabilities. The Thermo Scientific RACID Exposure software supplies an intuitive interface to the SpectraCAM while providing the user with the desired data in a wide variety of formats at the touch of a button.

All of the Thermo Scientific CID based cameras offer unmatched anti-blooming, wide dynamic range, and UV sensitivity performance that has become synonymous with CID technology.

Charge Injection Device

The Charge Injection Device (CID) is a solid-state imaging sensor with unique capabilities that make it well suited for applications where commercially available Charge Coupled Devices (CCDs) have difficulty. Like a CCD, the CID employs pixels to capture 2-D images, converting light into electronic charge, which is in turn displayed on a monitor or alternatively captured digitally on a computer. The CID architecture is designed to specifically be resistant to radiation damage, which is obviously a significant advantage for radiation tolerant and hardened imaging applications for the nuclear power, medical, dental, and aerospace industries. In addition, the inherent anti-blooming performance of the CID ensures accurate image detail even under extreme lighting conditions.

The CID is uniquely positioned to serve the growing imaging market and the challenges for higher levels of accuracy in the radiation tolerant inspection market, as well as machine vision, scientific imaging applications. Thermo Scientific - CIDTEC is the leading manufacturer of CMOS imagers using the CID pixel architecture, and Thermo Scientific provides imaging solutions to Original Equipment Manufacturers (OEMs) as well as directly to end-users throughout the world.

Applications

Thermo Scientific CID based video cameras and sensors provide solutions for the most demanding applications including:

- Radiation Hardened and Tolerant Video
- Spectroscopy
- UV Imaging
- Metrology
- Laser Profiling
- Medical Diagnostics
- Interferometry
- Aerospace
- Semiconductor Inspection
- Synchrotron Beam Profiling

Got Radiation?
See what you've been missing

The Thermo Scientific MegaRAD series of radiation hardened CID imaging cameras are capable of operating in high dose environments and provide excellent image quality to total dose levels over 100 times the tolerance of conventional solid state cameras.

- Color and Monochrome imaging to beyond 3 MegaRAD
- High resolution CID imager technology
- Small remote detachable head

Look closer at the Thermo Scientific line of radiation hardened cameras. Visit www.thermo.com/cidtec or contact us today about new innovative imaging products.

Tel: 1-315-451-9410 • Email: sales.cidtec@thermo.com

The world's only color rad hard camera

Innovative Preamp per pixel CID design allows high radiation tolerance and excellent image quality even in low light conditions.

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Thermo SCIENTIFIC

DO-Ra...

Continued from page 69

smartphone's built-in camera. In this case, the image of the source of ionizing radiation will contain the following information related to it: geographical coordinates, the time the image was taken and radiation level. The image can be sent via e-mail.

Background radiation dose measurement.

The DO-RA.Classic is currently fitted with the traditional Geiger-Muller (GM) meter, which, according to its Russian manufacturer, is capable of measuring hard gamma radiation in the range from 60 keV to 3 MeV.

SBM-21-1DO-RA.Classic with GM meter may: Operate in the following range of dose rate measurement of ionization radiation.

- From 1.5 mSv/h to 14.4 mSv/h with relative efficiency +/- 15%,
- And with less efficiency in a range of natural background radiation.

The device has radiation calibration. Sources from set of reference spectrometric gamma-radiation sources manufactured by Khlopin Institute are used for calibration. Also, we use personal spectrometer /radiation detector AT1321 as reference instrument for calibration. AT1321 has been certified under NSS1 and IEC 62327:2006. Both devices are similar. Differences in readings by 10-15% are allowed.

The certification of the device is expected to be conducted either at the Specialized Scientific Research Institute for Instrumentation Engineering or a similar state agency. Currently, the DO-RA already has the Certificate of Conformity from an accredited body obtained under the voluntary certification program.

Starting from October 2011, the DO-RA.Soft application has been available through all major online stores, including App Store, Android Market, WP7 Market, etc. , at no extra cost. A total of 11,000 downloads of the DO-RA.Soft app have been made so far, with 8000 downloads going to Android-run devices, 2500 to iOS-run devices and 800 to WP7-run devices.

Right from the beginning, the DO-RA.Soft app has been available in Russian, English and Japanese, with support for many more languages being planned. When you switch a phone or any other device with installed DO-RA.Soft, the software will automatically adjust itself to the new user.

We have plans to test it in Chernobyl in the future.

Sale and distribution

We are currently holding talks with several Japanese companies. The results of the talks are expected to be finalised soon.

