Nuclear Plant Journal

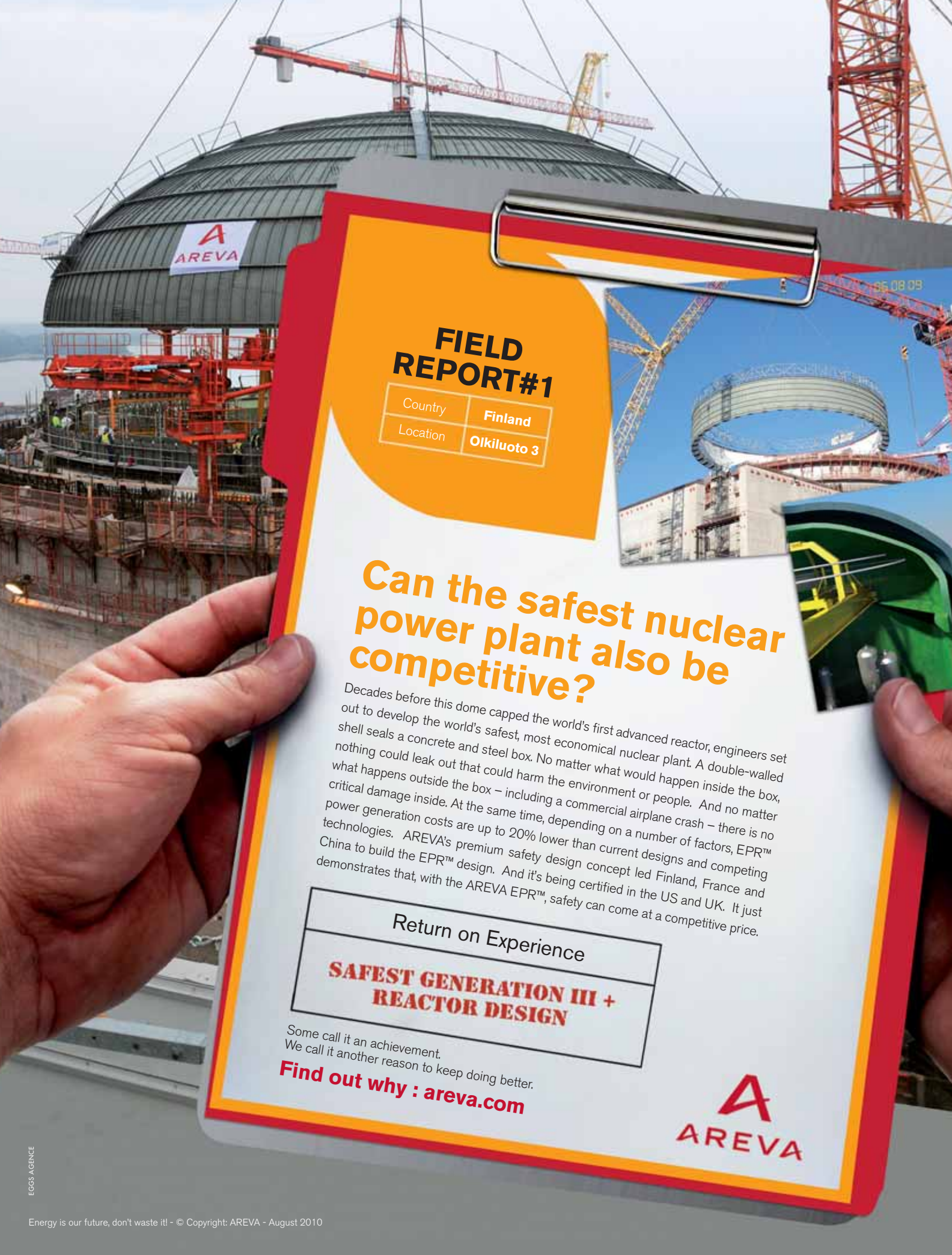
An International Publication
Published in the United States

Plant Maintenance & Advanced Reactors

Sanmen, China

September-October 2010
Volume 28 No. 5

ISSN: 0892-2055



NDE
FROM A TO

The world-leader in nondestructive (NDE) inspection solutions

Zetec is now hiring!
For current openings, please refer to:
www.zetec.com -> Company -> Careers

ZETEC®

Inside AREVA's EPR™ reactor containment structure at EDF's Flamanville construction site (August 2010).

Your Partner for New Nuclear Energy. Today.

For those companies looking at new nuclear, UniStar Nuclear Energy provides economies of scale and scope through coordinated and systematic development of a standardized fleet of AREVA EPR™ new nuclear energy facilities.

To find out more about UniStar, call 410.470.4400 or visit **www.unistarnuclear.com**.

For information on AREVA's U.S. EPR™ technology, visit **www.us.areva.com**

For monthly photo updates of construction progress, send your e-mail address to **info@unistarnuclear.com**.

EPR™ by AREVA

UniStar® NUCLEAR ENERGY

Building Certainty

Nuclear Plant Journal®

September-October 2010, Volume 28 No. 5

28th Year of Publication

Plant Maintenance & Advanced Reactors Issue

Nuclear Plant Journal is published by EQES, Inc. six times a year; January-February, March-April, May-June, July-August, September-October, and November-December (Directory).

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) 858-8787.

Staff

Senior Publisher and Editor
Newal K. Agnihotri

Publisher and Sales Manager
Anu Agnihotri

Assistant Editor and Marketing Manager
Michelle Gaylord

Assistant Office Manager
Kruti Patel

Administrative Assistant
QingQing Zhu

***Current Circulation:**

Total:	12,154
Utilities:	3,993

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

Articles & Reports

Industry Innovations

Plant Profile

Departments

Journal Services

On The Cover

With the commitment to build the first four AP1000 units at the Sanmen and Haiyang sites, China has entered a new era of sustainable, safe, and ecologically sound energy development. Photo courtesy of Westinghouse. See page 52 for a profile.

Mailing Identification Statement

Nuclear Plant Journal (ISSN 0892-2055) is published bimonthly; January-February, March-April, May-June, July-August, September-October, and November-December by EQES, Inc. EQES, Inc., 1400 Opus Place, Suite 904, Downers Grove, IL 60515. The printed version of the Journal is available cost-free to qualified readers in the United States and Canada. The digital version is available to qualified readers worldwide. The subscription rate for non-qualified readers is $150.00 per year. The cost for non-qualified, non-U.S. readers is $180.00. Periodicals (permit number 000-739) postage paid at the Downers Grove, IL 60515 and additional mailing offices. POSTMASTER: Send address changes to *Nuclear Plant Journal* (EQES, Inc.), 1400 Opus Place, Suite 904, Downers Grove, IL 60515.

List of Advertisers & NPJ Rapid Response

Page	Advertiser	Contact	Fax/Email/Website
2	AREVA NP, Inc	Donna Gaddy-Bowen	(434) 832 3840
11	Atomic Energy of Canada Ltd	George Bothwell	bothwellg@aecl.ca
13	The Babcock & Wilcox Company	Lisa Tomlin	lctomlin@babcock.com
37	Black & Veatch	Chad Pulley	(913) 458-2012
53	Crane Nuclear, Inc.	Drew Mead	(770) 429-4750
14	Curtiss-Wright Flow Control Company	Arlene Corkhill	(714) 528-0128
27	Divesco, Inc.	Susan Kay Fisher	(601) 932-5698
29	Enertech, a business unit of Curtiss-Wright Flow Control Company	Tom Schell	tschell@curtisswright.com
19	EXCEL Services Corporation	Donald Hoffman	(301) 984-7600
23	GE Hitachi Nuclear Energy	Karen Ellison	(910) 362-5017
17	HSB Global Standards	Betheny Allen	Betheny_Allen@hsbct.com
7	Kinectrics Inc.	Cheryl Tasker-Shaw	(416) 207-6532
31	MHF Services	Lisa Sabol	(866) 772-5282
25	Nuclear Logistics Inc.	Craig Irish	(978) 250-0245
9	Petersen Inc.	Susan Chrisman	(801) 732-2098
56	QualTech, a business unit of Curtiss-Wright Flow Control Company	Arlene Corkhill	(714) 528-0128
10	Reef Industries, Inc.	Chris Attaway	(713) 507-4242
22	Remote Ocean Systems	Sandy Kennedy	sandyk@rosys.com
43	Rolls-Royce	David Hall	www.rolls-royce.com
31	Seal Master	Thomas Hillery	(330) 673-8410
35	The Shaw Group Inc., Nuclear Power Division	Holly Nava	(856) 482-3155
39	Tri Tool Inc.	William Atkinson	(916) 351-9125
4	UniStar Nuclear Energy	Mary Klett	(410) 470-5606
49	Urenco Enrichment Company Ltd.	Please e-mail	enquiries@urenco.com
33	Westerman Nuclear	Jim Christian	(740) 569-4111
55	Westinghouse Electric Company LLC	Karen Fischetti	(412) 374-3244
51	Wolf Creek Nuclear Operating Corp.	Kelly Ledom	(620) 364-4155
8	Zachry Nuclear Engineering, Inc.	Lisa Apicelli	(860) 446-8292
3	Zetec, Inc.	Ki Choi	(418) 263-3742

Advertisers' fax numbers may be used with the form at the bottom of the page. **Advertisers' web sites are listed in the Web Directory Listings on page 45.**

Nuclear Plant Journal Rapid Response Fax Form

September-October 2010

To: _____ Company: _____ Fax: _____

From: _____ Company: _____ Fax: _____

Address:_____ City:_____ State: _____ Zip:_____

Phone: _____ E-mail:_____

I am interested in obtaining information on:_____

Comments: _____

Nuclear Experts
Knowledge is Power!

Kinectrics offers unique testing and assessment capabilities to help utilities and suppliers make and validate critical decisions for both existing nuclear plant operations and, new station design / build projects. We have been delivering proven solutions to the nuclear industry in North America for over 70 years.

KINECTRICS

$1,000,000 investment in new advanced EQ testing facilities!

Kinectrics Services

- Equipment Qualification
- Commercial Grade Dedication (CGD)
- Seismic Qualification
- EMI / RFI Testing
- Radiochemistry
- Tritium Management – Process & Plant System Design
- Field NDE (Visual to Phased Array UT methods)
- Electrical Equipment & Cable Condition Assessment
- Metallic and Non-metallic Material Evaluation
- Mechanical Testing & Aging Simulations
- Rotating Machine Monitoring & Condition Assessment
- Root Cause Failure Analysis & Forensic Evaluation
- Concrete Structure Assessment, Repair & Rehabilitation
- Obsolescence Management & Reverse Engineering
- Probability & Risk Assessment
- Radioactive Materials Characterization
- Fish Protection / 316 (a)&(b) Solutions
- Environmental Assessment & Thermal Studies
- Chemical Analysis

Advanced Services by Kinectrics Companies

- Field Inspection – CGSV & ASNT NDT & Level III Services by **Axiom NDT Corp.**
- Nuclear Regulatory, Safety, Licensing, Health & Environmental Services by **Candesco Corporation**

www.kinectrics.com

New Energy

New Build

Two North West companies **Cammell Laird** and Nuvia are announcing an ambitious partnership agreement which aims to 'catapult' them to the forefront of the UK's multi billion pound new nuclear build program.

The agreement will see Merseyside based Cammell Laird and nuclear engineering specialist Nuvia Limited, based in Risley, Warrington, join forces to bid for contracts for the fabrication of heavy modules and components for new nuclear plants.

Announcing the partnership the companies said the alliance could potentially create and secure hundreds of jobs at Cammell Laird when the new build programme begins in around two years time.

Under proposals announced by the Government in November 2009 10 potential sites have been identified for new nuclear power stations. If built the stations could generate up to 25 per cent of the country's energy needs, compared to 13 per cent now.

Contact: Cammell Laird, telephone: 44 1 51 649 6600, fax: 44 151 649 6699.

Supply Chain

EDF Energy held its second national supply chain event on September 13, 2010 for UK contractors bidding for billions of pounds worth of work on its nuclear new build programme.

The "New Nuclear Opportunities" forum highlighted the role that British businesses will have in delivering the company's plans to invest in new nuclear power stations in the UK.

EDF Energy proposes to build four new nuclear EPRs, with partner Centrica, subject to the right investment framework being in place.

EDF Energy announced the project has let over 130 contracts to British companies or consortia involving British companies to date, with a total value exceeding £50m ($78m).

The programme is expected to lead to about 150 further, major contracts worth many billions of pounds, and UK business is expected to play a considerable role.

Contracts announced include site preparation for Hinkley Point, awarded to Kier BAM. The work will include perimeter fence erection and providing site access improvements and utility connections.

Contact: David Litterick, telephone: 44 207 404 5959.

(Continued on page 10)

Bet you didn't know

Petersen Inc. has been in business for 48 years and has booked over $750,000,000 in sales. We have aimed for the moon and reached it! To put it in perspective, if every one of our project dollars equated to one mile, we would have made over 150 round trips to the moon in the past 30 years. Not too bad for a company with over 5,800 years of combined manufacturing experience. We must admit though, most of our work takes place right here on Earth.

Oh yeah, with that many years of experience, it's no wonder that founder, Denis Petersen, welded on the Lunar excursion module.

Current projects include producing the LAW and HLW Melters for the River Protection Project in Hanford, WA, as well as large and small projects for D.O.E. companies like Battelle, Bechtel. LANL, TRU Solutions and Shaw AREVA. Companies rely heavily on our expertise to help clean up and protect the environment.

Petersen Inc. prides itself in offering solutions that some may say are out of this world. What are you waiting for?

ASME U, U2, S, R • NQA-1 • ISO9001-2000

www.peterseninc.com • 801-732-2000

Woman Owned Small Business.

PETERSEN® INCORPORATED

"A Winning Combination."

Utah and Idaho

Manufacturing • Fabrication • Large Precision Machining • Small Precision Machining • Field Services • Warehousing & Distribution

New Energy...

Continued from page 8

Engineering Collaboration

GE Hitachi Nuclear Energy (GEH) has signed a preliminary agreement with India's Tata Consulting Engineers, Ltd. (TCE) to explore potential project design and workforce development opportunities in support of GEH's future nuclear projects in India and around the world.

As GEH prepares for potential ESBWR projects in India and other countries, planning to build new reactors, the agreement sets the stage for the companies to collaborate in areas such as workforce skills identification and development, as well as early feasibility design studies, product and project engineering work.

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

Small Modular Reactor

Savannah River National Laboratory (SRNL) and **Hyperion Power Generation Inc**. announced an agreement that could lead to deployment of a small modular nuclear reactor at the United States Department of Energy's (DOE) Savannah River Site (SRS).

The agreement was signed by John R. (Grizz) Deal, Chief Executive Officer and co-founder of Hyperion Power, and Garry Flowers, President and Chief Executive Officer of Savannah River Nuclear Solutions (SRNS). SRNS operates SRNL under contract to DOE.

"This is one of the first in a series of steps that can put this region in an active role toward transforming America's energy future," said Flowers. "Small and modular reactors can become the primary base of new, clean power for the world. SRS is an ideal place to develop and demonstrate this exciting technology."

Hyperion Power is developing a "mini" nuclear power reactor referred to as the Hyperion Power Module (HPM), which produces 70 megawatts of thermal energy. Connected to an electricity generating system, the thermal energy produces 25 MW_e.

The reactor features uniquely stable uranium nitride fuel, an environmentally secure lead bismuth eutectic coolant, and robust HT-9 stainless steel construction. Scientists on the HPM project believe they have selected the safest combination of materials studied over decades of the nuclear age to create the most proliferation-resistant designed reactor thus far.

Contact: Deborah Deal Blackwell, telephone: (703) 722-2821.

R&D Bill

The House Committee on Science and Technology's Energy and Environment Subcommittee approved H.R. 5866, the Nuclear Energy Research and Development Act of 2010, last week. The bill authorizes the Department of Energy to fund advanced research and development programs on various aspects of nuclear energy. Following is a statement from Alex Flint, the **Nuclear Energy Institute's** senior vice president of governmental affairs.

"This is important legislation. It provides the resources needed to keep the nation moving ahead in research and development that will take state-of-the-art technologies from the laboratory and make them available for commercial application. This is especially the case with the support for small modular reactor research, a technology with a lot of promise."

Contact: telephone: (202) 739-8000. ■

Strength in partnership

A nuclear solution built right at home. That's the value of a CANDU reactor program. Our focus on localization and technology transfer provides economic opportunities to local suppliers and shows our long term commitment to our markets. We've demonstrated this approach in our projects around the world with local content as high as 75%. It's another powerful reason to consider CANDU technology.

For more information, visit www.aecl.ca

AECL

Partnerships that Power the World

Utility, Industry & Corporation

Utility

ANO Tour

A group of future "Navy nukes" recently toured Arkansas Nuclear One to get a first-hand look at the technology that may one day bring them back to the industry as nuclear-plant employees.

The tour was coordinated by **Entergy** to meet a request from the Navy Recruiting District in Nashville, Tennessee, which directs recruiting activities in Arkansas, Tennessee and most of the South. The 10 recruits who visited ANO recently are preparing to enlist in the Navy Nuclear Propulsion Program and will be trained to serve on nuclear-powered submarines and aircraft carriers.

Contact: Ann Becker, telephone: (601) 368-5014, email: abecker@entergy.com.

Leadership Award

Retired **Entergy Nuclear** CEO Mike Kansler, a 30-year industry veteran who served at Entergy for nearly a dozen years, received the Utility Leadership Award at the 2010 American Nuclear Society Working Conference in August, 2010.

Mike Kansler (left) receiving the award from Jim Scarola.

Given only to a prestigious group of industry leaders in recent years, Kansler's achievements in his career – and specifically at Entergy during his rise as president of the second largest nuclear fleet in the United States – earned him this national utility distinction. Kansler led efforts to improve plant performance while decreasing outage times, to implement the Entergy Continuous Improvement program across all sites, and to standardize operations while building fleet culture.

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

Industry

NEI's Board Members

The **Nuclear Energy Institute** has elected Christofer M. Mowry, president of Babcock & Wilcox (B&W) Nuclear Energy, Inc., and K. Keith Roe, chairman, president and CEO of Burns and Roe Group, to its board of directors. Members of the NEI board typically serve three-year terms.

