



Summer 2007
Volume 3, Issue 3

NUCLEAR WORLDWIDE

A Commitment to Nuclear Power: NWI Visits France

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In May, an NWI representative visited France, one of the largest nuclear power producers in the Europe. In fact, France derives 75% of its electricity from nuclear energy. This is due to a long-standing policy based on energy security. France has 59 nuclear reactors operated by Electricite de France (EdF) with total capacity of over 63 GWe, supplying over 426 billion kWh per year of electricity, 78% of the total generated there. In 2005 French electricity generation was 549 billion kWh net and consumption 482 billion kWh - 7700 kWh per person. Over the last decade France has exported 60-70 billion kWh net each year. See also EdF web site. France is the world's largest net exporter of electricity, and gains over EUR 3 billion per year from this. France has been very active in developing nuclear technology, and reactor technology is a major export.

The present situation is due to the French government deciding in 1974, just after the first oil shock, to expand rapidly the country's nuclear power capacity. This decision was taken in the context of France having substantial heavy engineering expertise but few indigenous energy resources. Nuclear energy, with the fuel cost being a relatively small part of the overall cost, made good sense in minimizing imports and achieving greater energy security. As a result of the 1974 decision, France now claims a substantial level of energy independence and almost the lowest cost electricity in Europe. Over 90% of its electricity is nuclear or hydro.

Current policy. A parliamentary debate in 1999 reaffirmed three main planks of French energy policy: security of supply (France imports more than half its energy), respect for the environment (especially re greenhouse gases) and proper attention to radioactive waste management. It was noted that natural gas had no economic advantage over nuclear for base-load power, and its prices were very volatile. Despite "intense efforts" there was no way renewables and energy conservation measures could replace nuclear energy in the foreseeable future. In May 2006 the EdF board approved construction of a new 1650 MWe EPR unit at Flamanville, Normandy, alongside two 1300 MWe units. The decision is seen as "an essential step in renewing EDF's nuclear generation mix". First concrete is scheduled for December 2007 and provisional takeover by EdF May 2012 after a 54-month construction period. In January 2007 EdF ordered the main nuclear part of the reactor from Areva. The turbine section was ordered in 2006 from Alstom. This means that 85% of the plant's projected EUR 3.3 billion cost is "locked in."

Future policy. France has been pursuing three Gen IV technologies: gas-cooled fast reactor, sodium-cooled fast reactor, and very high temperature reactor (gas-cooled). While Areva has been working on the last, the main interest in it has been in the USA, as well as South Africa and China. CEA interest in the fast reactors is on the basis that they will produce less waste and will better exploit uranium resources, including the 220,000 tonnes of depleted uranium and some reprocessed uranium stockpiled in France.

Economics. France's nuclear power program has cost some FF 400 billion in 1993 currency, excluding interest during construc-

CBT for Dry Cask Storage Technicians

NWI has developed a computer-based Dry Cask Storage (DSC) Reactor Services (RS) Technician Training program. A multi-site Computer-Based Training (CBT) program for RS Initial and Continuing Training is now in its final beta testing. The DCS CBT project began in April 2006 with a targeted implementation for Exelon's Midwest RS technicians and supervisors by mid 2007. The software design combines the training programs of Dresden Nuclear Station and Quad Cities Nuclear Plant addressing both common and site-specific equipment operations. DCS CBT was created using procedures from both plants. It contains interactive modules and video clips to familiarize the student with specific plant equipment. It is a "smart" system designed with a requalification module which presents students with the opportunity to bypass modules already mastered. An online exam and feedback form are pre-

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tion. Half of this was self-financed by Electricité de France, 8% (FF 32 billion) was invested by the state but discounted in 1981, and 42% (FF 168 billion) was financed by commercial loans. In 1988 medium and long-term debt amounted to FF 233 billion, or 1.8 times EdF's sales revenue. However, by the end of 1998 EdF had reduced this to FF 122 billion, about two thirds of sales revenue (FF 185 billion) and less than three times annual cash flow. Net interest charges had dropped to FF 7.7 billion (4.16% of sales) by 1998. In 2006 EdF sales revenue was EUR 58.9 billion and debt had fallen to EUR 14.9 billion - 25% of this. The cost of nuclear-generated electricity fell by 7% from 1998 to 2001 and is now about EUR 3 cents/kWh, which is very competitive in Europe.

Apart from one experimental fast breeder reactor, all French units are now PWRs of three standard types designed by Framatome - now Areva NP (the first two derived from US Westinghouse types): 900 MWe (34), 1300 MWe (20) and 1450 MWe N4 type (4). This is a higher degree of standardisation than anywhere else in the world. The 900 MWe reactors all had their lifetimes extended by ten years in 2002, after their second 10-yearly review. Most started up late 1970s to early 1980s, and they are reviewed together in a process that takes four months at each unit. A review of the 1300 MWe class followed and in October 2006 the regulatory authority cleared all 20 units for an extra ten years' operation conditional upon minor modifications at their 20-year outages over 2005-14. In the light of operating experience, EdF uprated its four Chooz and Civaux N4 reactors fom 1455 to 1500 MWe each in 2003.