In the middle of 2012, we will have finished developing engineering documentation for the Do-Ra device. A prominent company in Eastern Europe specializing in promo-design is working on preparing to help advance Do-Ra's mass production.

Do-Ra contact: Julia Davydova, Intersoft Eurasia; email: davydova@intersofteurasia.ru.

Nuclear Plant Journal believes that enablement of the general public with a radiation detection device similar to Do-ra will be very beneficial to the industry. It is also acknowledged that currently the developers have taken the first step. Comments from the industry expert on these devices, on how to make these devices optimally beneficial to the general

The effect of radiation on various organs.

public as well as to the workers engaged in nuclear environment will be helpful. The comments may be sent to the listed contact person with a copy of the email to newal@goinfo.com.

There are two additional organizations, worldwide providing/ developing a similar devices. Nuclear Plant Journal is in process of obtaining direct information from the respective organizations.

1. United States' Scosche's Model RDTX

http://www.scosche.com/consumer-tech/product/2254

2. Japan's Softbank's model Pantone 5 107 SH. ■

Utilities Seek Proven Solutions for New Challenges — AREVA Delivers

In today's rapidly changing world of energy, utilities are looking for vendors with vision and leadership to manage obsolescence issues and help them comply with evolving regulations. That's why AREVA focuses on delivering solutions that enhance performance and plant reliability. Through proven expertise, alliances and innovation, AREVA is fully committed to the success of the nuclear industry.

For example, the installation of AREVA's TELEPERM® XS recently received top industry honors as our customer wins the "Best of the Best" and the Vision and Leadership Top Industry Practice (TIP) Award at the annual Nuclear Energy Assembly Conference held in Charlotte, N.C.

This installation of AREVA's TELEPERM® XS is the first comprehensive application of a safety-related Digital Instrumentation & Control (I&C) Reactor Protection System in the United States. The system enables state-of-the-art digital processing of functions for the Reactor Protection System (RPS) and the Engineered Safeguards Protection System (ESPS).

For reliable, efficient inventory management, AREVA has new Integrated Product Solutions that include: Risk-Informed Procurement, Inventory Optimization and Warehousing, Commercial Grade Dedication, and Component Testing and Qualification, including the new U.S. Technical Center.

AREVA and VEGA Americas, Inc. have signed a cooperative agreement to provide safe, reliable and economical Spent Fuel Pool (SFP) Instrumentation solutions to nuclear utilities in North America. Through this agreement, utilities can leverage the combined expertise of AREVA, the world leader in nuclear services, and VEGA, the world leader in level measurement and instrumentation, to obtain safe and reliable, through-air radar level measurement solutions based on proven technology.

AREVA is committed to providing a comprehensive solution to meet your specific overall plant needs with proven engineering, solid project management and precise execution. To learn more about AREVA's solutions, visit **www.us.areva.com.**

Major innovations include:

- **Post-Fukushima Regulatory Solutions**
- **Cybersecurity Solutions**
- **Seismic Testing**
- **Integrated Procurement Solutions**
- **Global Testing Centers in France, Germany and U.S.**
- **Integrated Electrical Systems Upgrade**
- **Major Systems Installations or Modifications**
- **Digital Control Systems**
- **Total Motor Solutions**
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- **Variable Frequency Drives**
- **Electronic Monitoring Systems**
- **Electronic Equipment Restoration**
- **Regulatory Solutions**
- **Fire Protection**

AREVA

Angel Wings Improve Safety

By Troy Hollowoa, Entergy Nuclear.

Troy Hollowoa

Troy "Butch" Hollowoa is a 23-year employee at Entergy where he serves as project manager. Hollowoa's previous positions include auxiliary operator, component engineer, system engineer and maintenance first-line supervisor. He is a certified Project Management Professional, the most important industry-recognized certification for project managers. Hollowoa earned a Bachelor of Science degree at Arkansas Technical University and a Masters of Business Administration from the University of Arkansas, Little Rock.

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

This entry was a 2012 TIP Award Winner

The team members who participated included: Troy "Butch" Hollowoa, Project Manager, team lead; Terry Freeman, Corporate Projects; David Bauman, Project Manager; Terry Windham, Project Manager; Vicki Mills, Safety Manager.

During the Arkansas Nuclear One Unit 2 "A" reactor coolant pump (RCP) and motor replacement project, a significant amount of scaffold erection and removal must be performed to complete the work. This large scaffold scope increases the potential for dropped objects and increases the amount of radiological dose received. Ultimately, it challenges the outage duration.

Using Angel Wings, 40 scaffold tasks were eliminated for the RCP project improving safety and saving dollars. In 2012 ANO was honored by Nuclear Energy Institute with a Top Industry Performance award in plant support for Angel Wings.