Mowry oversees B&W's commercial nuclear business and is leading the development effort to license and deliver the company's scalable, safe advanced light water reactor with modular architecture. In his role as chairman and CEO of Burns and Roe Group, an international engineering and construction company, Roe has full responsibility for all operations and administration. Roe is a graduate of Princeton University, where he earned a Bachelor of Science degree in mechanical engineering. He also has a Master of Science and an engineer's degree in nuclear engineering from Massachusetts Institute of Technology.

Contact: telephone: (202) 739-8000.

Review Improvements

Acting on an initiative advanced by Commissioner George Apostolakis and Chairman Gregory B. Jaczko, the **Nuclear Regulatory Commission** has taken steps to further improve the licensing reviews of potential applications to license small modular reactors (SMRs).

Commissioners Kristine Svinicki, William Magwood and William Ostendorff concurred in the proposal that directs the NRC staff to produce a plan within six months on how to more fully integrate the use of risk insights into pre-application activities and the potential review of small modular reactor applications.

Contact: telephone: (301) 415-8200, email: opa.resource@nrc.gov.

Corporation

EPR Studies

AREVA has signed an Early Work Agreement with Horizon Nuclear Power, joint venture between E.ON and RWE, for site specific design studies on its EPR™ reactor which the two German utilities are considering for construction in the United Kingdom.

Under the agreement, AREVA will undertake studies to support the deployment of two EPR™ reactors on Horizon's Wylfa site on the Isle of Anglesey in Wales.

In support of this early works activity, AREVA has also opened a project office in Gloucester, where Horizon Nuclear Power is headquartered.

Contact: Julien Duperray, telephone: 33 1 34 96 12 15, fax: 33 1 34 96 16 54, email: press@areva.com.

Director of Business Development

Michael Wadley has joined **Black & Veatch**'s as Director of Business Development within the company's nuclear business. In his new role, Wadley will be responsible for the development and execution of strategic business planning efforts and new business development activities, including direct support of major nuclear programs.

Wadley possesses more than 35 years of expertise in the nuclear industry ranging from plant operations to chief nuclear officer. Prior to Black & Veatch, he most recently served as Site Vice President at a nuclear generating plant in Minnesota.

Contact: Linda Lee, telephone: (913) 458-4629, email: leala@bv.com.

(Continued on page 16)

Delivering Proven Results

Nuclear capabilities for global energy needs

Nuclear Services

Manufacturing | Construction | Engineering

With more than 50 years of uninterrupted service, The Babcock & Wilcox Company (B&W) is an industry leader in commercial nuclear innovations. Through our North American nuclear operations companies, we provide quality solutions in inspection and repair services, heavy component manufacturing and construction to enhance plant capacity, efficiency and reliability.

B&W

www.babcock.com

clean energy technologies™

B&W nuclear steam generator mockup


The equipment and controls in this nuclear plant must function flawlessly.
And that's why they hire us.
For over 50 years, we've been a trusted partner of the nuclear power industry, providing innovative solutions for new and existing plants that improve performance, solve emerging obsolescence issues, reduce critical path outage time, and enhance safety. We look forward to the next 50 years.
CURTISS WRIGHT
Flow Control Company
Engineering transformation.™
Learn more about our plant performance solutions at www.cwfc.com

New Products, Services & Contracts

New Products

Thorium Reactor

The Accelerator Driven Thorium Reactor (ADTR™) power station is the name given by **Aker Solutions** to the energy source for a new type of nuclear power station. It is targeted at the global energy market, aligning itself with fourth generation reactor concepts that will come to fruition by 2025-2030.

The reactor is designed to drive a steam turbine/generator balance of plant similar to other nuclear power stations in design.

Contact: Victoria Ashley, telephone: 44 1642 334000, email: Victoria.ashley@akersolutions.com.

Energy Multiplier Module

General Atomics is developing the Energy Multiplier Module (EM2), an economically competitive approach to electricity generation that turns used nuclear fuel into energy without conventional reprocessing, in a closed fuel cycle, sustainable for decades.

Contact: Ken Schultz, telephone: (858) 455-4304, email: Ken.Schultz@ga.com.

Software Solution

Geovariances announces the launch of Kartotrak, the first integrated software solution based on geostatistical methods.

Kartotrak is designed to characterize in real-time sites that are contaminated by radioactive substances before, during and after soil or structure clean-up.

Kartotrak was unveiled at DD&R (Decommissioning, Decontamination & Reutilization Conference) in Idaho Falls, that was held from August 29th to September 2nd, 2010.

The decommissioning of radio-contaminated sites is a highly sensitive challenge: hundreds of facilities across the world - power stations, waste storage sites, research centers are - or will be - faced with this issue.

Contact: Ken Schultz, telephone: (858) 455-4304, email: Ken.Schultz@ga.com.

Modular Helium Reactor

The Modular Helium Reactor is **General Atomics'** latest design of the High Temperature Gas-cooled Reactor (HTGR), based on graphite moderator and core structure, helium coolant and TRISO-coated particle fuel. It offers modular size of 350 to 600 MWe, inherent passive safety, very low environmental impact with dry cooling possible, good economics, and excellent proliferation resistance.

Contact: Ken Schultz, telephone: (858) 455-4304, email: Ken.Schultz@ga.com.

Services

Valve Testing

VOTES® Infinity from **Crane Nuclear** is a portable, state-of-the-art diagnostic system that was developed to change the way valve testing is performed. By combining the voice of customers with Crane Nuclear's long legacy of valve diagnostic expertise and breakthrough technology, Crane Nuclear has engineered an innovative test system that simplifies the data collection and analysis process, reducing the time spent at the valve, and reducing human performance errors associated with valve diagnostics.

Contact: telephone: (800) 795-8013, email: info@cranevs.com.

Buried Pipe

Nuclear utilities are dealing with the new buried pipe initiative -- which is a challenging and complex issue – with all the different pipe systems, conditions, materials, and operating processes at each generation site. **IBEX** helps make this issue easier to deal with – by utilizing an integrated team approach that focuses on providing a Total Solution for assessing the performance of buried piping systems, groundwater conditions and other plant asset programs. From initial program assessment, to planning, to identifying high risk ranking elements – and on through inspection, leak detection and pipe repair/replacement – the IBEX Buried Pipe Alliance can assist utilities in preserving and managing assets long term.

Contact: Jett Anderson, telephone: (630) 730-7033, email: jett.anderson@ibexesi.com.

Contracts

Steam Generator

The Babcock & Wilcox Company (B&W) announced that its subsidiary Babcock & Wilcox Canada Ltd. (B&W Canada) has been awarded a replacement steam generator (RSG) contract from Industrias Metalúrgicas Pescarmona Sociedad Anónima (IMPSA) in Argentina.

B&W Canada will design and fabricate key components and provide manufacturing technology for the completion of four CANDU RSGs. IMPSA will deliver the completed RSGs to the Embalse nuclear plant, which is owned and operated by Nucleoelectrica Argentina, S.A. (NA-SA).

The work will be performed by B&W Canada's operations in Cambridge, Ontario, which has designed and manufactured more than 300 nuclear steam generators for customers worldwide.

Contact: Natalie Cutler, telephone: (519) 621-2120, email: nacutler@babcock.com.

Enriched Boric Acid

Ceradyne Boron Products, LLC ("Boron Products, LLC"), a wholly owned subsidiary of Ceradyne, Inc. announced a contract award of approximately $8 million for the supply of B-10 Enriched Boric Acid to Electricité de France SA (EDF) for its first European Pressurized Reactor (EPR) presently under construction

(Continued on page 16)

Contracts...

Continued from page 15

in France. Enriched Boric Acid is designed into the EPR as the primary coolant additive for rate of reaction control. Isotopically enriched boric acid increases criticality control, achieves higher levels of long-term control, reduces the corrosion effect and reduces operator exposure to radiation.

Contact: Dennis Manning, telephone: (918) 673-2201.

Emergency Diesel Generators

DRS Consolidated Controls, a DRS Defense Solutions line of business, has been awarded a contract to supply Fairbanks Morse Engine with nuclear safety rated controls for emergency diesel generators. The controls will operate and monitor emergency diesel generators at the Department of Energy's Mixed Oxide Fuel Fabrication Facility.

Shaw AREVA MOX Services LLC, a joint venture of The Shaw Group Inc. and AREVA, has a contract with the Department of Energy's National Nuclear Security Administration to design, build and operate the facility to convert surplus weapons-grade plutonium into fuel for use in commercial nuclear power plants. The facility is being built at the Savannah River Site near Aiken, SC.

The PLµS 32™ Digital Distributed Control System has been performing successfully in safety applications at six nuclear power plants in Asia for over ten years. Earlier analog versions continue to operate in over twenty nuclear plants throughout the United States. These controls are designed, built, and tested in accordance with U.S. Nuclear Regulatory Commission (NRC) requirements for Class 1E safety rated equipment.

In addition to the two PLµS 32 Digital Distributed Control Systems for the emergency diesel generators, DRS Consolidated Controls will provide two safety rated digital governors and voltage regulators.

Contact: Richard Goldberg, telephone: (973) 451-3584, email: Goldberg@drs.com.

Engineering Services

GEI Consultants, Inc., a geotechnical, environmental, water resources, and ecological science and engineering firms, announced that it is performing geotechnical engineering services at the Pilgrim Nuclear Power Station in Plymouth, Massachusetts. GEI is working for Holtec International.

GEI will perform the geotechnical investigations and calculations necessary to support the design of an independent spent fuel storage facility and haul path at the nuclear power plant site owned and operated by Entergy Nuclear Operations Incorporated.

Contact: Jennifer Shelby, telephone: (508) 685-0763.

Design Studies

Nuclear Power Delivery UK - the delivery organization for the Westinghouse-designed AP1000™ nuclear reactor - signed a contract with Horizon Nuclear Power for preliminary work to be carried out between now and the end of the year, as part of preparatory design studies for Horizon's proposed new power station in North Wales.

Contact: website: http://www.nuclearpowerdeliveryuk.co.uk/.

Waste Storage

The contract for the first phase of a massive new multi-million pound waste storage facility at **Sellafield** has been won by a Babcock and Balfour Beatty Joint Venture.

The contract, for the Early Contractor Engagement Phase of the Box Encapsulation Plant Product Store and Comprehensive Import Export Facility (BEPPS and CIEF) Project, will start immediately with completion of the entire project scheduled for 2019.

The BEPPS and CIEF project will incorporate the completion and expansion of a purpose-built, above-ground nuclear waste store and the construction of a new import/export facility to handle radioactive waste, arising from the ongoing nuclear decommissioning and high hazard reduction operations at the Sellafield site in West Cumbria.

Contact: John Reynolds, telephone: 01946 785848, email: john.z.reynolds@sellafieldsites.com.

Technical Support Services

The Shaw Group Inc. has signed an initial contract with State Nuclear Power Engineering Corp. Ltd., a subsidiary of China's State Nuclear Power Technology Corp. Ltd. (SNPTC), to provide technical support services for additional AP1000 nuclear power plants in China.

Beginning with two new AP1000 units at the Xianning nuclear power plant project in Hubei province, Shaw will provide technical support services, which include engineering and design management, project controls, quality assurance, construction management and project management, as well as health, safety and environmental management.

Contact: Gentry Brann, telephone: (225) 987-7372, email: gentry.brann@shawgrp.com. ■

Corporation...

Continued from page 12

Partnership

Nuclear Logistics Inc (NLI), a global provider of safety-related equipment and equipment maintenance to the nuclear industry, has formed a new partnership with Cooper B-Line to offer bolted framing, cable tray, pipe hangers and electrical enclosures to the nuclear industry. With an extensive range of combined experience, Nuclear Logistics and Cooper B-Line are now able to provide a wide range of products that meet the quality assurance requirements for Class 1E safety-related projects. Cooper B-Line, a subsidiary of Cooper Industries plc (NYSE: CBE), is a global provider of innovative, labor-saving support systems and enclosure solutions for engineered facility subsystem applications. Cooper B-Line's products are used in a variety of settings for the commercial, industrial, utility and OEM markets.

Contact: Craig Irish, telephone: (800) 448-4124, website: www.nuclearlogistics.com.

Teaming Agreement

Transnuclear, Inc. has signed a teaming arrangement with AT&F Nuclear, Inc. for the fabrication of NUSTOR™ spent fuel storage racks.

AT&F will manufacture NUSTOR™ racks in its new high-bay, 32,000 square-

foot facility in Cleveland, Ohio. Opened in November, the shop is dedicated exclusively to nuclear fabrication.

NUSTOR™ racks are designed to be flexible enough for deployment in any reactor spent fuel pool in operation, regardless of design.

Contact: Glen Rae, telephone: (434) 847-4925, email: glen.rae@transnuclear.com.

Final Design Review

Westinghouse Electric Company LLC has successfully completed the Final Design Review of the AP1000™ squib valves. Representatives from the U.S. Nuclear Regulatory Commission (NRC) and AP1000™ utility customers were in attendance during the Final Design Review.

The squib valve technology is used in aerospace and Department of Defense applications. It was selected to further enhance the AP1000™ Passive Cooling System. The twelve highly specialized squib valves found in each AP1000™ nuclear power plant are being manufactures by SPX Corporation for Westinghouse Electric Company. Westinghouse has also successfully completed prototype testing of the AP1000™ squib valves and has begun the manufacturing process.

Contact: Vaughn Gilbert, telephone: (412) 374-4896, email: gilberhv@westinghouse.com.

Leadership Certification

Westinghouse Electric Company announced that its Boiling Water Reactor (BWR) Service Center office building at its Chattanooga, Tennessee campus has achieved Leadership in Energy and Environmental Design (LEED) Silver certification from the U.S. Green Building Council (USGBC).

LEED is a third-party certification program and the nationally accepted benchmark for the design, construction and operation of high-performance green buildings. It promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality.

Contact: Vaughn Gilbert, telephone: (412) 374-4896, email: gilberhv@westinghouse.com.

Training Facility

Westinghouse Electric Company celebrated the grand opening of a First-of-a-Kind Startup Test Engineer Training Facility at its headquarters in Cranberry Township, Pennsylvania on August 25, 2010. The grand opening celebration included a ribbon-cutting ceremony, followed by facility tours featuring the facility's diagnostic lab room.

The Westinghouse Startup Test Engineer (WeSTE™) Training Facility will be used to train Westinghouse employees, customers and industry representatives on the proper testing and safe maintenance of Westinghouse AP1000 nuclear power plant systems, structures, and components. The Westinghouse Startup Test Engineer Training Facility is comprised of a state-of-the-art AP1000 simulator that replicates the AP1000 digital control, protection and monitoring systems for component testing and diagnostics training. In addition to the simulator, which is comprised of a digital lab room and a flow loop lab room, the facility includes two traditional training classrooms.

Contact: Vaughn Gilbert, telephone: (412) 374-4896, email: gilberhv@westinghouse.com. ■

New Documents

EPRI

1. *Pressurized Water Reactor Zinc Application: Data Analysis and Evaluation of Primary Chemistry Responses.* Product ID: 1021111. Published August 2010.

The Electric Power Research Institute (EPRI) Pressurized Water Reactor Zinc Application Users Group (PWR ZUG) facilitates and improves the use of zinc injection in PWR primary coolant systems by assisting in the evaluation of zinc injection performance; documentation of lessons learned; communication of information on zinc injection qualification, monitoring, and operating experience; and review of zinc application effectiveness regarding primary water stress corrosion cracking (PWSCC) and radiation field reduction.

2. *BWRVIP-167NP, Revision 2: BWR Vessel and Internals Project, Boiling Water Reactor Issue Management Tables.* Product ID: 1020995. Published August, 2010.

Nuclear utilities face numerous ongoing issues related to degradation of boiling water reactor (BWR) pressure vessels, reactor internals, and American Society of Mechanical Engineers (ASME) Class 1 piping components. These issues have resulted in the need for a summary tool to assist in prioritizing and addressing research and development (R&D) issues and BWR Vessel and Internals Project (BWRVIP) requirements.

3. *BWRVIP-87NP, Revision 1: BWR Vessel and Internals Project, Testing and Evaluation of BWR Supplemental Surveillance Program Capsules D, G, and H.* Product ID: 1021553. Published August, 2010.

Each boiling water reactor (BWR) has a surveillance program for monitoring changes in reactor pressure vessel (RPV) material properties due to neutron irradiation. This report describes testing and evaluation of BWR Supplemental Surveillance Program (SSP) capsules D, G, and H. These results will be used to monitor embrittlement as part of the BWR Vessel and Internals Project (BWRVIP) Integrated Surveillance Program (ISP).

4. *BWRVIP-113NP: BWR Vessel and Internals Project, River Bend 183 Degree Surveillance Capsule Report.* Product ID: 1021555. Published August, 2010.

Each boiling water reactor (BWR) has a surveillance program for monitoring changes in reactor pressure vessel (RPV) material properties due to neutron irradiation. This report describes testing and evaluation of 183-degree surveillance capsule for River Bend. These results will be used to monitor embrittlement as a part of the BWR Vessel and Internals Project (BWRVIP) Integrated Surveillance Program (ISP).

5. *H.B. Robinson Unit 2 Baseline Inspections of AREVA 15x15 HTP Fuel.* Product ID: 1021043. Published August, 2010.

The report specifically recommends fuel assembly visual exams, grid-to-rod fretting (GTRF) wear, and fuel rod corrosion thickness measurements for pressurized water reactors (PWRs). This report summarizes the post-irradiation examination report of AREVA PWR fuel operated at H.B. Robinson Unit 2. The plant had been identified as a "high priority" plant (Priority #1) for AREVA 15x15 HTP fueled plants and was recommended for inspection prior to the end of 2010.

6. *Inspection Methodologies for Buried Pipes and Tanks*. Product ID: 1021561. Published August, 2010.