France has exported its PWR reactor technology to Belgium, South Africa, South Korea and China. There are two 900 MWe French reactors operating at Koeberg, near Capetown in South Africa, two at Ulchin in South Korea and four at Daya Bay and Lingao in China, near Hong Kong.

In mid 2004 the board of EdF decided in principle to build the first demonstration unit of an expected series of 1630 MWe Framatome ANP (now Areva NP) EPRs, and this decision was confirmed in May 2006, after public debate. The overnight capital cost is expected to be EUR 3.3 billion, and power from it EUR 4.6 c/kWh - about the same as from new combined cycle gas turbine at current gas prices and with no carbon emission charge. Series production costs are projected at about 20% less. EDF then submitted a construction licence application. Site works at Flamanville on the Normandy coast should be complete and the first concrete poured about the end of 2007, with construction taking 57 months and completion expected in

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sented at the conclusion of each module. The results are automatically exported into each site's training data bases for recordkeeping. The software contains the flexibility to run on individual computer stations, local or wide area networks (LAN/WAN) or via distance learning on the NWI Intranet.

BASIC DESIGN

DCS training for RS technicians has become increasingly difficult to schedule due to multi-site support demands and outage support requirements (e.g., scheduled refueling and/or forced outages). While gaining large economies of scale, organizational structures such as a "fleet" format have increased the difficulty in gathering required students in a classroom at the same time to conduct training. This type of organizational structure has lead to a streamlined organization with little margin for schedule perturbations. Therefore, if an employee is ill or unexpectedly leaves the organization, required training is significantly impacted.

NWI's DCS CBT program has the flexibility to fit into the schedule demands of the workforce by conducting cost effective training 24 hours/day and seven days/week.

In designing the DCS CBT software architecture, storyboards were prepared to ensure alignment was achieved between logical flow paths and the multiple input and output data streams. Authorware® was chosen as the programming platform for this project due to its compatibility with LAN/WAN and its acceptability as a CBT software development tool. An initial entry screen was designed as the gateway to ten topical modules representative of the RS training program. This screen allows selection of several variables including RS initial training, RS continuing training, and job site location.

The DCS CBT design allows for both common and site specific modules to enhance learning. Once the program identifies each student's station, it then presents the station specific information wherever differences exist with testing conducted at the end of each module. Feedback is also collected at the end of each module automatically affording a method to capture program improvement opportunities. Training modules were

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2012. EdF is aiming to firm up an industrial partnership with other European utilities or power users for its construction. (Finland is also building an EPR unit at Olkiluoto). In August 2005 EdF announced that it plans to replace its 58 present reactors with EPR nuclear reactors from 2020, at the rate of about one 1600 MWe unit per year. It would require 40 of these to reach present capacity. This will be confirmed about 2015 on the basis of experience with the initial EPR unit at Flamanville - use of other designs such as Westinghouse's AP1000 or GE's ASBWR is possible. EdF's development strategy selected the nuclear replacement option on the basis of nuclear's "economic performance, for the stability of its costs and out of respect for environmental constraints." There have been two significant fast breeder reactors in France. Near Marcoule is the 233 MWe Phenix reactor, which started operation in 1974. It was shut down for modification 1998-2003 and is expected to run for a further few years. A second unit was Super-Phenix of 1200 MWe, which started up in 1996 but was closed down for political reasons at the end of 1998 and is now being decommissioned. The operation of Phenix is fundamental to France's research on waste disposal, particularly transmutation of actinides. Eleven experimental and power reactors are being decommissioned in France, eight of them first-generation gas-cooled, graphite-moderated types, six being very similar to the UK Magnox type. There are well-developed plans for dismantling these (which have been shut down since 1990 or before). However, progress awaits the availability of sites for disposing of the intermediate-level wastes and the alpha-contaminated graphite from the early reactors.

Main Sources—EdF, Nov 1996, Review of the French Nuclear Power Programme, EdF web site, IAEA 2003, Country nuclear power profiles., WNA 2001, Global Nuclear Fuel Market., Nuclear Review, July 2001.NuclearFuel &Nucleonics Week, August 2005.

NWI Consulting Team Assists Palo Verde's ImPACT Project

A new project has been initiated by the NWI team; support of Palo Verde's ImPACT project. The ImPACT project is an onsite team of 50 people that is investigating and categorizing historical and current site deficiencies. The team, headed by APS's Mike Shea, has asked NWI to assist them in analyzing legacy and current performance data utilizing fault tree and root cause analyses method(s) resulting in a collective evaluation to help improve plant performance. The NWI team comprised of Steve Pettinger, Bill McNeil, Karen Pettinger, and Frank Tsakeres are supporting the overall project which started on June 7, 2007. The outcome will be used to generate specific actionable corrective actions (and those to prevent recurrence) following definition of RCA problem statements. The overall output is to be designed to assist the station's support of the upcoming NRC 95-003 inspection.