Angel Wings are a safe, lightweight construction platform that is useful for many applications including welding and cutting, and inspection and repair of a number of industrial – and now nuclear – industry uses. They are made from a light aluminum alloy that is easily installed, dismantled and transferred by one person.

Angel Wings feature a compact, folding design. Each component is designed so that the stage can hold a 440-pound load with a 4:1 safety factor.

An Angel Wing is a remarkably simple product. It has been described as a portable work platform which installs in minutes without special tools. It has also been described as a non-powered suspended scaffold and as an elevated work platform; it qualifies as a member of the scaffold family of construction products.

Previously not used in nuclear but exclusively in the construction industry, a Job Safety Hazard Analysis was performed which approved to allow this type of portable work platform use at ANO.

Following hands-on demonstrations and discussions with safety representatives, the feedback collected was very favorable. In practice, workers gave Angel Wings a hardy thumbs-up for convenience, safety, ease of installation and overall cost and dose savings over use of scaffolding.

The ultimate affirmation was in the results: both industrial safety and radiological safety were improved. It was determined that there were reductions that totaled 1400 man-hours in the reactor building with an 800 mRem savings of dose in the total outage budget.

We evaluated the hard-dollar costs. Besides savings on scaffolding, the other financial benefit comes from the productivity gained when using the Angel Wings.

Welders that are comfortable in a secured elevation work perform more efficiently. The Angel Wing is a quality work platform that is lightweight and easy to put up and take down. The welders have noted the work-condition benefit of using this new structure over conventional scaffolding.

Angel Wings are a big improvement over scaffolding in time saved, financially, in safety aspects and any way you look at it.

An example of the true efficiency of the Angel Wings was during removal of the Whip Restraint Girder (WRG) bolting. Using traditional scaffolding would have required the scaffold to be constructed under each end of the WRG from below to allow access to the bolting. After bolting removal, scaffold would be removed, and then the WRG would be removed. The sequence would be reversed during WRG installation.

With the Angel Wings, the worker carries the Angel Wing to the work location, attaches the Angel Wing to the WRG and goes to work.

"We borrowed a best-practice from the construction industry with great results. I credit the team for being proactive to put this in place. Sometimes we get "stuck" doing the same things in nuclear – this is a brilliant addition to

the ANO plant, for our fleet and for the industry," said Terry Freeman, corporate projects manager and team member.

Angel Wings have proven to be a simple-to-implement and highly-effective improvement for daily and outage work.

Plant Background

Arkansas Nuclear One is a two-reactor site located in Russellville, Ark. On December 19, 1974, ANO Unit 1 began commercial operations and six years later, on March 26, 1980, ANO Unit 2 began generating electricity for the state of Arkansas. The ANO Unit 1 license expiration date is May 20, 2034; ANO Unit 2 expiration date is July 17, 2038. Together, the plants supply 1,823 megawatts of power, which is equal to approximately 25 percent of the total energy demand of the state.

The Occupational Safety and Health Administration acknowledge Arkansas Nuclear One as a 15-year participant at the Star level in the Voluntary Protection Program (VPP). VPP is the most prestigious workplace safety and health recognition program in the United States.

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Angel Wings

Evolution of...

Continued from page 68

the exact factory test values, even after the engine has been in the field for any number of years.

Diagnostic and monitoring capability

Digital systems offer diagnostic and monitoring options for every major element in the EDG system. On the engine alone the monitored temperatures now include the bearings, exhaust, air, oil, water, fuel, cooling water, pneumatics, and a few more. Add pressures, limit switches, and others, and the total sensor count can exceed 100 inputs. All this information is available for data logging. Given all this data, the operator can have a higher degree of certainty of the health of the EDG while it is running and at the time it was shut down—and have greater assurance that it will start the next time. Fairbanks Morse provides this expanded diagnostic and monitoring as non-safety construction (managed by digital serial link in a non-safety arrangement) and retains the required monitoring and shutdowns listed in IEEE 387 (IEEE Standard Criteria for Diesel-Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations) as safety construction.

Flexible logic

Digital controls also offer more flexibility and variety of options for rearranging the EDG logic sequences. Over the service life of the EDG, there will be changes to the hardware and the interconnecting wiring. In electromechanical designs, such changes are, at best, tedious—especially when compared to simply swapping out the printed circuit card that contains the memory chips that hold the program.