This report presents techniques for the inspection of buried pipes and tanks from a user's point of view. The objective of the document is to assist utilities in the selection of inspection methods and to provide a perspective on the inspection capabilities of the various options. The technologies discussed include in-line buried pipe examination, indirect buried pipe assessment, and inspection of plates and welds in tanks.

7. *Advanced Nuclear Fuel Cycles — Main Challenges and Strategic Choices*. Product ID: 1020307. Published September, 2010.

This report presents the results of a critical review of the technological challenges to the growth of nuclear energy, emerging advanced technologies that would have to be deployed, and fuel cycle strategies that could conceivably involve interim storage, plutonium recycling in thermal and fast reactors, reprocessed uranium recycling, and transmutation of minor actinide elements and fission products before eventual disposal of residual wastes.

8. *Evaluation of Fuel Cladding Corrosion and Corrosion Product Deposits from Vandellos II Cycle 16: Final Report After Second Cycle of Zinc Addition*. Product ID: 1021037. Published September, 2010.

This study reports on a program co-sponsored by the Electric Power Research Institute's (EPRI's) Fuel Reliability Program (FRP) to qualify zinc injection in pressurized water reactors (PWRs). Zinc has been shown to have a positive impact on shutdown radiation fields and is beneficial for primary water stress corrosion cracking (PWSCC) initiation.

The above documents may be obtained from EPRI Order and Conference Center, 1200 West WT Harris Blvd., Charlotte, NC 28262; telephone: (800) 313-3774, email: *orders@epri.com*.

NEA

1. *Nuclear Energy Data 2010*,. ISBN: 9789264094383. Price: $35, 140 pages.

The above publication may be ordered at the OECD bookshop: www.oecd.org/scripts/publications/bookshop/redirect.asp.

Cost-free Document

Comparing Nuclear Accident Risks with Those from Other Energy Sources, ISBN: 978-92-64-99122-4. 52 pages.

The above free publication is available at www.nea.fr/html/pub/webpubs/. Paper copies may be requested by sending an email to neapub@nea.fr.■

EXCEL
SERVICES CORPORATION

With nearly 25 years of services, EXCEL has earned the reputation of the premier company providing diverse licensing, operations, and engineering services, which has made EXCEL uniquely qualified to manage large, complex projects supporting both the current fleet of reactors and the proposed fleet of new reactors, both domestically and internationally.

EXCEL continues to provide innovative solutions for complex operational, engineering, safety and regulatory issues, and provides insightful consultation to senior utility executives and committees striving to maintain and enhance the quality and safety of their organization. These services have proven to be extremely beneficial to the nuclear facilities and the regulatory agencies both in the U.S. and internationally as well.

This cumulative experience, expertise and knowledge ensure the development of the most cost effective, best quality product in accordance with the highest standards of professional excellence.

Vision. Passion. Innovation. Execution.

25 YEARS of Service

Services Domestic/International

Improved Technical Specification Conversions
Operations, Maintenance, Engineering Support
Logic System Functional Testing Evaluation
24 Month Fuel Cycle Interval Extension GL-91-04
Security Assessments
Fire Protection
Procedure Upgrade
UFSAR Upgrade
License Renewal
Power Uprate
Security Plans
Security Management
Construction Oversight
New Build Project Management Tools
Due Diligence
General Licensing Support
Steam Generator Replacement
General Part 52
Early Site Permitting
Combined Construction and Operating License
ITAAC
Licensing for Fuel Enrichment Facility
Department of Energy Facilities Support
Licensing for Test Reactors both Domestic and International
Design and Licensing Basis Recovery Projects
Probabilistic Risk Assessment and Risk Management
Nuclear Knowledge Management Consulting
Nuclear Knowledge Management Certification Course
Licensing for the Yucca Mountain Repository
Decommissioning
Environmental Qualification Evaluations
Preventive Maintenance Optimization
Reliability/Availability Studies
Environmental Report Site Evaluation
Setpoint Calculations
Fleet Setpoint Control Programs
Instrumentation Licensing

Select International Clients

Technical Specification Licensing Pilot – *Germany*
Compliance Matrix for PBMR Project – *South Africa*
Regulatory Management Group Development – *South Africa*
Licensing and Regulatory Support – *Finland, Sweden, Mexico, South Africa, Switzerland, UAE*
Technical and Regulatory Support – *Canada, United Kingdom, South Africa, Switzerland, UAE*
Decommissioning and Decontamination – *United Kingdom*
Regulatory Initiatives – *Russia, France, Bulgaria, Brazil, Argentina, Germany*

Charting the Course of Success...

11921 Rockville Pike, Suite 100
Rockville, MD 20852 USA
PHONE 301.984.4400
FACSIMILE 301.984.7600
WEB www.excelservices.com

Meeting & Training Calendar

1. The 13th International Conference on Environmental Remediation and Radioactive Waste Management. October 3-7, 2010, Tsukuba, Japan. Contact: John Bendo, **ASME**, email: bendoj@asme.org.
2. Nuclear Plant Chemistry Conference, 2010, October 3-7, 2010, Hotel Le Concorde, Quebec City, Quebec, Canada. Contact: Elizabeth Muckle-Jeffs, **Canadian Nuclear Society**, telephone: (800) 868-8776, fax: (613) 732-3386.
3. Nuclear Material Conference, October 3-9, 2010, ZKM Center for Art and Media, Karlsruhe, Germany. Contact: telephone: 44 0 1460 259776, email: numat2010@event-logistics.co.uk.
4. 11th International Conference on CANDU Fuel, October 17-20, 2010, Sheraton Fallsview Hotel and Conference Center, Niagara Falls, Ontario, Canada. Contact: Denise Rouben, **Canadian Nuclear Society**, telephone: (416) 977-7620, email: cns-snc@on.aibn.com.
5. **Nuclear Energy Institute** International Uranium Fuel Seminar, October 17-20, 2010, Hyatt Savannah, Savannah, Georgia. Contact: Janet Schlueter, telephone: (202) 739-8098, email: jrs@nei.org.
6. Building the Value Chain for Commercializing Small Modular Reactors, **Energy Experts**, October 18-20, 2010, Washington, D.C. Contact: telephone: (818) 888-4444, email: erind@infocastevents.com.
7. 17th Pacific Basin Nuclear Conference, October 24-30, 2010, Hilton Cancun Golf and Spa Resort, Cancun, Mexico. Contact: **Pacific Nuclear Council,** email: info@pbnc2010.org.mx.
8. International Conference on Challenges Faced by Technical and Scientific Support Organizations in Enhancing Nuclear Safety and Security, October 25-29, 2010, Tokyo, Japan. Contact: Dagmar Umgeher, **International Atomic Energy Agency,** telephone: 43 1 2600 21324, email: D.Umgeher@iaea.org.
9. 3rd International Symposium on Innovative Nuclear Energy Systems, October 31-November 1, 2010, Tokyo Institute of Technology, Tokyo, Japan. Contact: Yukitaka Kato, **CRINES, Tokyo Institute of Technology,** telephone: 81 3 5734 2967, email: yukitaka@crines.titech.ac.jp, website: www.crines.titech.ac.ip.
10. Licensing Information Forum, November 1-3, 2010, Marriott Crystal Gateway, Arlington, Virginia. Contact: Linda Wells, **Nuclear Energy Institute,** telephone: (202) 739-8039, email: registrar@nei.org.
11. 37th National Energy and Environmental Conference, November 1-3, 2010, Omni Hotel, San Antonio, Texas. Contact: **ASQ, Energy & Environmental Division,** telephone: (414) 272-8575, website: www.asq.org/ee.
12. Symposium on International Safeguards: Preparing for Future Verification Challenges, November 1-5, 2010, Vienna, Austria. Contact: Malcolm Nicholas, **International Atomic Energy Agency,** telephone: 43 1 2600 22140, email: M.Nicholas@iaea.com.
13. 2010 **ANS** Winter Meeting and Nuclear Technology Expo, November 7-11, 2010, Riviera Hotel, Las Vegas, Nevada. Contact: website: www.ans.org.
14. Facility Decommissioning Training Course, November 15-18, 2010, Tuscany Suites & Casino, Las Vegas, Nevada. Contact: Lawrence Boing **Argonne National Laboratory**, telephone: (630) 252-6729, email: lboing@anl.gov.
15. Winter 2010 Corrosion Symposium, November 16, 2010, Stevens Institute of Technology School of Engineering, Hoboken, New Jersey. Contact: **NACE International**, telephone: (800) 797-6223, website: www.nace.org/calendar.
16. **EPRI** Nuclear Utility Procurement Training Course, November 30-December 2, 2010, Charlotte, North Carolina. Contact: Electric Power Research Institute, email: bmcrimmon@epri.com, website: http://guest.cvent.com/.
17. TLD Dosimetry Training for Professionals Engaged in Personnel Radiation Protection, December 6-10, 2010, Oakwood Village, Ohio. Contact: Nicole Kelly, **Thermo Fisher Scientific**, telephone: (440) 703-1511, email: Nicole.kelly@thermo.com.
18. Conference on Nuclear Training and Education, February 6-9, 2011, Hyatt Regency Jacksonville Riverfront, Jacksonville, Florida. Contact: **American Nuclear** Society, website: www.ans.org/meetings.
19. **WM Symposia** 2011, February 27-March 3, 2011, Phoenix Convention Center, Phoenix, Arizona. Contact: telephone: (520) 696-0399, website: www.wmsym.org.
20. World Nuclear Fuel Cycle, April 5-8, 2011, Swissotel Chicago, Chicago, Illinois. Contact: Linda Wells, **Nuclear Energy Institute**, telephone: (202) 739-8039, email: ljw@nei.org.
21. International High-Level Radioactive Waste Management Conference, April 10-14, 2011, Albuquerque Marriott, Albuquerque, New Mexico. Contact: **American Nuclear Society,** telephone: (708) 579-8253, email: eleitschuh@ans.org.
22. iCAPP International Conference Exhibition, May 2-5, 2011, Nice, France. Contact: **SFEN,** telephone: 33 1 53 58 32 16, fax: 33 1 53 58 32 11, email: icapp2011@sfen.fr.
23. Nuclear Energy Assembly, May 9-11, 2011, Grand Hyatt Washington, Washington, D.C. Contact: Linda Wells, **Nuclear Energy Institute**, telephone: (202) 739-8039, email: ljw@nei.org. ■

Striving to be the Best

By Phil Summers, Exelon Corporation.

Striving to be "the best operator of nuclear power plants worldwide" is the Exelon Nuclear Vision. The maintenance organizations have implemented strategic initiatives in the areas of professionalism, knowledge transfer and retention and critical components and parts inventory control as key focus areas in support of the company vision. These initiatives are being implemented from the corporate office down to the maintenance technicians.

Professionalism in Maintenance

Professionalism is part of core business in Exelon's maintenance organizations. The first day that an individual steps into the maintenance department, they are assigned a mentor who leads them through "a day in the life" of a typical nuclear maintenance employee. Supervisors that are new to the maintenance department are walked around by the department head and introduced to the senior management team. They attend various strategy meetings to gain an understanding of how their role as a maintenance technician or a First Line Supervisor, supports the Exelon Nuclear Business Model. These measures provide a solid foundation for support of the Nuclear Vision. Observation of these strategy meetings help the new maintenance employees understand what it is required on their part to effectively demonstrate that the "key measures in safety, production and cost are achieved while executing the highest recognizable standards in nuclear professionalism."

The values of professionalism continue to be reinforced throughout the first year. Maintenance department supervisors are sent to a Basics Skills class taught by our station senior management team where the values of "Safety, Respect, Diversity, Integrity, Accountability and Continuous Improvement" are introduced to the future leaders. This class is followed up later in the year as part of the Supervisory Development Program (SDP). This program is designed to expose the new supervisor to both the nuclear and non-nuclear side of the power production and distribution business and is attended by supervisors from across the company. Maintenance workers also annually attend sessions on the Nuclear Safety Principles instructed by senior managers to emphasize the importance of day to day professionalism regarding safe operation of the plant.

The investment in future Exelon leaders continues beyond the qualifications years as demonstrated by the stations' commitment to have all supervisors participate in an interactive "Crucial Conversations" class. The investment has paid off as evidenced in the observable "open" communication that can be seen across departments. Additionally, key members of the maintenance department play a vital role in the "Janus Project" which is a strategic initiative to drive continuous improvement The overall project objective is for maintenance personnel to utilize operational experience to review and refine existing processes, and apply that information systematically fleet-wide. This project is currently analyzing the Preventive Maintenance optimization process to further enhance the operational focus of the maintenance department.

Exelon's professionalism focus does not stop with the supervisors. The value is continually reinforced at the technician level through work force engagement in resolution of plant, company and industry administrative and technical issues as well as involvement in community affairs. The maintenance technicians are engaged in improving the personal, radiological and nuclear safety processes. Examples include participation as Assistant Safety Advisors, representatives in standing committees in the SAT process of training, ALARA reduction initiatives, and in support of key community charitable support activities such as the United Way.

The pride and professionalism demonstrated by our technicians are exemplified in our Nuclear Master Craftsman of the Quarter program. Exelon recently established The Nuclear Master Craftsmen Award Program to recognize those Maintenance nuclear professionals that consistently demonstrate "precision

(Continued on page 22)

Phil Summers

Phil Summers is currently the Maintenance Director at the Quad Cities Nuclear Station, Exelon Corporation. Prior to his current position, he also held leadership positions with Exelon at the Braidwood Nuclear Station in the Instrument Maintenance, Work Control, and Nuclear Oversight Departments. Prior to his employment with Exelon, he held various management positions with Progress Energy at the Harris Nuclear Plant, as well as Parsons Engineering, and Westinghouse Idaho Nuclear Company. He received his B.S. and M.S degrees from Virginia Polytechnic Institute & State University and Tennessee Technological University, respectively.

Striving to be...

Continued from page 21

maintenance" within their respective disciplines (i.e., mechanical, electrical, and instrument). This program provides the highest level of recognition that can be achieved within the Exelon fleet Maintenance organization. Individuals receiving the Nuclear Master Craftsman award are recognized as an outstanding role model within their departments, demonstrate continued excellence in their field, willingly share their knowledge, raise standards with their peers, and provide the highest level of equipment reliability possible before, during, and after work performance. They are recognized by all as individuals that can be counted on to get the job done correctly the first time and hold others to the same level of professionalism.

The prime tool utilized in the maintenance professional toolbox is the application of the Exelon Management Model Handbook. This handbook delineates the tools needed to understand the company's vision, values, strategic focus areas, program and processes. The utilization of this tool demonstrates how the department management team executes, manages performance and assesses the results to strive to be the "best operator of nuclear plants worldwide."

Knowledge Transfer and Retention

Knowledge Retention and Transfer is an area that Exelon addresses with several different strategies. The strategies include the use of shared resources across functional areas to broaden the overall knowledge of plant operation, over-hires and the use of summer interns to provide a pipeline for future nuclear hires.

The knowledge retention process provides the tools to use in conducting risk assessments to determine the potential for loss of knowledge (especially undocumented) caused by the loss of experienced workers. Additionally, it identifies areas of vulnerability due to the lack of documented processes or procedures. A knowledge Transfer and Retention (KT&R) risk ranking is performed annually in conjunction with the analysis phase of the business planning process.

The shared resources approach is used in those areas that require a great deal of knowledge and hands-on expertise to become proficient. This approach allows the incumbent to work alongside the individual that will be their replacement to attain a solid understanding of the requirements of the position. This process improves the turnover and knowledge transfer and allows for a smoother transition for the highly skilled positions.

Exelon strategically approves over-hires in maintenance in preparation for upcoming retirements. This has allowed the new hires to get the necessary training, plant experience and transfer of knowledge prior to individuals retiring from the company.

Exelon has also fully embraced the use of summer interns. This program exposes potential new hires to vital

(Continued on page 24)

GE Hitachi
Nuclear Energy

Confidence built on experience.

How do you keep your nuclear deployment plans on track to succeed? Choosing a development partner with a proven track record is the perfect way to get started. For decades, GE Hitachi Nuclear Energy (GEH) has been developing nuclear plants on schedule and on budget while minimizing risk. Our approach combines GEH experience with innovation to give you more options – from proven ABWR Generation-III solutions to the simplicity of the evolved ESBWR design. GEH's commitment and leadership can make your plans a reality. To learn more visit ge.com/nuclear

HITACHI

Striving to be...

Continued from page 22

aspects of Nuclear Power and provides invaluable experience during their college years.

Exelon has partnered with several local universities and colleges to develop nuclear maintenance and operations training programs. The students enrolled in these programs are then placed in summer internships at the various Exelon sites to observe and work with the technicians and equipment operators for hands on experience. This gives the interns the opportunity to get a head start on becoming a maintenance technician or a non licensed operator. Several maintenance technicians have been hired from this program once they have finished their education.

Focus on OPCC

Exelon Nuclear identified that in 2009 there were 19 plant shutdowns that were a direct result of unexpected critical equipment failures. An evaluation of these events showed that there were opportunities for the organization to prevent the failures and the unplanned plant transients through better focus on the most important components. A Fleet Equipment Reliability (ER) High Impact Team (HIT), with representatives from all 10 Exelon Nuclear sites, have identified a small subset of components whose failure can directly lead to a plant transient of greater than 20% power. To clearly identify these components, a change in the critical component classification has been introduced to identify these components as "Operational Critical Components (OPCC)". These components are unique in that no redundancy is provided to prevent unacceptable consequences of failure.

The ER HIT is working with Engineering, Work Management (WM), Outage Services and Maintenance Peer Groups to improve the focus on these components. Through this collaboration a process been developed to identify tasks that have the potential to impact the function of an OPCC and provide additional reviews and oversight during the planning and execution of work on these components. During the planning phase, component Subject Matter Experts (SME) review work packages and identify unique requirements to ensure high quality work instructions are provided to the field. Incorporation of appropriate Operating Experience is considered critical to the success of this effort. These work packages also receive collegial reviews and management challenges to verify that work is ready to be performed successfully. Selected work activities receive coversheets that clearly identify the activity as one that can affect an OPCC. The coversheet provides clear expectations for the pre-job brief and how the work should be executed. During work execution, additional oversight and controls such as work "hold points" and certification of completed work packages by SMEs or First Line Supervisors are being implemented to validate proper work execution.

