ALARA Notes

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From The Editors

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We have a great deal of material to bring to the attention of our readers. Unfortunately, it costs a lot to produce and distribute each issue of ALARA Notes. In these times of meager budgets the cost has been too high. We have two very good solutions, which are in accord with the trend of the times. Both solutions let users obtain ALARA Notes through on-line systems.

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This new approach will hopefully reach most of our readers and will reduce costs. If you have any information on an ALARA related topic or would like to contribute a small item to ALARA Notes, please send your contribution to the address below:

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Some New Developments About U/MRUG (Utility/Manufacturers Robotics Users Group)

Although U/MRUG is not a commercial enterprise, they are constantly searching for new ways to proliferate the use of robotics and advanced remote technologies within the utility industry.

Recent events show that U/MRUG is on the right path of reaching out and spreading the use of robotics. They have increased the frequency of meeting hosted by end users. They are also displaying equipments at these meetings to the hundreds of outside host utility guests that visited these display and walked away with a new awareness of robotics and an enthusiasm that was not there before.

Prior to the November, 1994 U/MRUG meeting, EPRI agreed to establish a formal relationship with U/MRUG. The relationship will add professionalism to U/MRUG's conduct of business. For example, EPRI assistance and access to resources will allow them to become more efficient in the way they coordinate meetings and prepare and distribute meeting minutes. They will also be able to jointly prepare and distribute an U/MRUG newsletter.

The relationship can also provide feedback and direction to EPRI with respect to robotics, remote technologies, and video research for the electric utility industry. This is quite important because EPRI has not fared so well with this in the past, and they are clearly looking to U/MRUG utility membership to provide them with support for R&D.

Finally, as U/MRUG takes advantage of EPRI's impressive communications network, it will allow them to reach a far wider audience on a consistent basis within the utility industry. If you would like to be added to the U/MRUG mailing list, or need to update your files with them, contact Leona Bares at (412) 765-3064 or fax at (412) 765-3069.

Taken From, "A Special Chairman's Letter to the Membership About U/MRUG's Future," by P.Hamby. For further information, contact Peter Hamby at Commonwealth Edison Company, 1400 Opus Place, Downers Grove, IL 60515. Tel: (312) 394-8607

Integrated Outages Are Quicker And Cheaper

Two years have gone by since Westinghouse started its outage integration program, which led to the 50 day, $20 million - or better outages achieved today.

As recently as 1992, the average refueling outage lasted 70 days and cost $25 million more. The outage term at Westinghouse knew there had to be a way to perform these outages both faster and more efficiently. From the beginning, this program was designed to foster a partnership between Westinghouse and the utilities that own and operate the nuclear power plants. Over the last two years, the program has been continually enhanced so that now utilities can often reduce maintenance outages to less than 50 days while reducing the cost of each to $20 million or less. Once the partnership is made between Westinghouse and its utility customer, both companies work together to set challenging, but achievable goals. They plan outage together and work year round in the Services Planning Implementation Meeting (SPIM) program, in which Westinghouse and its utility customers deal with issues that will surface during the outage or look for new technology to make the outage run smoother.

Many utilities already use efficient outage procedures and practices to make their plants more cost effective. An integrated outage program can blend existing high quality and efficient practices with new processes that are the result of experience gained over the past two years.

Taken From, "Integrated Outage Are Quicker and Cheaper," by T. Christopher, pp.45-46, Nuclear Engineering International, October 1995.

Steam Generator Channelhead Decontamination Project

Hennigan Engineering has developed and implemented a remotely operated, 3-Dimensional Vessel Dose Reduction System (VDRS). The VDRS was designed to effectively reduce the levels of smearable contamination and radiological exposure associated with steam generator tube testing and repair work. It is fully remote operated from a central control station which incorporates the units air and high pressure water controls. A 400 H.P. hydroblast pump provides the pressure and flow requirements to operate the 3-D rotary, high pressure nozzles. The system was designed to allow for rapid setup in order to accommodate critical path schedules. The dose reduction associated with the system have far surpassed that of all other traditional steam generator channelhead decon techniques. Variations of the VDRS can be used for pipe decon, tube decon, RHR channelhead cleaning and related decon activities.