Future regulatory issues

Future emissions requirements may affect EDG design in several ways. They may eventually necessitate the use of electronic fuel injection for emissions control. This change, coupled with the industry expectation of black start, will require some new design planning to provide for the power requirements of the fuel injectors. Similarly, if standalone after-treatment systems become necessary, their processor-based controls will have to be arranged in such a way that no possible failure scenario can prevent the EDG from performing during a design basis event.

Conclusion

While much can be retained from the logic of analog EDG controls, the traditional analog hardware is rapidly being superseded by computer control, which provides far more features. Some decisions facing engineers and operators are listed in the box. With careful design, such as use of embedded processors, adequate configuration control, and appropriate siting of the controls within the design, the benefits of processor control can be safely exploited.

This article is based on a presentation at the Fall 2011 American Nuclear Society conference in Washington, D.C.

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Alleviating Tritium Concern

By Electric Power Research Institute.

During nuclear plant operation, leaks and spills can occur that lead to radionuclides such as tritium entering the soil and groundwater. While the levels of radioactivity in the soil and groundwater do not pose a health hazard, detecting and characterizing these leaks is important in ensuring public safety and informing remediation actions.

Nuclear power plants typically implement groundwater monitoring programs to understand the amount of radionuclides in the groundwater, to assess the extent of the plume, and to prevent off-site migration. Samples taken using traditional methods such as low-flow pumps, however, may take as long as a week to analyze, resulting in a time lag between leak occurrence and operator awareness.

Recognizing this limitation, EPRI has been investigating supplemental options for identifying leaks. There currently is no viable in-situ technology for detecting the low levels of radioactivity found in nuclear plant groundwater. Instead, EPRI has been exploring how technologies for monitoring other chemical and physical properties could be used to detect changes in the groundwater that might indicate contamination. These properties include conductivity, pH, dissolved oxygen, salinity, temperature, and water level.

One type of in-situ probe that has not been widely used in nuclear applications is called a sonde, which is specifically designed for long-term deployment in groundwater monitoring wells. Sondes can stay in the monitoring well between sampling campaigns and provide information about groundwater temperature, conductivity, level, and pressure.

Example of a downhole water quality probe. Photo courtesy of YSI Inc.

An increase in groundwater temperature, for example, might indicate a leak of hot system water from a particular part of the plant. Using an in-situ sonde, temperatures can be tracked over time and subtle shifts could trigger an investigation to determine whether a leak had really occurred or if the change in temperature was a natural occurrence.

In-situ sensors like sondes can detect minute changes and then alert plant personnel through telemetry systems such as radiofrequency or wi-fi networks. They also can be programmed to trigger automatic sampling systems when specified changes are detected. This way, anomalies can be immediately detected, sampled, and additional investigations can proceed.

The advanced technologies addressed in the EPRI report can enhance existing groundwater monitoring programs by capturing critical data between sampling campaigns. In effect, they can serve as the proverbial "canary in the coal mine," providing early warning of potential problems. Because the performance and applicability of these technologies are site-specific, however, field

Example of a downhole water quality probe. Photo courtesy of YSI Inc.

demonstration at nuclear power plants will be needed to fully assess their value as groundwater protection tools. EPRI is currently pursuing several such field demonstrations.

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A Pioneer Plant

Oconee Nuclear Station is located on Lake Keowee in Oconee County, S.C., eight miles north of Seneca, S.C. Unit 1 began commercial operation in 1973, followed by units 2 and 3 in 1974.

Since it began operating, Oconee has safely and reliably generated more than 500 million megawatt-hours of electricity — the first nuclear power station in the United States to achieve this milestone. Oconee is one of the nation's largest nuclear plants with a generating capacity of approximately 2.6 million kilowatts. This is enough electricity to power 1.9 million homes.

Oconee earned the further distinction of being the second nuclear station in the country to have its licenses renewed by the Nuclear Regulatory Commission (NRC) for an additional 20 years. All U.S. reactors are initially licensed by the NRC for 40 years.

Duke Energy nuclear power plants operate at a very high level of security every day. Oconee was designed and built with redundant safety systems and multiple barriers to protect the public, plant workers and the environment.

World of Energy

Located at Oconee Nuclear Station, Duke Energy's World of Energy offers educational activities and interactive exhibits for visitors interested in learning more about electricity generation, Duke Energy and Lake Keowee. This energy education center also regularly hosts free, family-friendly events.

Digital Upgrade

When it came on line in the summer of 1973, Oconee Nuclear Station, in Seneca, South Carolina, was one of the nation's first nuclear power plants to begin commercial operation. Years later, it became the nation's first nuclear station to generate more than 500 million megawatt-hours of electricity. In 2011, Oconee completed two more firsts.