This process was identified as one of the key actions that contributed to one Exelon's plant improved on-line performance. Exelon has realized that the most important benefit is the improved focus and attention of the entire organization on ensuring these components are maintained at the highest level of reliability. Equipment Reliability is truly a "Team" effort and it takes the entire organization to achieve the results. Specific contributions of some of the organizations include:

- System Managers and Component Maintenance Specialists: Ensuring the right technical details and controls are specified for work being performed on an OPCC.
- Outage and Cycle Managers/Work Week Managers/Maintenance and Outage Planners: Ensuring the work and Post Maintenance Testing on OPCC is clearly defined, prioritized, and planned to facilitate flawless execution of the work as scheduled.
- Maintenance Craftsman: Ensuring that any work on an OPCC is clearly understood and any inconsistency or discrepancy in work instructions or the "as found" or "as left" condition is identified and raised to their supervisor.

The entire Exelon Nuclear organization is engaged in this process to ensure that a targeted focus is applied for all work performed on an OPCC. By doing the right work planning and execution up front, Exelon can achieve a reduction in plant transients, improve nuclear safety, as well as a reducing occupational dose, and improving work-life balance.

Inventory Control

At Quad Cities Station, staff has reduced the inventory of spare parts needed to support the operation of the plant resulting in an overall cost savings to the company.

This reduction in inventory has been achieved through several strategic supply initiatives. These strategies include shared stocking, where a particular item used at multiple Exelon locations will be stocked at one plant, and available for the entire Exelon fleet to use.

Some items are maintained in stock at the vendor's location so that specific items are available when needed, but not stocked in Exelon site inventory. In addition to shared stocking, interchangeable and spare components can be more efficiently utilized between Exelon sites.

Exelon also participates in PIM's, which is a Pooled Inventory Service in the industry that stocks required components/equipment that is common to PIM members. Options for reverse engineering are also utilized for further cost savings for the company.

The maintenance focus on professionalism, knowledge transfer and retention and critical components and parts inventory control are paying dividends in performance.

With continued focus on their strategic initiatives, the Maintenance Department is well positioned to fully support Exelon's vision to be "the best operator of nuclear power plants worldwide."

Contact: Phillip Summers, Exelon; telephone: (309) 227-2500, email: Phillip.Summers@Exeloncorp.com. ■

Maybe you can do this during the next outage.

Outages require negotiating one hazard after another.

But you can avoid a lot of problems just by replacing your low voltage breakers with MASTERPACT®. These breakers are easy to install, extremely reliable and virtually maintenance free—for 40 years! And while you may not be able to take the day off to play golf during an outage, the MASTERPACT® is just one of the many innovative products and services that NLI provides that will eliminate a variety of hazards and dramatically improve your score. Next time your facility is faced with equipment and maintenance challenges, call NLI. We're your single source.

NLI

NUCLEAR LOGISTICS INC

ELEMENTS FOR THE NUCLEAR INDUSTRY

www.nuclearlogistics.com • 800.448.4124

Creating & Maintaining Public Confidence

By Jack Grobe, Nuclear Regulatory Commission.

Jack Grobe

Jack Grobe is the Deputy Director for Engineering and Corporate Support in the Office of Nuclear Reactor Regulation (NRR). Notably, he leads the agency's initiatives in the areas of digital instrumentation and controls and fire protection at operating reactors. He holds degrees in Bionucleonics and Nuclear Engineering from Purdue University. In 2005 he was awarded with the Meritorious Executive Rank Award by the President of the United States for his contributions to nuclear safety.

1. *How do you compare the nuclear power plant safety with the trousers, suspenders, belt (three levels of support) analogy?*[1]

The analogy is kind of simplistic but it addresses two things. It addresses redundancy, meaning that you have two ways of holding up your pants but it also addresses diversity so not just two ways that are the same (left and right suspenders), and it is two ways that are different (suspenders, belt). So you have a higher likelihood of success. Let me go back to fundamentals and I'll talk a little bit and answer your question. But I'm going to take it a little bit differently than the way you asked the question. When we began regulating nuclear power a number of years ago we focused on trying to identify any potential malfunctions that could occur. This was before there were any sort of sophisticated computer capabilities or sophisticated probabilistic risk analysis capability. So we had very smart people that sat down and tried to figure out possible ways things could go wrong and we refer to those as design basis accidents. Then we insisted that the nuclear plants were designed with redundancy and diversity to address those. So for any potential type of accident that might occur, there are at least two systems and usually four that can assuage the consequences of that problem and typically the four systems are also diverse from each other meaning that they solved the problem differently. For example, if you feed water to a steam generator and I appreciate these technical concepts but how you cool the reactor core in a pressurized water reactor is for water to get to the steam generator, it's like an automobile radiator. If you lose that cooling water you have typically at a PWR three or four different systems that can put water into the steam generator, two of them are motor operated, meaning they use electricity from emergency diesel generators. One of them is a turbine driven pump using hot steam from the steam generator, that is generating steam so that steam will power the turbine-driven pump that pumps the water into the steam generator. So not only do you have redundancy but you have diversity in the systems that you design to mitigate the consequences of the problem.

So when we use the concept of defense in depth, we typically are talking about something more than redundancy and diversity. Defense in depth goes beyond that. It is looking at not only hardware but also what I call software which is humans and programs. So within the concept of defense in depth for example, the operators in the control room are part of defense in depth. If all of the systems don't work they have procedures. We call them emergency operating procedures. They're called symptom-based procedures. If the safety systems work even though there's a major accident, you won't have any of the symptoms that require the operators to take action. But if one of the safety systems isn't working, because something is malfunctioning, you will have a symptom, meaning a high-pressure, or a high temperature somewhere on one of the many parameters that they will monitor and the operators are now available to take action. So the defense in depth includes the administrative controls of designing equipment properly and operating it properly, it's the human involvement of having operators there just in case. The operator shouldn't have to do anything in response to an accident and then it's the redundancy and diversity in the hardware that's designed to mitigate the consequences of all these accidents. Redundancy and diversity in hardware; defense in depth goes beyond the hardware.

As we went along, we developed computer technology and what we can do today is extraordinary compared to what we were able to do 40 years ago. We have the capability to do very sophisticated analysis that we call probabilistic risk analysis. That uses what is called fault trees and you can think about this like a family tree. It has many branches so you take all the different faults that could occur and this is down to each individual piece of equipment a switch, a valve, a motor, a wire, all of these things can

[1]Analogy provided by Rod Adams of Atomic Insights (www.atmoicinsights.com).

An Interview by Newal Agnihotri, Editor, Nuclear Plant Journal at the American Nuclear Society Utility Working Conference in Amelia Island, Florida on August 10, 2010.

fail and each one of them has a failure probability and what you can do is with very sophisticated computer models you can go through all of these different equipment failures and try to identify what sequence of equipment failures might cause you a problem and then predict the probability of that. What probabilistic risk assessment does for us is two things. First, it gives us a much better handle on what are the important sequences of equipment failures so then we can pay attention. It also gives us the capability to predict what the likelihood of that is. We know the sequences that can cause problems. There might be a piece of equipment over here, a motor operated valve, if that fails it's really not that important because there are no sequences where that valve is important. It's part of our defense in depth, it's part of our diversity and redundancy so it's going to be there but from a probabilistic risk perspective it's not as important maybe as this air operated valve or this motor on this piece of equipment or this battery bank. So the PRA identifies the important sequences, gives us an indication of the likelihood of those sequences of occurring so it gives another level of importance and it causes us to focus our attention in the right places. Now we've taken to another level of safety not only do we have redundancy and diversity and defense in depth but we have a more detailed knowledge of what are the important components in that spectrum and we can spend additional attention on those.

2. *How does root cause analysis fit into the safety features described in question 1?*

Part of the defense in depth is commonly today referred to as safety culture but part of an important piece of that safety culture is the willingness to identify problems and address them and it's typically captured in a corrective action program. Every utility is required to have a corrective action program under our regulations. At a typical plant you would have in a typical year thousands and thousands of issues entered into the corrective action program. Anything from a light switch failing in an administrative building, that would go to the corrective action program and it would get taken

(Continued on page 28)

Continued from page 27

care of, to a major design defect in a piece of equipment. So you have a very broad diversity. What's important to the safety of a nuclear power plant is that everybody uses the corrective action program all the time. So everybody is feeding things in to this corrective action program. It gives you the capability to ensure safety of the plant. Most of the things that go in there are just fixed, you just fix it and track it and make sure that it's not a repetitive problem because they're very low-level issues, very simple issues, you just fix them.

At a higher-level you might do what's called an apparent cause where you put hours, a few hours, eight hours, 10 hours, 12 hours worth of effort into trying to figure out exactly what might have caused this to go to a higher level, a deeper level of understanding what caused it, making sure you take actions to prevent it in the future. For the most significant issues, each plant might have a few per year, you bring in a diverse team of people with all sorts of different capabilities and you integrate them together to do what's called a root cause analysis. Those would be the most significant deficiencies. They hopefully didn't result in an accident because the whole goal of this is to not have an accident. So these are the more complex issues that might involve equipment. They might involve people and processes and programs where you really want to get the full spectrum. The problem will have a human performance component. It will have a leadership and supervision component. It will have a programmatic component. It will have some hardware issues, some deficiencies, maybe an installation issue. So there'll be many things and that's why they're selected for root cause. The objective is to try to get to all of these different aspects of the problem to make sure that it's fixed.

3. *How do you ensure the safety of digital systems at the plants which are similar to Westinghouse's simulator for AP1000?*

I actually chair the digital instrumentation and control steering committee for the Nuclear Regulatory Commission. What you looked at is the control room for the next generation of reactors, called the AP 1000. We had one of our digital I&C steering committee meetings at Westinghouse specifically to see that simulator and study it.

At the current nuclear plants that are operating today for the safety systems we use what is called analog instrumentation and control and what that is, is you have a sensor that measures, for example pressure and that pressure measurement is converted to electricity and is commonly referred to as 4 to 20 milliamps. It's an electrical signal that is low voltage and low current and you have a pressure indication that's converted to an electrical signal that travels over a wire that goes to an actuation instrument, it might be a relay or something like that, that opens or closes a relay and causes something to happen. Either a light goes on or a pump starts or a valve closes or opens or whatever the case may be. It's very easy to maintain, when we talked about redundancy and diversity, it is very easy.

For a safety system there will typically be four instruments and they'll all be separate and all have separate converters, they'll all have separate wires, all have separate actuators and they'll do their thing and that's to make sure that one thing that fails or two things that fail can't cause a safety problem. So typically, for example in the Westinghouse pressurized water reactor there will be four instruments for every critical safety function. The non-safety related equipment is completely separate and the non-safety related equipment can't interfere with the safety functions. In a digital system it's a whole new ballgame because all of this information goes into a computer. So how do you keep the computer focused on what's more important? How you keep the non-safety signals from interfering with the safety signals? How do you keep the outside from interfering with the inside of the plant? The cyber security issue. All of these issues are thoroughly studied.

Right now the Oconee plant is the first plant in the United States to have a full upgrade of analog safety-related equipment to digital safety related equipment. That was just approved this past year. It hasn't been installed yet. It will be installed over the next several years. It's a three unit plant so it will take three re-fueling outages to install the equipment at all three units. It won't be like you saw at Westinghouse because it's an existing building so you can't do all of that. We spent about 7,000 hours of review effort with a whole team of digital experts looking at the software and hardware to make sure it was properly designed and will be safe, as safe as the analog system, it will be replacing. In our Office of New Reactors there are two branches of digital experts who are reviewing the new reactor digital instrumentation and control systems. Some of the reviews are going along well and some of them are more challenging. Under the direction of the digital I&C steering committee, over the past three years, we spent about 20 man years of effort developing guidance for utilities who want to retrofit or build new digital control systems.

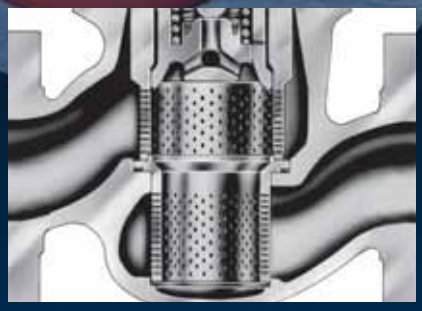
4. *Concluding remarks.*

I think what you folks do is critically important because if the public doesn't have confidence in what we are doing then we might as well not even bother trying. I'm very focused on making sure the information that the media has is good information.

Contact: Eliot Brenner, Nuclear Regulatory Commission; telephone: (301) 415-8200, email: Eliot.Brenner@nrc.gov. ■

Engineered Control Valve Solutions

Bring on your toughest nuclear plant applications



Dresser Masoneilan® Engineered Control Valves

When the catalog is not enough, rely on Enertech for your most challenging control valve applications. At Enertech, we have the expertise to deliver engineered control valve solutions in the most severe nuclear applications, such as high pressure drop, debris-laden fluid; high pressure drop ratio steam letdown; and extreme flow rangeability. Bring us your plant's most difficult service, and we will provide a proven control valve solution every time.

CURTISS WRIGHT Flow Control Company
ENERTECH

Learn more about our plant performance solutions at http://enertech.cwfc.com or call 866-211-6840.

Optimistic About the Global Nuclear Market

By Aris Candris, Westinghouse Electric Company.

Aris Candris

Aris Candris is the president and CEO of Westinghouse Electric Company. Prior to this appointment, Dr. Candris served as senior vice president, Nuclear Fuel, providing fuel fabrication, components and services to commercial nuclear power plants worldwide.

Prior to this role, which he assumed in September 2006, Dr. Candris served as senior vice president in charge of the Nuclear Services business unit. His areas of responsibility included ensuring nuclear plants operate safely and competitively through field, engineering, and repair and replacement services. He first held this position in 2000 and resumed the role in 2004 after completing a special assignment as senior vice president, Operational Excellence, from June 2003 through August 2004.

Dr. Candris holds a B.A. in physics, math and engineering from Transylvania University in Lexington, Kentucky, and an M.S. and a Ph.D. in nuclear engineering from Carnegie Mellon University in Pittsburgh, Pennsylvania. He is a member of the Board of Trustees for Transylvania University, and a member of the Nuclear Energy Institute's Board of Directors.

1. *What has been Westinghouse's strategy behind its growth in the last few years?*

Everyone knows that in the 1980s and 1990s, the nuclear industry, including Westinghouse, had a difficult time. Workforces contracted, hiring programs contracted and the market for new construction, especially in the United States, was dormant.

Fortunately, the lean years are behind us, and we are now experiencing unprecedented growth. In 2009, we hired more than 1,600 new employees, bringing the cumulative five-year total of new hires to more than 5000. Worldwide, we employ more than 15,000 persons in 17 countries.

Clearly, our current situation is much preferred. But growth brings challenges as well. For example, on an internal level, space to house our growing workforce has become an issue.

When we started planning for our new headquarters building [in Cranberry Township, Pennsylvania, USA] about four years ago, our forecast was that by 2014 we would need roughly 3,320 seats there and that our three new buildings would be sufficient. We have now occupied the three new buildings, are building a fourth and have leased space in two others-- and we're still running out of space.

And of course, preparing for the continuing global growth of the industry, including the emerging new plant business, the expansion in the fuel and services segment, and an expanding customer base—poses challenges that go beyond simply hiring, training and deploying human resources.

That is one of the major reasons why we are now implementing a new organizational structure built around a regional approach to business. Each region (Europe, Asia, Americas) will focus on customer relationships, business development, and product delivery with strong interaction with and support from our four product lines—Nuclear Power Plants, Nuclear Services, Nuclear Fuel and Nuclear Automation.

An interview by Newal Agnihotri, Editor, Nuclear Plant Journal in Cranberry Township, Pennsylvania on July 27, 2010.

2. *What is "Global Growth and Innovation" initiative at Westinghouse?*

Our Global Growth and Innovation initiative was started about two and a half years ago when we realized that we needed to take a hardcore, comprehensive strategic analysis of the entire company. We wanted to look at not only improving efficiencies internally; we wanted to look outward, as a result of the growth of the industry.

So we took 50 to 70 people from every area of the company and from all of our global locations, and assigned them to develop new ideas for improving the organization. Some of their suggestions were recommendations for strategic growth, and some were focused on improving the way we do things internally, both from an infrastructure and organization perspective.

We also picked the right time to look at our global structure, because much of the growth we had been experiencing, and continue to experience, is outside of the United States, especially in Asia and Europe.

Let me put our growth in perspective. A decade ago, Westinghouse was approximately a $1 billion company, with most of our revenues originating in the United States. Today, we are five times that large with about one-half of our revenues originating outside of the United States.

In essence, the Global Growth and Innovation initiative mapped out the process and the mindset that resulted in our new Regional approach to business that we are right now implementing.

Additionally as a result of the Global Growth and Innovation initiative, we've formed the Operations Support and Core Process Innovation department and have recentralized some functions such as quality, supply chain, and information technology that previously were distributed across the organization.

3. *What is Westinghouse's current involvement in the UK nuclear power market?*

The U.K. market is fast-emerging, and all indications are that the new government there maintains strong support for nuclear.

Westinghouse intends to deploy our AP1000 nuclear plant there through Nuclear Power Delivery UK, a team company of Westinghouse, The Shaw Group, Laing O'Rourke and Toshiba. We just signed an early works agreement with Horizon Nuclear Power, a joint venture of RWE and Eon that is investigating construction of a new nuclear power station in North Wales.

Also, Westinghouse has announced an arrangement with the U.K. Nuclear Decommissioning Authority (NDA) involving the long-term lease of the Springfields nuclear fuel manufacturing site, near Preston in Lancashire, in which the ownership of Springfields Fuels Limited (SFL) has been transferred to Westinghouse. SFL, which employs around 1,350 persons, is the company currently operating the site under the management of Westinghouse Electric UK Holdings Limited. This paves the way for significant investment by Westinghouse in Springfields that will maintain high-quality jobs and provide security for current and new employees. Longer-term, we would expect to expand production to manufacture fuel for AP1000 nuclear power plants we intend to build in the U.K. and elsewhere in Europe.