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chosen based upon differences between the two station's equipment and required RS technician work tasks. The modules developed include Overview, HI TRAC Movement & MPC Transfer, HI TRACK/ MPC Preparation and Fuel Pool Operations, MPC Operations, Vacuum Drying System, Helium Backfill System, Helium Cooldown and Reflood, 4 Point Lift System/Cask Transport, and Site Cask Transport.

DCS Inspections. These modules allow the program to be also used for topical refresher training before operating equipment or performing certain tasks associated with the Dry Cask Systems. For initial training, all of the training modules are required to be completed in conjunction with on-the-job (OJT) and task performance evaluation (TPE) prior to RS qualification.

Initial and Continuing Training. DCS CBT contains all of the material required for initial and continuing classroom training. For continuing training, the utility can select modules required for the training period, choose to examine the students to determine where weaknesses exist or use a combination of both methodologies. Based on testing performance, the program can bypass modules for the students who demonstrate a satisfactory level of required knowledge. This allows continuing training to be individually tailored and administered.

Program Testing and Tracking. The DCS CBT program requires the student to login using an identifier and password. Time demands may require the student to be interrupted during CBT. DCS CBT automatically retains the student's requirements and progress. When the student reconvenes the CBT session, historical data are then retrieved and used to determine the student's: 1) Correct path through the DCS CBT modules and 2) Continuation point based on the last module completed by the student. Required and completed modules are identified and available to be reviewed. Objective summary quizzes and activities help to re-enforce key concepts while video clips and animation help to highlight and illustrate important points. Student testing and tracking data are stored in a Microsoft Access® database for easy retrieval and reporting.

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DCS CBT combines common and site-specific equipment operations for RS technician initial and continuing training needs. It contains interactive modules and video clips designed as a "smart" system which affords students with the opportunity to bypass modules already mastered. Online exam results and feedback data automatically exported into site-specific training data bases for record-keeping.

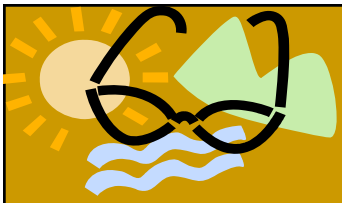
NWI News Board

FP&L's Fleet Maintenance Standardization Initiative

NWI has been conducting a fleetwide initial maintenance training material upgrade project (i.e., Fleet Maintenance Initial Training or FMIT for short) at FP&L's St. Lucie Nuclear Plant. The FMIT project, designed to standardize all fleet initial Maintenance training program material including instrumentation and controls, electrical and mechanical maintenance, has been underway since late 2006. The project is projected to complete in the second quarter of 2008 and is ahead of schedule at this writing. Standardizing selected training programs has been an ongoing initiative by the FP&L fleet since commencing in early 2006. NWI employees Chuck Pixler, Bryan Collins, George Farley, Mack May, David Treadway, and Phil Burklow have been hard at work and doing a great job supporting FP&L's project lead Ron Minear and the overall fleet schedule.

NWI Supports Turkey Point Training Recovery

Since October of 2006, NWI has been successfully helping Turkey Point's Operations training programs by assisting in designing and completing probation recovery activities. The expert NWI team consisted of Bill Lindsey (consultant and Acting - Operation Initial Training Supervisor), Weldon Hardon (consultant and instructional technology specialist), Jim Werner (consultant), Ken Gerling (Operations Training Instructor), Carolyn Hardin (Instructional Technologist and Organizational Development specialist), Mark Carey (Consultant), and Dan Slater (Instructional Technologist) and had over 600 years of expertise to contribute to the overall effort! Following a successful recovery ATV evaluation, accrediting board, and ILT NRC examination (100% pass rate) by the FP&L team, the NWI team transitioned moving toward supporting the longer term Operations Training Materials Upgrade Project which is expected to complete in 2008.



We wish to express special thanks to the following clients for recently making NWI a preferred full services company.

- AEP's D.C. Cook Nuclear Power Plant
- Exelon's Quad Cities Nuclear Station, Oyster Creek Generating Station & Outage and Reactor Services
- FPL's St. Lucie, and Turkey Point Stations
- TVA's Watts Bar Nuclear Plant
- PSE&G's Salem Station
- APS's Palo Verde Nuclear Generating. Station

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Our program specialties include: Human Performance, Training and Accreditation, Simulator Instructor Training, Operations Training, Engineering Services, Corrective Actions Program Improvement, Root Cause Analysis and Self-Assessment, NRC Exam Writing, CBT for Dry Cask Storage/ RadWaste Training, and many Human Performance Trainers.