The station performed major upgrades to its reactor protection system (RPS) and engineered safeguards protection system (ESPS), a first for a U.S. pressurized water reactor design.

The RPS/ESPS upgrades were implemented on unit 1 during the plant's spring 2011 refueling outage, making Oconee the first plant in the nation to move the systems from analog to digital. Units 2 and 3 will receive the upgrades during 2012 and 2013. While the operators' interaction with the new system isn't drastically different, the modifications

RPS Work.

further enhance the safety and reliability of an already safe plant.

With the exception of a few extra indicator lights and digital read-outs, the system looks and feels the same as the old one. Behind the scenes though, in cabinets full of computer equipment and large mazes of strategically placed wiring, the system provides real-time assessments and calculations on a number of important parameters.

On a continuous basis, the reactor protection system monitors inputs like reactor coolant system temperature and pressure, while the engineered safeguards system monitors pressure changes in the reactor coolant system and reactor building. If any limits are approached, the RPS/ESPS systems can automatically trip the reactor or activate key systems that would mitigate the situation.

On the flip side, the system also knows when to exclude inaccurate information. In other words, if one of the plant's many back-up sensors fails, the new system will automatically exclude the bad sensor and won't use it to make decisions for the plant. This prevents reactor trips and further improves plant reliability.

The upgrade was a large undertaking for Oconee, which planned an extended unit 1 refueling outage to accommodate the work.

"As the first plant in the nation to add this new equipment, Oconee is demonstrating its commitment to continuous improvement as new systems and technologies become available," said Oconee Site Vice President Preston Gillespie. "It's enhancements like these that have us well-positioned to operate a safe, reliable, efficient plant through the duration of our license."

With more units to upgrade, the project work isn't complete, and the site knows the industry is watching.

"Our plans went through an extensive approval process with the Nuclear Regulatory Commission, and we want to be an industry leader for this important work," Gillespie added. "The system has worked extremely well and we look forward to completing the upgrades on the other two units.

"Oconee has more than two decades of operation remaining on its current license, which was renewed in 2000," Gillespie added. "We're making the necessary investments in this plant, and we're implementing new systems and guidelines that position Oconee Nuclear Station as a leader in the industry."

A more detailed article on Oconee's digital upgrade, "Digital Has Served Us Well." (Questions and Answers by Michael Bailey, Nuclear Engineering Section Manager for I &C Systems at Duke Energy's Oconee Nuclear Station) may be reviewed in Nuclear Plant Journal, September October 2011 issue, Volume 29 No. 5, starting on page 32.

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ADVERTORIAL

Westinghouse Electric Company has a proven track record for providing the safest, most advanced and cost-effective technologies for the commercial nuclear power industry. Our research and technology is the basis for nearly half of the world's operating nuclear power plants, and we continue to make investments in new technology and processes that will take safety to even higher levels.

Worldwide electricity demand is expected to nearly double by the year 2030 and Westinghouse is preparing to meet this increased demand, while continuing to service existing plants. Leading the nuclear renaissance is our newest reactor design, the **AP1000** nuclear power plant. It is designed to shut down automatically, without the need for backup power, and will cool itself for 72 hours before any human intervention is necessary. This is made possible through the use of gravity, natural circulation, condensation and convection.

Westinghouse is also meeting the increased challenges faced by today's global power industry with the introduction of the Westinghouse SMR, a 225 MWe integral pressurized water reactor (PWR), with all primary components located inside of the reactor vessel. It utilizes passive safety systems and proven components, as well as modular construction techniques—all realized and already licensed in the **AP1000** nuclear power plant design. Westinghouse believes that this proven approach will provide licensing, construction and operational certainty that no other SMR supplier can match with competitive economics.

Nuclear Services
Westinghouse provides PWR and BWR support, advanced products, component services and training; engineering services to help plants improve reliability and sustain regulatory compliance; and installation and modification services, including plant engineering, welding and machining, site installation and decommissioning, and dismantling services.

Nuclear Automation
Westinghouse provides full-scope, word-class instrumentation and control (I&C) solutions for operating and new nuclear power plant designs.

Nuclear Fuel
Westinghouse partners with nuclear plant operators to support the fullest range of facility and fuel configurations including PWR, BWR, VVER and AGR, and Magnox reactors.

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To date, a total of ten **AP1000** reactors are under contract — four in China and six in the US. Construction is underway on four units in the US (Vogtle and VC Summer), after receiving their combined construction and operating licenses in 2012. All four Chinese plants remain on schedule, with the first Sanmen unit on track to produce electricity by the end of 2013.

The **AP1000** plant is ready to provide future generations with safe, clean and reliable electricity.

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