4. *India, too, is an emerging market for nuclear power. Can you comment on India's liability protection issue and its effect on Westinghouse?*

We have made if very clear to the Indian government that in the absence of proper liability coverage for western vendors, including Westinghouse and General Electric we will not be able to operate there. I have high hopes that this message has been heeded by the right governmental parties in India and that India will take the steps necessary to bring its nuclear liability regime into compliance with international norms.

On a global level, there is something called the Convention on Supplementary Compensation for Nuclear Damage (CSC)[1] adopted by the International Atomic Energy Agency in 1997. This is an international convention on liability, similar to the Vienna convention[2] that is in place right now. India is one of the countries that we would like to see participating in this organization, and

[1]NFCIRC/567, "Convention on Supplementary Compensation for Nuclear Damage," International Atomic Energy Agency, September 1997.

[2]INFCIRC/500, "Vienna Convention on Civil Liability for Nuclear Damage," International Atomic Energy Agency, May 1963.

(Continued on page 32)

Continued from page 31

India has expressed an interest in doing so.

In the meantime, we have been moving forward to augment our engineering resources in India as we prepare for work to begin in that country. We have finalized a master agreement with the global engineering services provider Infotech Enterprises[3] for the provision of balance-of-plant engineering services in India and the United States by creating the Westinghouse India Engineering Center (WIEC). Our partnership with Infotech serves as another sign of our commitment to the Indian market. This is one of several relationships that Westinghouse is forming with Indian companies. We have also established Memoranda of Understanding with several partners in India including Larsen and Toubro and Nuclear Power Corporation of India.

5. *What is Westinghouse's current involvement in China's nuclear energy program?*

In 2007, Westinghouse signed an agreement with China to build four nuclear power plants and to transfer technology for the AP1000 to the State Nuclear Power Technology Corporation (SNPTC).

I am happy to report that we are off to an excellent start. The first of two plants at Sanmen is scheduled to come online in 2013 and the first of two in Haiyang in 2015.

This is important because when progress on a nuclear power plant falls behind anywhere in the world, it reflects negatively on the whole industry, as the general public and the finance industry do not tend to make a distinction between vendors. That is just one reason why we want to see nuclear plants under construction around the world, including those projects under construction by our competitors, to be built in a timely, on-budget manner.

The world is watching the progress that Westinghouse is making in China, and the good news is that the projects at Sanmen and Haiyang are on budget, on schedule, and proving a great deal of the promise that both Westinghouse and our Chinese customers desired. For example, the timeframe from first pour of nuclear concrete to the installation of plant's the last structural module was 12 months on Sanmen Unit 1 and 10 months on Haiyang Unit 1. These timescales demonstrate vast improvements over conventional nuclear plant construction.

We are also employing innovative construction techniques in China that will be helpful as we begin to build AP1000 reactors elsewhere in the world. The manner of construction, as compared to previously built plants, is as different as night and day. The footprint is about one-third to one-fourth the size of those at existing plants, and the construction is mostly modular. Much of it is built in the factory under a strict quality control and quality assurance program, and then shipped to the site, where it is assembled.

Of course, as on any large engineering project, we face challenges, but we are capturing daily significant lessons learned in order to proceed smoothly. We are targeting an on-schedule installation of the reactor vessel at Sanmen Unit 1 in the spring of 2011.

The AP1000 is truly a new generation of nuclear plant that provides the kind of schedule and financial assurances that we need as an industry to move forward. But no matter how good the technology is, unless the financial sector sees new nuclear projects as a manageable risk, it isn't going to move forward. So with the AP1000 design, we are proving that we can build these units on time and on budget, and the world will see that nuclear energy is a viable and workable energy option.

6. *What is the long-term business arrangement with China for the transfer of Westinghouse technology?*

It is not unusual to sign a technology transfer agreement with a project of this scope. The Chinese want to have eventual control over the deployment of nuclear energy in China, and this arrangement will enable that to happen. But the agreement is mutually beneficial. Westinghouse benefits by being able to build the first AP1000 units sooner rather than later, and we will also be long-term participants in the future deployment of AP1000 units there.

We are negotiating for 10 more units in China, and there will be significant scope for Westinghouse, as no country can become fully competent with a new technology overnight just because the documentation and deliverables are passed over to it. It is a win-win situation for both Westinghouse and the Chinese.

The reason that we participate in technology transfers is that we continue to advance nuclear technology and our belief, proven over decades, is that we will continue to stay a step ahead of the pack, if you will.

Korea is another good example of the mutual benefits of technology transfer. There, we are still participating, after 21 years, in the construction of new plants[4].

Korea Electric Power Company (KEPCO) recently won the contract to build four nuclear power plants in the United Arab Emirates (UAE). Westinghouse also has significant scope in those projects.

7. *What is Westinghouse's involvement in smaller countries such as Vietnam, Thailand, and Indonesia?*

These countries are experiencing tremendous growth, so there are good reasons behind their interest in nuclear energy. Vietnam, which has a prior relationship with Russia, is starting with Russia's VVER[5] reactors. Westinghouse

[3]Collectively, "Infotech."

[4]The technology basis for the Korean Next Generation Reactor (KNGR) is the Westinghouse 1350 MWe System 80+™ advanced plant design, the only large evolutionary PWR that has received design certification from the U.S. NRC under its one-step licensing process.

[5]The VVER is the Russian version of the Pressurized Water Reactor (PWR).

has had discussions with the Vietnamese, and we're confident it will open the market to Western vendors for commercial bids. I have no doubt that with the AP1000 design, Westinghouse will be a player in Vietnam.

All of the members Association of Southeast Asian Nations (ASEAN), which includes Vietnam, Thailand, and Indonesia, have recently begun to outline aggressive plans for their countries' energy needs, and we are optimistic that in the coming years, the ASEAN countries will look to the West, including Westinghouse, for their nuclear energy needs.

I'd like to add that we've been contacted by upwards of 50 countries that are interested in building nuclear reactors. We obviously are not chasing all of these markets, but there are a lot of serious discussions going on for new build to happen in the 2020 time frame.

8. *Do you believe that these smaller countries can get financing for nuclear energy from the Export-Import Bank (EX-IM)[6] and the World Bank?*

To my recollection, we have not had an occasion where a country went to EX-IM for financing and did not get it. So if these smaller countries qualify, in terms of their credit--and most of them do--the financing will be there. The nuclear industry has excellent support from the EX-IM and other global financing organizations, with the exception of the World Bank, which generally does not get involved in offering loans for nuclear energy projects.

9. *Concluding remarks.*

I am very optimistic about the global nuclear market, and especially about the Westinghouse share of that market. The Chinese will eventually build hundreds of plants, so the world will see a huge fleet of AP1000 reactors. There is bright future out there, and once we get past these brief difficulties associated with the current financial crisis, the nuclear renaissance is going to proceed smoothly.

Contact: Sarah Barczyk, Westinghouse Electric Company, 600 Cranberry Woods Drive, Cranberry Township, PA 16066; email: barczysj@westinghouse.com.

[6]The Export-Import Bank of the United States (Ex-Im Bank) is the official export credit agency of the United States. Ex-Im Bank's mission is to assist in financing the export of U.S. goods and services to international markets.

A Modular & Versatile Reactor

By Eric Loewen, GE Hitachi Nuclear Energy.

Eric Loewen

Eric P. Loewen, PhD, is Chief Consulting Engineer, Advanced Plants Technology of GE Hitachi Nuclear Energy. He is currently promoting the sodium cooled reactor and electrometallurgical processing of used nuclear fuel as an option for US President Obama's Blue Ribbon Commission on the future on nuclear energy.

The American Nuclear Society's 2005 Congressional Fellow, Dr. Loewen worked in the office of Senator Chuck Hagel (R-NE) where he coordinated the Senator's inclusion of America's first legislation addressing global climate change policy into the Energy Act of 2005. Joining the Idaho National Laboratory in 1999.

Loewen graduated from Western State College, Gunnison, CO, with a Bachelor of Science, Mathematics and Chemistry, and attained a Master of Science, Nuclear Engineering and PhD, Engineering Physics from the University of Wisconsin - Madison. He is currently Vice President/President-Elect of the American Nuclear Society.

1. *What percentage of design of PRISM is complete?*

About 30%, but it's important to note that the conceptual design is fully complete. Most of the work was accomplished prior to 1994 as the government's Advanced Liquid Metal Reactor (ALMR) program. A GE-led commercial consortium continued the program as the Power Reactor Inherently Safe Modular (PRISM). In 2006, GE Hitachi Nuclear Energy (GEH) began validating and updating that earlier work for the Bush Administration's Global Nuclear Energy Partnership.

2. *During the design phase are you taking advantage of system simulation and other computational tools to analyze safety and licensing issues? Is this effort being undertaken in-house or it is subcontracted to another organization?*

Simulation and modeling is a part of our design process that we are conducting in-house.

3. What is the planned megawatt capacity/ capacities (electrical) of PRISM?

GEH recognizes PRISM as our small modular reactor. PRISM MOD A is 170 MWe. PRISM MOD B is 300 MWe. S PRISM is 360 MWe. Therefore, we feel that we have the 3 different grid appropriate reactor sizes to meet the needs of our future customers.

4. *Provide a spotlight on the digital instruments and controls of PRISM. Has GE Hitachi Nuclear chosen a vendor to supply the digital controls and instrumentation for PRISM?*

The PRISM conceptual design was fully digital in the late 1980s. Currently, Generation III and III+ designs that use digital controls are working on many issues with the Nuclear Regulatory Commission (NRC). When the PRISM detailed design process starts again, we will take lessons learned from this process and improve PRISM design from there.

5. *Who is manufacturing the key components, such as reactor vessel, turbine, fabricated modules, steam generator (if applicable), diesel generators, piping, large valves, and large motors for PRISM?*

GEH's PRISM reactor has the potential to be fully fabricated in the U.S. since the reactor vessel can be easily fabricated with domestic suppliers. GEH's location in Canonsburg, PA has the capability to build the PRISM reactor vessel, and many other components for the PRISM reactor system. This capability was affirmed in 2007. Other components could be built by GE subsidiaries in the U.S., including the unique electromagnetic pump (EMP) to circulate the molten sodium.

6. *Who will be supplying the fuel for PRISM? Has GE Hitachi Nuclear or one of its contractors done a fuel analysis to ensure the optimal efficiency and optimum safety?*

The optimum safety for fuel in PRISM is the use of metallic fuel. If PRISM starts up on a uranium core, this could be done with the private sector. If PRISM starts up on a plutonium core in support of the president's nuclear weapons materials reduction, we see this being done in a government facility. Importantly, the national laboratory infrastructure could supply the initial core for PRISM as the efficiency and optimization is worked out.

7. *What thermal hydraulic testing and analysis has been done on PRISM to ensure reactor safety and efficiency?*

Much of this work was completed by the Argonne National Laboratory during the ALMR program.

(Continued on page 36)

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

SAME PLANT, MORE POWER
MAKES GREEN SENSE

Shaw's nuclear power uprates generate more power from operating plants, meeting growing energy demand with existing resources. We've helped our clients add more than 3,000 MW to the U.S. power grid. Whether the solution is building a new nuclear plant or increasing the efficiency of an existing one, Shaw puts the power of nuclear to work for you.

ENGINEERING, PROCUREMENT, CONSTRUCTION
UPGRADES, UPRATES & RESTARTS
LICENSING SUPPORT & SAFETY ANALYSIS
MAINTENANCE & MODIFICATION
SPENT DRY FUEL STORAGE

Shaw®

POWER • ENVIRONMENTAL & INFRASTRUCTURE
ENERGY & CHEMICALS • FABRICATION & MANUFACTURING

www.shawgrp.com/MorePower

A Modular...

Continued from page 34

8. *Please summarize the results of serious accident analysis, including loss of coolant accident (LOCA) and Non-LOCA analysis that has been done on PRISM to ensure safety and reliability?*

The PRISM conceptual design is safe and reliable.

9. *What are the different applications such as desalination, hydrogen generation, and other industrial applications which may utilize PRISM?*

PRISM has potential to perform all the applications listed above. The key take away regarding the PRISM concept is that it can produce clean power in an economic manner.

However, the relatively low PRISM operating temperature of 500˚ C makes it unattractive for optimal hydrogen production / generation.

For other industrial applications, PRISM is a typical candidate for co-location with sited coal and / or natural gas power plants that are currently attached to the grid.

Considering its relatively small size and its modularity to support electricity generation expansion, PRISM may also be considered appropriate for military complex placement to assure energy security.

10. *How will the sale of reactors in small countries such as Vietnam, Indonesia, Thailand, Angola, and others be supported financially?*

Neither GEH nor any small modular reactor vendor can solely finance deployment to a third world nation. The infrastructure, staffing, security and sustainability costs cannot be realistically accommodated by industry alone.

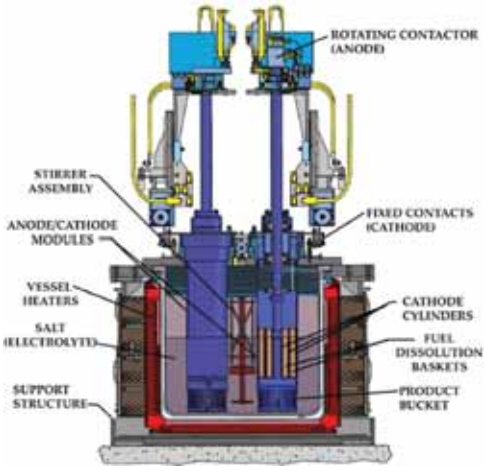
11. *How did you determine the material suitability for the reactor vessel and other components taking into account the corrosion, cracking, and other material degradation issues which have occurred in current light water reactors in the last 30 years?*

PRISM operates at lower operating temperatures and with coolant shielding conditions that provide much less material challenge to the reactor vessel and the balance of plant machinery. Further, we have incorporated past lessons learned.

12. *What are the design features which makes PRISM a better reactor to withstand terrorism attack?*

The PRISM reactor vessel provides two special conditions that thwart terrorism attack:

- The reactor vessel is located below grade, and
- Any disruption to normal reactor operation triggers an automatic passive shutdown. The sodium coolant quickly "freezes" to a solid encasement which prevents near-term access to the targeted fuel rods.



13. *Why you believe your reactor may be constructed on time and under budget, without any cost and time overruns?*

As with any new reactor, the first step is the NRC licensing process. Once that time/cost challenge has been addressed, PRISM construction (U.S. based) and deployment will face all other reactor systems challenges. PRISM is unique in that the construction challenges will be simplified by U.S.-based construction of previously proven technologies – reactor vessel, electro-magnetic pump, and the balance-of-plant infrastructure.

14. *How will PRISM minimize its per megawatt cost by making the thermal hydraulics and fuel more efficient?*

GEH will continually seek ways to improve its product and make it more efficient, especially from lessons learned once one is in operation.

15. *Provide a brief description of PRISM providing additional information which is not covered above.*

Simply put, the PRISM reactor could decrease the long-term radioactivity of used nuclear fuel and thus reduce the storage time for the waste products. GEH believes that the "recycling" of used nuclear fuel should be pursued, rather than "reprocessing." The terms may sound similar, but there is a significant difference. The PRISM reactor, as part of the Advanced Recycling Center (ARC) would "recycle" used nuclear fuel without the separated plutonium created by "reprocessing," which is a potential proliferation concern.

Recycling would generate additional electricity from used nuclear fuel. Today, used fuel is incorrectly considered "waste." In fact, about 95% of energy reserves remain when used fuel is removed from a light water reactor – it simply needs to be used in a different kind of reactor. With our PRISM and ARC initiatives, we could reduce the amount of eventual waste product dramatically, not only in volume, but more importantly in how long it remains highly radioactive. Today's used nuclear fuel could take up to 1 million years to return to the low-level radioactivity of uranium mined from the earth. But, after recycling, the waste product would be highly radioactive for only 300-500 years. In the U.S., this offers a new path in the debate about a long-term repository, removing uncertainty from the equation.

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

BUILDING A WORLD OF DIFFERENCE®

planning | consulting | design | implementation

From operating plant services to new-build advanced units,
Black & Veatch has experienced teams to provide full-service
consulting, design, procurement and construction for your nuclear project.

www.bv.com

BLACK & VEATCH
Building a world of difference®

Profound Respect for the Core

By Mike Kansler, Entergy Nuclear.

Mike Kansler

Kansler joined Entergy in 1998 as vice president of operations support, based at Entergy Nuclear's headquarters in Jackson, Miss. In 2000 he was named as the company's chief operating officer for the Northeast, then becoming president of the same region. In 2007 he was charged with Entergy fleet executive management responsibilities as president, CEO and CNO.

Kansler's educational background includes a bachelor's degree in mechanical engineering from Virginia Polytechnic Institute and State University, earned a senior reactor operator license, and completed Pennsylvania State University's executive management program.

Kansler served as chairman of the Nuclear Energy Institute Nuclear Strategic Issues Advisory Committee; on the board of directors for the Institute of Nuclear Power Operations and is a former member of the INPO National Nuclear Accrediting Board. He is a member of the American Society of Mechanical Engineers. He is a founding member of the Northeast Energy Alliance and serves on the Executive Committee of the Energy Association of New York State.

1. *What were Entergy's strategies to being successful when other utilities were hurting in the early 80's?*

Let's start with Indian Point 2 and Indian Point 3 as successful acquisition examples. Two different companies were running each reactor on the same site, side-by-side. Entergy always knew we could go in there and operate the plants, improve plant conditions and make them peak performers. We also knew they would be profitable especially with deregulation allowing these plants to be merchant plants.

Entergy knows nuclear operations - how to make these plants run well and safely. At that time, the owners were willing to sell off what they perceived as a nuclear liability and we were willing to take it on.

The one thing Entergy has done well is operating plants. Regardless if it's a big unit or little unit, our philosophy was to run a plant in a fleet-consistent manner. You can standardize the way you do business. You do it by working on both people and processes. You get the right people in the right positions; next you get the processes to be consistent; and finally take advantage of fleet synergies.

If one site had a struggle in one particular area, we focused, with fleet resources and expertise, to turn that area around. It's a matter of having the right management team in place and giving the right tools to the staff. Entergy has taken pride in our level of nuclear experience.

We knew if we started a structured knowledge sharing between the units that we could take the plants to higher performance levels across the board.

Sometimes it's the process, sometimes it's the leaders that need fleet expertise and support to be applied. As far as leadership, Entergy either grows them in our organization or acquires them. Leaders have to be on board with the business philosophy.

An Interview by Newal Agnihotri, Editor, Nuclear Plant Journal at the American Nuclear Society Utility Working Conference in Amelia Island, Florida on August 8, 2010.

2. *How have the NRC and the utilities tackled the plant security regulation and the fire protection regulation?*

In security, ever since 9/11, the NRC says we need to make sure the security at the plants is the best that it could be. There is no argument there. That's where the force-on-force exercise program came from.

That program has gotten muddled. For example, the team that comes for the force-on-force exercise says they can cut into a pipe and get into the plant in "X" amount of minutes. Sometimes, it seems to us that these capabilities may be overstated. We would like to see the force on force team go out and do a demo and see if they can cut it in "X" minutes before "taking credit" for it. It's being realistic about what you can and can't do in a security region to breach security, but in my opinion, we are starting to push the limits on reality.

NFPA (National Fire Protection Association) codes and standards are a way to state how a plant is protected against fires. Formerly, methods varied from plant to plant depending on when they were built. That means that some plants are operating under new standards system and some plants are sticking with the old methods. I think that will eventually work itself out.

Fire protection policies have been around for a long time. My opinion is that the bigger issue the industry may have to worry about is regulating and overseeing safety culture. The issue seems to be clearer definition of findings and inspection processes relative to the "health" of the safety culture.

I think this area still needs a lot of attention from the NRC. And I think the industry needs new focus on fire protection to make sure we stay engaged in the whole issue of regulating and

overseeing assessments, safety culture definition and issue management.

3. *Has the nuclear power industry done a good job in educating the public about the safety of nuclear power plants?*

I believe that we as an industry have not done a good job of talking about the nuclear industry, how well it's run and how we have performed for the past two decades. From 1990 on, the units in this country have generally run well.

It's a very difficult thing to explain to the public. They make a lot of assumptions that are simply incorrect. For example, when they look at a picture and they see a cooling tower, they think it's a nuclear plant even though fossil stations have cooling towers.

The industry needs to continue to improve how it communicates - how transparent our industry is, the rigor of the training, what oversight from the NRC means and the role of organizations like INPO.

I personally applaud industry groups like NEI that are working on the concerns of the public and other issues that the people in those plants face every day. Remember that employees live and breathe safety, service and providing affordable power everyday.

We as an industry have not addressed those things well to the public in my opinion. If you go around most plants in the local vicinity of current plants where the people interact with the workers that work in the plant, they understand the sense of achievement and commitment it takes. But if you go a little bit further out, we haven't been effective - in schools, communities and the broader public. Now, because everybody knows about global warming and $C0_2$ emissions, we have a great opportunity to tell our story to ears that are more open than they have ever been.

I believe that the industry as a whole must continue winning the public's trust. You see surveys where 60-70% of U.S. citizens are OK with nuclear but still say don't put it in my backyard. We have to move that needle to where the general public understands the importance of supporting license renewals as well as new nuclear in their communities. There is work to do. That's where we have to go. We're not there yet.

4. *What can the industry do to manage its spent fuel and high level waste?*

We can deal with the waste in the interim. We can store it safely but ultimately we are going to need a long-term solution.

My perspective is this: how many countries in this world don't reprocess nuclear that have nuclear plants? Just about zero. They either do it themselves or they have another country doing it for them.

We reprocess nuclear fuel in this country that is used for defense but not for nuclear plants producing electricity. It's a huge waste of a fuel resource because of all the usable fuel being stored in fuel rods. Look at the amount of waste you are generating by keeping in spent fuel pools. The U.S. can reduce all unspent fuel down to a very small manageable amount. We have the technology – we need the political will to make it happen.

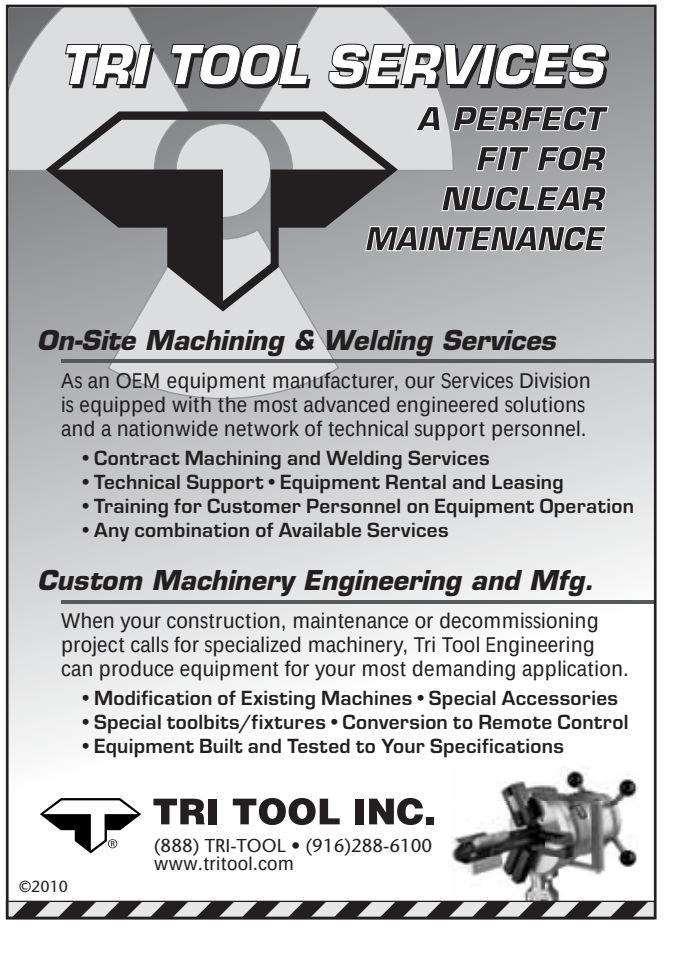
5. *Concluding remarks.*

I want to urge others in the industry not to forget where this industry came from. Make sure that the people running these plants understand nuclear safety and what it really means to protect that core. And make sure you give them their voice so if they have an issue or a concern you stand behind them.

You have to have a profound respect for the core. If you understand that, then you'll know how to operate these plants. If you don't understand this safety imperative, then you don't realize potential of this energy source.

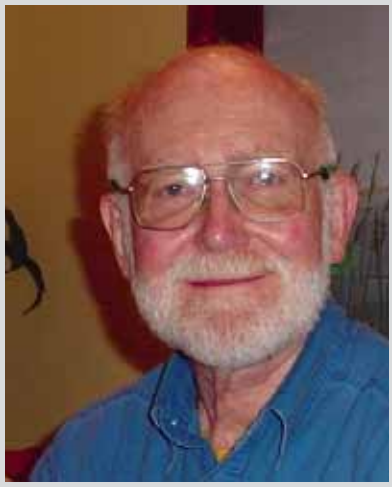
It is amazing technology. People need to realize that you have a 12-foot diameter core, 12 feet tall. And this reactor is running for 18 or 24 months, 24 hours a day. When you change fuel, you are only taking a third of it out and putting a third back in place. It is this powerful science that is helping to power our world in a safe, green, baseload and affordable way for our customers. I am proud to have spent my career in this industry.

Contact: Margie Jepson, Entergy Nuclear; 1340 Echelon Parkway, Jackson, MS 39213; telephone: (601) 368-5460, email: mjepson@entergy.com. ■



Understanding History to Interpret the Present

By Bill Corcoran, Nuclear Safety Review Concepts Corporation.



Bill Corcoran

Bill Corcoran is president of the NSRC Corporation, founded in 1993. His organization provides root cause training, mentoring, advice, leadership, and assistance to a variety of high hazard industries, including chemical processing, construction, environmental site remediation, decommissioning, nuclear power, natural gas, electric transmission/distribution, construction, engineering services, and fossil power generation. Dr. Corcoran earned his Ph.D. in nuclear engineering at MIT, his MS in management at RPI, and his BS (with distinction) at the U.S. Naval Academy. He is a registered Professional Engineer (nuclear) and is a Fellow of the American Nuclear Society. He is a Senior Member of the American Society for Quality. He also belongs to Sigma Xi (The Scientific Research Society), and the American Association for the Advancement of Science.

1. *How will you explain to the general public the concept of root cause analysis?*

The bottom line is root cause analysis is determining what needs to be fixed and how to fix it. For "continuous learning organizations" it also includes what needs to be learned and how to learn it. That's the bottom line on root cause analysis.

In order to determine what needs to be fixed one needs to understand the factors that resulted in what went wrong. The important things about what went wrong are the nature, the magnitude, the location and the timing of the consequences. So if the root cause analysis does not begin with the consequences it's very highly unlikely that it will determine the factors that resulted in the nature, the magnitude, the location, and timing of those consequences.

The fixes are based on those factors so that if you get the wrong factors or you miss some of the important factors then you miss some of the important fixes. That's root cause analysis in a nut shell.

Another part of root cause analysis is looking at the proposed fixes, linking the proposed fixes to the factors that resulted in the consequences, and making a determination as to what the future effects of those fixes are going to be. This last item is important because frequently solutions cause problems.

Some issue investigation professionals are beginning to use the term "business issue investigation" in lieu of "root cause analysis" because the term "root cause" often tends to cut off inquiry at a shallow level and convey a level of certainty that has not been achieved.

Let's get back to "solutions cause problems." A typical and tragic example of solutions cause problems is automobile airbags. Many years ago one of the insurance safety organizations tried to get the automobile industry to put airbags in cars to reduce insurance claims. Eventually the automobile industry and the government came to an agreement on this and they put in airbags.

One of the first effect of airbags was that a lot of people got killed when the airbags either deployed inappropriately or deployed appropriately for small people. Then there were some solutions to that. Another effect of the airbags was to mandate that child seats be put in the back of cars not in the front seat.

In the old days when people drove their babies around, the babies were in the front seat. But the advent of the child seat with the airbag moved the child seat to the back seat of the car. What this resulted in was many instances of people getting out of their cars and leaving their babies in the cars to die from overheating. So it's important to evaluate the downside of corrective actions before you implement them.

2. *Please help me understand defense in depth as applicable to the nuclear power industry.*

There are two ways of looking at the defense in depth in the nuclear industry. One is hardware defense in depth where we have the fission products inside of ceramic pellets which is the first barrier. You have the pellet, the cladding, the reactor coolant pressure boundary, the containment, and the distance to the public. Each barrier has some effect on keeping radioactive fission products away from the public. At Three Mile Island a failure of the third barrier (the reactor coolant pressure boundary) resulted in failures of the inner barriers, but not the outer barriers.

Then there is another aspect of defense in depth where you have the four levels of defense of quality and safety where the first level of defense is the workers and workgroups, the second-level defense is management/supervision and the third level of defense is independent assessment. That's assessment by the QA department, by the radiation protection

An Interview by Newal Agnihotri, Editor, Nuclear Plant Journal at the American Nuclear Society Utility Working Conference in Amelia Island, Florida on August 9, 2010.

people, by fire protection people and so forth, they are the third level. The fourth level of defense is external assessment. The fourth level of defense of safety and quality is made up of the company nuclear review board or off-site safety review committee plus INPO (Institute of Nuclear Power Operations) and the NRC. Those three are generally thought of as the fourth level defense.

Now if you have an event, for example like the Davis-Besse near miss loss-of-coolant accident that we had in 2002, what that indicates is that all four levels of defense failed so that the corrective actions you certainly have to fix what the individual workers and their workgroups are doing, you have to fix management, you have to fix independent assessment and you also have to fix external assessment.

After the Davis-Besse event there were major efforts at the NRC and INPO to revisit how they did business because they realized that they were part of the problem and that they needed to fix themselves in order to move forward.

I think explaining defense in depth to the general public would be helpful in getting support because the four levels of defense of quality and safety is something that people in all of the high hazard industries are used to seeing. Many people understand the drug business where you have the individuals and workgroups in the pharmaceutical laboratories, you have management and then the drug companies have internal assessment departments including QA department and then they have the external assessment by the Food and Drug Administration. People understand that perfectly.

You have the same thing in the aviation industry. Where you have the mechanics and ground crews and then you have management and then you have the airline QA department and then you have the FAA after that. In major cases you can see how they change the way business is done on the airplane and at the airplane and the way management views its role and the way the independent assessment QA type people and then the FAA is constantly revisiting how it does business. I think aviation safety is one of the major technical and organizational achievements of our age, we don't think twice about getting on an airplane. People ask me what they can do to make their next flight safer and I tell them, be sure your seat belt is buckled while driving to the airport.

3. *Can probabilistic risk assessment be a good tool to explain to the public about safety of nuclear power plants?*

The public that reads the papers knows that probabilistic risk assessment has not been completely successful in aerospace. For example, we had Challenger and Columbia accidents. The public also knows that probabilistic risk assessment is used extensively in the oil exploration and extraction industry. Given that we've had the recent Gulf accident, it is likely that in the minds of people who are familiar with the media, probabilistic risk assessment is probably not a selling point. I think what people want to know is that there are real human beings out there understanding the technology that's involved, who know what's right and what's wrong and make sure that people are doing right things. So I don't think that selling PRA to the public is a way to convince the public on nuclear power.

4. *What is the significance of teaching history of nuclear power plant safety to our young generation getting involved in the workforce in the industry?*

That is a big problem. I'm in frequent contact with groups of 12 to 20 young nuclear industry professionals. Very few of them are familiar with Three Mile Island. I was with a group of 16 young nuclear professionals last week and not one of them had ever heard of Fermi Unit 1. They all knew about the reactor named Fermi 2. They didn't know that there was a Fermi 1 that had sustained fuel damage. Fermi 1 was a 100 MW (electric) liquid metal fast breeder reactor.

The story of a Fermi Unit 1 is a very interesting story. It's a story of the importance of licensees being faithful to their own understanding of engineering. Fermi Unit 1 went all the way through the licensing process. At the last ACRS meeting a member of ACRS suggested that they install an extra device at the core entrance which would be beneficial in the event of a major meltdown. This device was not installed properly. It came loose and caused fuel failure. The licensee never believed that the thing was needed in the first place. In order to get the license they caved in to the regulator and it resulted in the failure of the plant.

As I teach root cause analysis I ask people about past events and what I find is that by and large the young people do not know about what one might call the sentinel events in the nuclear industry. They had not heard of the Calvert Cliffs diver incident, they hadn't heard of the Vogtle blackout, and so forth. So I think that the young people are in bad need of a history lesson and of course old people have been saying this since the Greeks said that the young people don't understand history. In our business you need to understand history in order to interpret the present.

Contact: Bill Corcoran, Nuclear Safety Review Concept Corporation; 21 Broadleaf Circle, Windsor, CT 06095; telephone: (860) 285-8779, email: William.r.corcoran@1959.usna.com. ■

Simplified Deposit Minimization Treatment

By Todd Mayer, Dominion.

Summary Statement

In 1991, Surry Power Station Unit 1 experienced power oscillations due to a loss of steam generator steam pressure. The pressure losses were due to excessive secondary side deposit loading. A costly chemical cleaning was performed in 1991. In 2006 sludge build up was close to 8000 lbs. on the secondary side. Something had to be done to mitigate or lessen the probability of having to perform another chemical cleaning. Several financial and safety factors drove Dominion to look for other option to maintain these important assets.

As part of the long-term Secondary Side Deposit Management Strategy, Dominion Engineering and Chemistry personnel worked in conjunction with AREVA to develop a process to decrease steam generator secondary side deposit inventory. The reduction was accomplished by implementing a [preventative] Deposit Minimization Treatment (DMT) application in the Surry Unit 1 and Unit 2 steam generators during the scheduled Spring and Fall 2009 refueling outages, respectively.

The first-of-a-kind DMT applications reduced the accumulated deposit inventories in each of the Surry steam generators by over 700-800 pounds with minimal corrosion to the component, no impact on outage schedule, and a significant financial savings (~ $32,000,000) and dose savings (~20 rem) when compared to hard chemical cleaning costs combined for both units.

With the simplified system design, the DMT process mitigated the safety hazards often associated with hard chemical cleaning applications. The DMT chemical process introduced a whole new class of compounds for the removal of deposits with the elimination of the hazardous chemical agents, hydrazine and ammonia, and the chelant, EDTA, with the use of the organic compound, oxalic acid, thus reducing the risk of hazardous chemical exposure.

Nuclear Energy Institute's (NEI) Top Industry Practice (TIP) Award's highlight the nuclear industry's most innovative techniques and ideas. They promote the sharing of innovation and the best practices, and consequently improve the commercial prospects and competitive position of the industry as a whole.

This TIP Award Entry is a 2010 NEI NSSS Vendor Award Winner.

The team members who participated included: Todd Mayer, Dominion Steam Generator Program Owner; Dennis Bostic, Dominion Chemistry; Derek Dunlap, Dominion System Engineer; Ed Turko, Dominion Supervisor ISI/NDE Engineering; Tom Worrell, Dominion Project Manager; Tim Cyburt, Dominion Project Manager; Chris Enroughty, Dominion Project Manager; Dennis Jones, AREVA Engineering Manager and Task Leader.

Safety

One of the features of the DMT process is the simplicity of the equipment required for the application and ease of the application. The DMT process system has a single connection to the steam generator via the blowdown system piping which is external to the containment. This straightforward connection to the steam generator reduces the risk of injury associated with equipment handling as well as reduces the total dose rates received during equipment installation and demobilization.

In general, the piece parts used in the DMT system were smaller (i.e., 2-4" versus 6" flange connections, hoses, etc.) and fewer in number as compared to the first generation hard chemical cleaning systems which required multiple direct connections to the steam generators via handholds and manways. By removing the need for installation of equipment in containment, the overall radiation protection saving may be estimated to be as much as 10 person-rem assuming a minimum containment time of four persons at eight hrs/day for five days in a general radiation field of 30 mrem/hr for both installation prior to the application and demobilization.

The key DMT components and equipment were contained in five 20' Sealand containers and connected to the necessary storage tanks within a bermed and fenced area approximately 1200' from the Surry units. The remote location limited the potential for unauthorized personnel in the area and increased the overall security of the area where the application chemicals were located during the application sequence.

The DMT chemical process introduced a whole new class of compounds for the removal of deposits with the elimination of the hazardous chemical agents, hydrazine and ammonia, and the chelant, EDTA. The DMT process technology is considered environmentally-friendly since none of the chemicals used in the process solutions are listed in the environmental hazards table. There are no off-gassing concerns, such as ammonia and hydrazine vapors, a common by-product of cleaning technologies that utilize hydrazine and EDTA, associated with the relatively non-volatile organic acid at the

(Continued on page 44)

Todd Mayer

In 1987, Mayer joined the Air Force and studied Non-destructive Inspection at the community college of the Air Force. In 1993, he started working specifically on Steam Generators. He started working for Dominion in April of 2004 and is now the Steam Generator program owner at Surry power station. Mayer has a degree from Western International University and 22 years experience in Non-destructive testing.

A nuclear future is nothing without a track record.

Throughout the lifetime of a nuclear reactor, having a trusted long-term supplier of nuclear services is critical to our customers' success. Our focus is on providing long-term support solutions across the reactor lifecycle from concept design through to plant-life extension. For over 40 years, Rolls-Royce has helped commercial nuclear utitlities maximise plant performance, safety and availability. And with extensive certified nuclear supply chain experience, we can meet your growing needs. The future of nuclear is exciting. Together we can make it happen.

Trusted to deliver excellence

www.rolls-royce.com

Rolls-Royce

Simplified Deposit...

Continued from page 42

DMT process application temperatures of ≤190°F. The lower process application temperatures reduces the risk of exposure to hot piping burns and steam leaks.

In addition, the resultant waste stream following dissolution of the iron in the steam generators was further treated to destroy the simple organic acid and reprecipitated the iron oxide solids for removal by filtration. With ion exchange, the remaining solution was demineralized and released without risk of exposure to radioactive liquid waste. This treatment resulted in no off-site transportation of liquid waste material. Hard chemical cleaning would have resulted in well over 150,000 gallons of waste disposal per unit for offsite processing and disposal.

The DMT application cleaning itself resulted in:

- No reportable injuries
- No Foreign Material Exclusion issues
- Zero Rework
- Zero Human Performance Issues
- Zero Radiological Personal Contamination
- Zero Budget impact
- No Schedule impact (i.e., beat outage plant schedule)

Cost-Savings Impact

While a significant benefit of the simplified DMT process system is related to safety and radiation protection savings, another benefit is related to the cost savings associated with performing a DMT application or soft chemical cleaning as compared to an EPRI/SGOG or hard chemical cleaning application. In general, a turn-key hard chemical cleaning application including final waste disposal is estimated to be approximately $14,000,000.00 for each unit compared to a turn-key soft chemical cleaning estimated to be between $2.5 M to $3 M for each Unit.

Another cost benefit of the DMT technology comes from the reduction in the waste disposal costs with additional savings in chemical costs, equipment mobilization/demobilization, and a reduced crew size.

However, the biggest benefit of the DMT process is the lack of critical path impact. It was estimated that a hard chemical cleaning would add 16 days of critical path time to each outage. Since the DMT process resulted in no outage schedule impact, the DMT process resulted in an additional savings of $4,800,000 in critical path time for each Unit.

Surry Unit 1 outage set a Dominion outage record best with only a 22 days 17 hours outage. The DMT application was applied within a nested outage window of 12 days.

Innovation

The DMT process was developed to provide the industry with a steam generator maintenance cleaning process, that:

- could be periodically applied in the SG's during plant cooldown or after cooldown to remove a portion of the corrosion products that accumulated during previous cycles,
- has the smallest possible impact on the outage schedule and budget
- has very low corrosion rates even if applied repeatedly
- does not use hydrazine
- has no hydrazine or ammonia emission
- produces easy to handle solid wastes.

In the 1990's, the US commercial utilities applied hard chemical cleaning processes which were focused on the complete removal of the accumulated steam generator deposits. These processes utilized a chemistry which required a large amount of equipment, required additional outage time, and in most cases, outage critical path time. Typically, the outage duration had to be increased to accommodate these types of cleanings. The process chemistry of hard chemical cleaning processes is based on the chelating agent, Ethylenediamine Tetraacetic Acid or EDTA, which required a large amount of waste processing equipment or transport of the waste off-site, thus adding another large cost to the steam generator cleaning process project. EDTA waste processing operations frequently required plant support for months after the outage and the trucking of thousands of gallons of slightly radioactive chemically concentrated waste to a secondary waste processing facility. This plethora of issues often made the hard chemical cleaning steam generator process the technology of last resort with regards to addressing SG accumulated deposits.

In the 2000's era, soft chemical cleaning processes are becoming the preferred process methodology to remove steam generator accumulated deposits. Soft chemical cleaning processes are focused on the removal of a portion of the steam generator deposits. AREVA's soft chemical cleaning process is called Deposit Minimization Treatment or DMT. The AREVA DMT process development focused a number of very simple key application parameters and requirements. The DMT process application needed to fit into the available outage window as much as possible, needed to have a system interface to the steam generators as straightforward as possible considering the plant configuration such that the process piping connection to the plant was as simple as possible, and, lastly, the waste generated from the DMT process had to be less costly than EDTA-based waste processing costs.

AREVA's soft chemical cleaning process development was successful in meeting all the key focus parameters of the development program. The single iron step DMT process provides a partial cleaning of bulk deposits (between 500-750 lbs deposit) that accumulate in the secondary side of nuclear SGs assuming a secondary volume of ~15,000 gallons. The DMT process chemistry utilized may be applied in a very short outage window and is flexible enough to work around other SG outage tasks. The connection to the steam generators can be made outside of the reactor building by accessing the blowdown piping in the Auxiliary Building (Aux Building) if the plant configuration allows. Thus, there is no "in" containment work for

the DMT operations. An additional DMT waste reduction feature is the ability to decompose the active chemical ingredient used in the DMT iron and DMT passivation steps, drastically reducing the waste disposal costs typically associated with a hard or other soft chemical cleaning processes.

Productivity/Efficiency

The simplified DMT process system included a number of features to increase productivity and overall efficiency during the deposit removal application. The system included remotely controlled injection pumps as well as in-line instrumentation to control and monitor the application sequence. In-line instrumentation included Total Organic Carbon (TOC) analyzers, and pH, conductivity and oxidation reduction potential (ORP) probes. Although grab samples were still collected as verification of the process parameters, the majority of the process was controlled with these systems. The simplified DMT system and inclusion of the in-line instrumentation allowed for a smaller crew size, about one-half of a hard chemical cleaning crew, and reduces the risk of human performance errors during operation and process parameter determination.

An inherent productivity feature of the DMT process is that no soaking at optimum temperature is required for the dissolution to occur. The thermal driver is sufficient to effectively remove the deposit upon exposure to the solution during the fill and drain evolution.

Surry Unit 1 outage set a Dominion outage record best with only a 22 days 17 hours outage. The DMT application was applied within a nested outage window of 12 days. A hard chemical cleaning would have resulted in an additional 16 days of critical path time. Unit 2 DMT window was completed in 11days.

Transferability

Although initially developed for reducing the deposit inventory on the secondary side of steam generators in PWRs, the DMT process technology is readily adaptable to other components or system with predominantly iron-based deposit accumulation and is not limited to the nuclear industry but may be utilized in other industry application where hazardous waste disposal is a concern.

This process can be utilized on balance of plant heat exchangers and any closed loop system in a PWR or a BWR. It can also used in a number of other industrial cleaning applications.

Contact: Catherine Mosley, AREVA; 3315 Old Forest Road, OF-68, Lynchburg, VA 24506; telephone: (434) 832-2934, email: Catherine.mosley@areva.com. ■

Nuclear Plant Journal
An International Publication
Published in the United States

Product & Service Directory 2011 Detailed Information

No charge for 5 listings & contact information.
List your organization in the Directory.

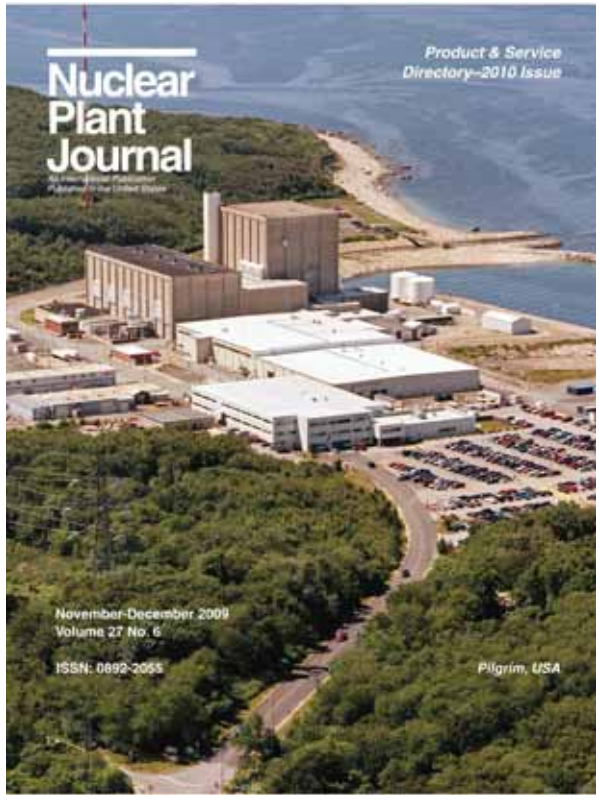
Advertise in the Product & Service Directory 2011

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 suppliers 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 **$7.50 per listing.**

1.2 The Suppliers contact information section of the Directory includes the organization name, industry contact person's name, address, phone and fax numbers, and e-mail and web site addresses.

1.3 The Corporate Capabilities section includes a comprehensive listing of an organization's featured products and services in one location. It also includes the supplier's complete contact information. Organizations may include their corporate logo for an additional $200.00 for each black and white logo. The cost for a 2-color logo is $500.00. A 4-color logo is $850.00. **See accompanying Corporate Capabilities flier for details.**



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 2011 will be distributed to the attendees at select nuclear industry meetings and conferences throughout the year.

Important Dates

Ad Reservation Deadline.....November 5, 2010
Input Form.....November 5, 2010
Ad Materials Deadline.....November 12, 2010
Directory 2011 Published....December 2010

Go to www.NuclearPlantJournal.com and click on "Directories" and then "Printed Directory-2011" for complete listing information.

NPJ Digital Version

The 2011 Directory will aslo be published in Digital format. To subscribe go to www.NuclearPlantJournal.com, click on "Subscription" button in the top row.

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

International & U.S. Suppliers are Welcome to List

Restart Source Term Reduction Initiatives

By Steve Cowan and John Underwood, TVA.

Summary Statement

The most intriguing and impressive aspect of the restart is that Browns Ferry Nuclear (BFN) Unit 1 quickly established itself as the lowest dose boiling water reactor (BWR) in the world. This accomplishment did not happen by accident. The real success of BFN Unit 1 source term reduction precipitated from the thoroughness in an approach to collective exposure mitigation.

Establishment of a team of dedicated professionals, use of innovative technology, collection of industry's best practices, calculated risk management, and TVA management commitment of financial resources resulted in a comprehensive program unequalled.

Innovative solutions to source term reduction have been and continue to be applied at BFN. These application include, but are not limited to, the use of X-Ray Fluorescent Technology for the identification of elemental cobalt, passivation, electropolishing and chromium coating of pipe and component internals, ultrasonic cleaning, a comprehensive source term reduction control procedure, as well an as ALARA designed vessel flange repair platform designed and constructed for the Unit 1 Cycle 7 Refueling Outage that won a TIP award for engineering design.

Engineering, worker, and RP Technician time has vastly improved. Improved worker efficiency allows for a greater dedication to equipment reliability issues, greater dedication of RP staff to implement program improvements, allows Engineering to be more focused on operational and equipment issues, and improves outage time—by days. In addition, respiratory protection requirements have been greatly reduced and worker efficiency is improved up to 25% in those instances where respiratory protection was previously required.

This TIP Award Entry is a 2010 NEI Process Award Winner.

The team members who participated included: John Underwood, Site Quality Assurance Manager, TVA; Paul Sawyer, Radiation Protection Manager, TVA; Billy Hargrove, Radiation Protection Technical Support and Outage Manager, TVA; Keith Nesmith, Chemist, TVA; Marty Gaston, Environmental Scientist; Steve Cowan, Quality Assurance Program Manager, TVA.

Safety Response

It is incumbent on nuclear utilities to minimize radiation exposure to as low as reasonably achievable (ALARA) levels. Below is a comparison for the most current outage year doses for each unit.

- Unit 1 – 94.848 Rem
- Unit 2 – 270.695 Rem
- Unit 3 – 353.570 Rem

The efforts thus far have resulted in a savings of > 100 person-rem while Ongoing Savings (recurring) have resulted in 150 Rem to 250 Rem per outage year. Annual: 30 Rem/year for non-outage years. Over the life of the plant the savings will result in, ~20 years x 125 Rem (averaged over outage and non-outage years) = 2500 Rem.

Cost Savings Response

Cost savings include reduction of Engineering man-hours required for Radiological Protection requests, improved worker efficiency, improved Radiation Protection Technician efficiency, and shorter duration outages. Application of a $25,000/Rem value is applied to recognize that dose equates to a definable dollar value associated with collective radiation exposure reduction. The $25,000/Rem value accounts for increased worker efficiency, outage duration reduction, and increased on-line production.

When compared to Unit 2 on an outage year basis, the dollar value that Unit 1 saves over Unit 2's most recent outage year is:

- 270.695 Rem (U2) – 94.848 Rem(U1) = 175.847 Rem
- 175.847 Rem x $25,000/Rem = $4,396,175

Steve Cowan

Steve Cowan has been a nuclear professional since 1983, entering nuclear power as a Health Physics Technician at Plant E.I. Hatch. From 1985 until 1998 he served as the Health Physics Foreman and in 1998 became the Radiation Protection Manager. In 2007 he joined TVA as a Health Physicist and is now a Quality Assurance Program Manager at Browns Ferry.

When compared to Unit 3 on an outage year basis, the dollar value that Unit 1 saves over Unit 3's most recent outage year is:

- 353.570 Rem (U3) – 94.848 Rem (U1) = 258.722 Rem
- 258.722 Rem x $25,000 = $6,468,050

Innovation Response:

TVA's Browns Ferry Unit 1 Restart represents an unprecedented achievement in nuclear power operations. Never before had a nuclear unit been shut down, cannibalized for parts, and then resurrected. But perhaps the most intriguing and impressive aspect of the restart is that BFN Unit 1 quickly established itself as the lowest dose boiling water reactor (BWR) in the world.

The restart effort included innovative technologies, such as the employment of X-Ray Fluorescence Technology (XRF) which identifies elemental cobalt associated with intrusive valve work. Identification of elemental cobalt found in grindings and tailings resulting from grinding, lapping, and other abrasive repair methodologies, which engaged the use of an existing technology to provide a unique and desperately needed means for identifying and removing source before it interacted with the reactor itself.

(Continued on page 48)

Restart Source...

Continued from page 47

Productivity/Efficiency Response

Reduced source term eliminates or minimizes the need for engineering controls, respiratory protection, and administrative controls for high radiation areas (HRA) and locked high radiation areas (LHRA).

The Engineering Department is rarely recruited for ventilation alterations, special project designs (such as end bell templates for remote eddy current testing on Reactor Water Cleanup (RWCU) or Fuel Pool Cooling Heat Exchangers), and temporary shielding evaluations, because Unit 1 source term is so low. Respiratory protection requirements are greatly reduced and worker efficiency is improved up to 25% in those instances where respiratory protection was previously required. Former High Radiation Areas (HRA) and Locked High Radiation Areas (LHRA) are largely downgraded to Radiation Areas. This improvement in radiological conditions reduces the need for locking HRA swing gates, and LHRA barricades, structures, and doors. Lower level radiation and contamination areas reduce protective clothing, telemetry, and communication requirements, and the need for CCTVs (cameras). Increased Engineering and worker efficiency allows less oversight by RP technicians, which allows for a greater focus on Radiological Protection Program improvement focus rather than constant monitoring and escorting of workers.

The real success of BFN Unit 1 source term reduction precipitated from the thoroughness in an approach to collective exposure mitigation. TVA management recognized the need to establish a disciplined, rigorous, and dedicated approach to reducing long term personnel exposure. Executive, Plant, and Radiation Protection Management chartered a team of professionals that represented a number of disciplines. The composition of the high impact team (HIT) is listed in the next column.

- Chemistry (1)
- ALARA (1)
- Design Engineer (2)
- Procurement (1)
- Planner (1)
- Foreign Material Exclusion Personnel (FME) (1)
- Cost/budget (1)
- Mechanical Craft (1)
- Senior Manager (1)

The HIT evaluated dose reduction opportunities at Browns Ferry and through collaboration and benchmarking developed a plan to transform a below average plant into a world class leader in source term reduction. The following are the results of the HIT effort.

1. Implementation of a Source Term Reduction and Control Procedure.
2. Innovation of X-Ray Fluorescent (XRF) technology to identify elemental Cobalt and development of a procedure to instruct Radiation Protection and craft as to proper techniques for identifying and cleaning elemental Cobalt.
3. Installation and use of hydrolazing ports in all three units' Fuel Pool Cooling lines which traverse the overhead of the Unit 1 Reactor Building 565'- a major source of ambient (background) dose rates on the 565' and 593'.
4. Installation of a 10th Condensate Demineralizer to improve activity levels in condensate water that can enter the reactor water system.
5. Change of Condensate Demineralizer filter elements to improve filtering capabilities for condensate water that can enter the reactor.
6. Site-wide surveys both inside and outside the site boundary utilizing a Pressurized Ion Chamber (PIC) to determine the effects of sky shine on annual site dose. Use of the PIC also led to evaluations that determined personnel in certain areas should be relocated or TLD badged because of background radiation levels attributable to sky shine.
7. A portable demineralizer on the Refuel Floor deck was used on Unit 1 to clean up spent fuel pool water and cavity water. A total of 6.5 Curies was removed which exceeded expectations for activity removal. The success realized by this project ultimately led to the purchase and use of 2 portable underwater demineralizers to reduce spent fuel pool activity on all three units during outages.
8. Replacement of all 185 Control Rod Blades (CRB) with non-Stellite CRBs.
9. Approximately 90 separate one-hour presentations to craft and utility personnel to provide insight and training as to the current challenges to the Radiation Protection Program at Browns Ferry.
10. Unit 1 Spent Fuel Storage Pool Clean-up Campaign (cut-up and removal of CRBs).
11. Engineering Drawing Change approved to convert a Temporary Shielding configuration to permanent installation on the Unit 1 593' (main floor elevation) of the Reactor Building.
12. Installation of permanent shielding in the Unit 1 Drywell (Recirculation System).
13. Unit 1 Received the Technology Transfer Award from EPRI.
14. Ultrasonic Cleaning of 92 fuel bundles to reduce activity that could have been transferred to system piping. (A total of 1160 Curies were removed).
15. Replacement of RWCU Heat Exchangers with new heat exchangers with chromium coated internals and replacement of RHR Check Valves.
16. Replacement of RECIRC and RWCU piping with new electropolished internal surfaces.
17. Replacement of RWCU pump casings with new electropolished internals.

(Continued on page 51)

urenco

enriching the future

Over 40 years of sustainable energy

With over 40 years of continuous improvement, URENCO is the leading supplier of enrichment services and technology and is positioned at the heart of the global nuclear fuel supply chain.

URENCO plays a vital role in the provision of secure and sustainable energy and is committed to supporting the nuclear industry by delivering safe, cost effective and reliable uranium enrichment services to utilities worldwide.

Integrity and customer service remain top priorities for URENCO as the company further expands to meet the growing demand for its enrichment products and services, thereby ensuring security of supply via a sustainable nuclear energy solution.

www.urenco.com

Radiation-101, An Internet-Based Course on Radiation Fundamentals

With 2.4 CEUs (24 PDHs) from the Illinois Institute of Technology

Start Date: November 8, 2010 **Fax Registration to (630) 858-8787**

Radiation Fundamentals (Radiation-101) runs for seven weeks beginning September 13, 2010. Each week, participants complete a reading assignment and submit required tests electronically. A list of assignments is given at the right. The test responses are graded instantly, and participants may view their grades immediately. At the end of the course, a certificate with 2.4 Continuing Education Units (CEUs) from the Illinois Institute of Technology will be issued to those participants who successfully complete the course work. The course registration fee is $245.00 per participant.

Yes! Register me for the Radiation-101 class.
Course Start Date: November 8, 2010
Course Fee: $245.00 per course per participant

_____ Amount authorized (fee x # of participants)
☐ Check is enclosed.
(Make checks payable to *Nuclear Plant Journal*.)
☐ Charge my credit card.
☐ American Express® ☐ MasterCard® ☐ VISA®
Card Number _____
Expiration Date _____
Card Holder Name (Print) _____
Signature _____
Date _____
Send payment with your order.
Name _____
Birthday (Month/Day/Year) _____
Company _____
Address _____
_____
Phone _____
E-mail _____

Fax or mail your order to:

Kruti Patel
Nuclear Plant Journal
1400 Opus Place, Suite 904
Downers Grove, IL 60515 USA

Phone: (630) 858-6161, X105
Fax: (630) 858-8787
E-mail: Kruti@goinfo.com

Course Topics for November 8, 2010 Session

Week 1: (November 8-14, 2010)
1. "Radiation--As Old As the Universe."
2. "Unstable Nuclei Make Material Radioactive."
3. "The Unit of Activity, The Becquerel."

Week 2: (November 15-21, 2010)
1. "Radionuclides & Your Body."
2. "Healing Radiation."

Week 3: (November 29-December 5, 2010)
1. "Industrial & Consumer Applications."
2. "Radiation Protection Across Borders."
3. "Dose, Dose Rate and Dose Limits."

Week 4: (December 6-12, 2010)
1. "Ionizing Radiation & Health."
2. "Any Harm from Small Doses?"

Photo Credit: Pavlicek/IAEA

Week 5: (December 13-19, 2010)
1. "Late Health Effects of High Doses."
2. "Acute Health Effects of Very High Doses."

Week 6: (December 27 2010-January 2, 2011)
1. "Nuclear Accident or Incident?"
2. "Radioactive Releases and Radwaste."

Week 7: (January 3,-9, 2011)
1. "True and False About Chernobyl."
2. "Radiation All Around Us All the Time."

Bulk registration costs are available for orders of 10+ participants.

www.radiationtraining.com

September, 2010

24 Professional Development Hours for your P.E. Recertification

Restart Source...

Continued from page 48

18. Replacement of Stellite-tipped LP Turbine blades with flame-hardened blades.
19. Replacement of all 185 CRBs with Stellite pins and rollers.
20. Replacement of 73 Stellite Valves with Non-Stellite Valves.
21. Construction of an RP Central Video and Telemetry Control Point at the main plant entrance.
22. Comprehensive Condenser Desludging.
23. Use of remote eddy current testing on Unit 1 Fuel Pool Cooling Heat Exchangers. The design of containments and equipment that allowed insertion of eddy current probes at a distance which reduced worker exposure.
24. Repair of the Unit 1 Vessel and RPV Head Flanges for ~1.8 Rem utilizing a custom designed platform to maintain doses ALARA.

Transferability Response

The greatest benefits to the industry fleet were established by the Source Term Reduction HIT during Browns Ferry Unit 1 Restart. Technologies previously available, but largely untested or implemented due to risk or cost have been used successfully at BFN. Many plants already have XRF instrumentation in use for Chemistry purposes. These instruments can be employed for Source Term Reduction (elemental cobalt control) for essentially no additional financial investment.

Large scale use of electropolishing, passivation, chromium coating and ultrasonic fuel cleaning have already reaped benefits as proven with a Unit 1 Cycle 7 Refueling Outage expending only 39 Rem of refueling outage dose. These processes that were implemented at Browns Ferry mitigate the need for testing at other facilities or the financial risk of trying a process that may or may not work. After the process was implemented, the stabilized chromium process became the industry norm. Browns Ferry provided the industry technical justifications for large scale use.

Browns Ferry's Source Term Reduction Control Procedure is available to any utility that requests a copy, as is a copy of the presentation for the 2009 ISOE World Class ALARA Performer award presented to BFN in January 2010. The engineering specification that identifies Stellite valves for replacement and ranks the valves according to source term liability is included in the Source Term Reduction Control Procedure. This document is especially useful for BWRs wishing to establish a program because it identifies valves and valve types that are the greatest contributors of elemental cobalt in the form of Stellite (which ultimately transmutates to Co-60) and the subsequent transfer to the reactor core.

In short, the financial risk taken by BFN and the manpower and think tank represented by the HIT working over the course of an entire year have established a source term reduction program that not only works, but rather—excels.

Contact: Steve Cowan, TVA; P.O. Box 2000, Decatur, AL 35609, telephone: (256) 614-6262, email: srcowan@tva.gov.

Ten Fold Capacity by 2020

By Grenville Harrop, Westinghouse Electric Company.

China's Plan

After increasing its nuclear energy target for the third time in two years, the Chinese government plans to increase its installed nuclear power capacity almost ten-fold to over 80 gigawatts (GW) by 2020. This new goal builds upon the 40 GW target announced in 2008, which has since been revised to 70 GW[1]. To accommodate the future demand for Chinese power generation while reducing its technology dependence on other countries, the People's Republic of China (PRC) central government initiated a national program to further develop advanced large-scale nuclear pressurized water reactors (PWRs), while concurrently stressing the need to accelerate progress toward nuclear self-reliance[2].

Years in the making, the PRC Nuclear Power Self-reliance Program formally began in July 2007 when contracts were signed among Westinghouse Electric Company and its consortium partner, the Shaw Group, and China's State Nuclear Power Technology Corporation Ltd., Sanmen Nuclear Power Company Ltd., and Shandong Nuclear Power Company Ltd. for four Westinghouse AP1000 nuclear power plants to be constructed in pairs at coastal sites at Sanmen (Zhejiang Province) and Haiyang (Shandong Province). The Westinghouse AP1000 is the only Generation III+ reactor to receive design certification from the U.S. Nuclear Regulatory Commission (NRC). The AP1000 nuclear power plant, based on the proven performance of Westinghouse-designed PWRs, is an advanced 1100 megawatt (MW) nuclear power plant that uses the forces of nature and simplicity of design to enhance plant safety and operations, and reduce construction costs and schedule durations.

With the commitment to build the first four AP1000 units at the Sanmen and Haiyang sites, China has entered a new era of sustainable, safe, and ecologically sound energy development.

Excavation commenced for the first four units between March 2008 and July 2009. The first unit, Sanmen Unit 1, will be fully operational in November 2013 followed closely by Haiyang Unit 1, which will be operational by May 2014. Operational dates for Sanmen Unit 2 and Haiyang Unit 2 are September 2014 and March 2015, respectively. Construction for all four units is largely concurrent. The first four AP1000 plants become operational in China ahead of the U.S. Domestic AP1000 plants presently being built.

Grenville Harrop

Employed by Westinghouse as Director, China Projects, Mr. Harrop has over 30 years experience in the nuclear industry encompassing design, construction, commissioning, operations, research and development (R&D) and Project Management.

Currently responsible for the successful performance (safety, cost, schedule, quality) of all US based activities related to the People's Republic of China AP1000 contract to provide four nuclear power reactor plants in China, using the first of the new AP1000 plant designs. Mr. Harrop provides the leadership and direction to the US China Project Managers and product groups for all Stateside day to day activities. He is accountable for the project P&L management and required to maintain strong working relationships with the Purchaser Organizations; including China's State Nuclear Power Technology Corporation (SNPTC) and the Owners of the Sanmen and Haiyang sites.

Mr. Harrop has a Master of Science in Control Theory and a Bachelor of Science in Electronic Engineering.

Sanmen Major Milestones

The Sanmen site is located on the China coast approximately 200 miles south of Shanghai. Excavation of the nuclear island (NI) for Sanmen Unit 1 commenced as planned in February 2008. Placement of the basemat concrete was successfully completed in March 2009, exactly as scheduled. This involved a continuous pour of nearly 5,000 cubic meters of concrete over a period of approximately two days. During the excavation and rebar placement period, the China-based module factory commenced construction of the early major modules, as well as the bending and forming of the containment vessel bottom head plates.

One of the many advantages of the new engineering concepts within the AP1000 design is the widespread use of mechanical and structural modules. This allowed the China Project Team, in June 2009, to successfully set in place a large structural module named CA20, consisting of two sections of the auxiliary building

(Continued on page 54)

[1]Y. Chan, 2009, "China to Increase Nuclear Capacity Ten fold by 2020," Business Green.

[2]X. Cheng, Y. H. Yang, Y. Ouyang, and H. X. Miao, "Role of Passive Safety Systems in Chinese Nuclear Power Development," Science and Technology of Nuclear Installations, vol. 2009, Article ID 573026, 7 pages, 2009. doi:10.1155/2009/573026.

A Breakthrough in Valve Testing Technology from Crane Nuclear

Crane Nuclear and the preceding companies that it acquired in the late 90's (MOVATS & Liberty Technologies) have been developing and improving valve diagnostic testing technology for over 25 years. Crane Nuclear is pleased to introduce Votes Infinity – a true breakthrough in valve diagnostic testing technology innovation.

With patent pending technology and features not available in any other valve diagnostic system on the market today, Votes Infinity will dramatically change the way your valves are tested. VOTES Infinity will greatly simplify your data collection and analysis process, reducing time spent at the valve by as much as 50% and reducing human performance errors by as much as 80%.

VOTES Infinity is the Future of Valve Diagnostic Systems

For more information or to schedule an onsite demonstration, contact us today!

CRANE NUCLEAR
A Crane Co. Company

VOTES INFINITY
VALVE DIAGNOSTIC SYSTEM

www.cranenuclear.com

2825 Cobb International Blvd., Kennesaw, GA 30152 | Phone: 770-424-6343 | Email: info@cranevs.com

Ten Fold...

Continued from page 52

comprised of plant and equipment for used fuel storage, a heat exchanger, and waste collection equipment. The CA20 module is approximately 45 feet wide, 67 feet long, and 69 feet high; equivalent in height to a five-story building. This 750 metric-ton module was lifted and set in place using an immense crawler crane, currently the largest mobile heavy-lift crane in the world. The containment vessel bottom head for Sanmen Unit 1 was set in place in December 2009; another major milestone achieved.

Successfully completed milestones in 2010 include the setting of the following other significant modules:

- Reactor vessel cavity (CA04) set January 2010
- Access tunnel and walls module (CA05) set February 2010.
- Steam generator and refueling canal module (CA01) set March 2010

The containment vessel rings 1 and 2 were set March 2010 and June 2010, respectively. By the end of 2010, approximately 35 percent of the bulk materials will be installed within the first Sanmen containment building.

Concurrently, excavation and preparations for Sanmen Unit 2 were completed. Placement of the basemat took place in December 2009, prior to the milestone date of January 2010, leading to the setting of the containment vessel bottom head and CA20, both in June 2010. Modules CA01 and CA04, and the CV first ring will be set later this year.

Haiyang Major Milestones

The Haiyang site is on the Shandong peninsula about 100 miles northeast of the Chinese coastal city of Qingdao. The Haiyang Unit 1 basemat was successfully laid via one monolithic concrete pour in September 2009, repeating the success achieved at Sanmen. Completed milestones in 2010 for Haiyang Unit 1 include the setting of the CA20 module in January 2010, the setting of the containment vessel bottom head in April 2010, and the setting of the containment vessel first ring in July 2010. Placement of the Haiyang Unit 2 basemat was successfully complete in June 2010, approximately six weeks ahead of schedule.

Continuous Improvement

A formal Lessons Learned program is in place to ensure that Haiyang construction and manufacture continue to benefit from the experiences at Sanmen. The application of Lessons Learned has contributed to the following examples:

- CV Bottom Head fabrication for Haiyang 1 took far less time than for Sanmen 1.
- CV Bottom Head welding at Haiyang is within a fully-enclose building.
- CA20 module fabrication for Haiyang 1 took far less time than for Sanmen 1.
- The NI basemat at Haiyang Units 1 and 2, and Sanmen Unit 2 was laid in less time than that of Sanmen 1.
- Ultra-large steam generator and reactor vessel forging lead times were reduced for the Units 3 and 4.
- Supply chain experiences are fed forward to ensure best practices.

Supply Chain Management

Early ordering of long lead materials and items of equipment started immediately after the agreement to a framework contract in February 2007. This is particularly important in the case of large forging, such as those associated with steam generators and reactor vessels, where a limited capacity of supply can influence the achievement of an overall schedule due to critical path equipment delivery dates. Currently, all Westinghouse major purchase orders are complete with the exception of instrumentation and control equipment, and spares. Fabrication of the primary components for China's first four AP1000 nuclear power plants is a global undertaking, covering North America, Asia, and Europe. Major items such as the steam generators, reactor vessels, fuel handling equipment, and heat exchangers are at an advanced stage of manufacture. The reactor coolant pumps are being tested and refined, the control rod drive mechanisms have passed their lifetime tests, and equipment qualification is underway for all safety valves. The first shipments of plant and equipment have begun to arrive in China.

Summary

China has entered a new era of sustainable, safe, and ecologically-sound energy development by committing to build the first four AP1000 units at the Sanmen and Haiyang sites. China's long-term plan to significantly increase the amount of electric power it produces from nuclear power plants will dramatically cut pollution from coal-fired plants, ease China's dependence on oil imports, and move the country even closer to its goal of energy independence. As the world's second largest consumer of energy, following the United States, China's path in achieving sustainable energy has profound global economic and environmental consequences. The contract with the Westinghouse Consortium for four AP1000 units is the largest of its type between the People's Republic of China and the United States.

Contact: Scott Shaw, Westinghouse Electric Company; 1000 Cranberry Woods Drive, Suite 140, Cranberry Township, PA 16066; telephone: (412) 374-6737, email: shawsa@westinghouse.com. ■

Westinghouse **AP1000**
Online in 2013

Setting of the containment vessel second ring at Sanmen, Unit 1.

WESTINGHOUSE ELECTRIC COMPANY LLC | PHOTOGRAPH BY MADAME CHEN YING

The Westinghouse **AP1000** nuclear power plant is the technology of choice for active and emerging new plant markets across the globe.

In China, four new **AP1000** plants are currently under construction and are being built with the highest standards in safety and quality, with the first scheduled to come online in 2013.

In the United States, the **AP1000** design has been selected as the technology of choice for more than half of the new plants announced, including the only six for which engineering, procurement and construction contracts have been signed.

Westinghouse nuclear technology will help provide future generations with safe, clean and reliable electricity.

Check us out at **www.westinghousenuclear.com**

Westinghouse

A Toshiba Group Company

You can be sure...
if it's Westinghouse

Growing QualTech NP to meet the challenges of today's nuclear power industry.

Our foundation is strong.
Our roots run deep...
Trentec, EGS Products, NETCO

Curtiss-Wright Flow Control has been rooted in supporting the nuclear power industry for over 50 years. To meet the growing requirements of today's industry, we have formed a new business unit, QualTech NP, dedicated to working with utilities, NSSS, EPCs and industry suppliers to meet their most challenging needs: qualification, seismic testing, commercial-grade dedication, connectors, cables, penetrations, airlocks, doors, hatches, spent fuel management, obsolescence solutions and custom manufacturing.

CURTISS WRIGHT
Flow Control Company
QualTech NP

Learn more about QualTech NP at http://qualtechnp.cwfc.com