For more information, please contact T.R.Hennigan Jr. at Hennigan Engineering Company, 55 Industrial park Road, Hingham, MA 02043-4306. Tel:(617)749-0220, Fax:(617)7408738

APS Successfully Frees Stuck Fuel Assembly

Engineers and technicians for Arizona Public Services Company (APS) on April 7 successfully dislodged a stuck fuel assembly in the reactor core at the Palo Verde-2 nuclear plant. The workers used hydraulic jacks to push the assembly up from the bottom while a manual operator lifted it from the top. Prior to the lifting operation, APS

reinforced the structure of the fuel assembly by placing metal plates on the top and bottom and metal cables down the side.

A utility person also cut notches into the bottom of the assembly legs to relieve the pressure that had them wedged in place. They did all of this under 50 feet of water with no damage to the fuel pins and no release of radioactive material. APS carefully planned and practiced the procedure once engineers were confident that it would work. it also had to be approved by the Nuclear Regulatory Commission. Work crews practiced making the necessary cuts and removing the assembly using a full-sized dummy assembly inside the reactor vessel. APS waited until all the steps had been tested and all safety precautions had been taken before attempting to free the assembly.

Taken From, "APS Successfully Frees Stuck Fuel Assembly," pg.17, Nuclear News, May 1996.

Industry Watches As Annealing Demo Begins

By late May, Westinghouse Electric Corporation personnel will be at the site of thc ncvcr-completed Marble Hill nuclear power plant near Paynesville, Ind,. preparing for the first demonstration of thermal annealing of a reactor vessel in the United States. The industry is looking to thermal annealing as a remedy for radiation-included embrittlement of the steel stress.

The 6 million annealing demonstration is being funded equally by the U.S. Department of Energy and the nuclear industry, including Westinghouse, the Electric Power Research Institute, and Consumers Power Company. The primary goal of the demonstration is to show that the vessel can withstand the thermal stresses of annealing. It is important to show that the vessel can be heated to 850°F and still be in good operating condition after it cools. The temperature was chosen based on the composition and thickness of typical steel used in the industry. A secondary goal of the demonstration is to verify that Westinghouse and the rest of the industry can predict the stresses on the vessel during annealing.

The DOE is planning two thermal annealing demonstrations. The first will be at Marble Hill. The second will be done at Midland nuclear plant in Midland, Mich. later this year. By the time Westinghouse starts the demonstration at Marble Hill, It will have conducted engineering analyses to evaluate the thermal and stress characteristics of the thermal annealing process, defined the heatup and cooldown parameters, and defined the instrumentation and data acquisition system.

Taken From, "Industry Watches as Annealing Demo Begins," pg.17, Nuclear News, May 1996.

On-Line Calibration Of Control Rod Position Indicator

Consolidated Edison has developcd a control rod calibration method that reduces outages time, avoid reactor shutdowns and decreases manpower. This is accomplished by an extension of the deviation limits and calibration of the rod position indicators online.

The method was implemented during the spring 1995 outage at Indian Point Unit 2. The new process saved 36 hours of critical path outage time, reducing calibration time, manpower requirements and control rod movement. Typically, the rod position indicators instrumentation requires a long time to achieve thermal equilibrium and the desired accuracy. With this method, calibration can be done during noncritical path outage time. The method also allows calibration of individual deviating rod position indicators on line. Under the old method, the plant would have to be taken off line to hot shutdown for recalibration. Under the new method, the plant power would be reduced but the plant would remain on-line.

Taken From, "Engineering Challenge," pg.32, The Nuclear Professional, Winter 1996. Taken From information, contact Arthur P. Ginsberg, Consolidated Edison, (212) 460-4331.

Radiological Protection

A significant amount of turbine work was planned for thc fall 1995 refueling outage at Nebraska Public Power District's Cooper Nuclear Station. The high pressure turbines were scheduled to be removed for extensive blade replacement.

Because the plant is a boiling water reactor, the turbine work area has always been treated as a radiologically controlled area. When work began on the high-pressure turbine, the RP technicians encountered some higher levels of contamination. After turbine was lifted out, the RP technicians wiped down the casing and posted a few contamination areas. During this part of the job, some worker were dressed in yellow coveralls and some in hospital green. Workers were allowed to wear the greens in and out through the personal contamination monitors. The greens were not used as protective clothing, they were used to prevent the loss of a shirt if someone picked up a small amount of contamination. By reducing dress-out and monitoring time and other nonproductive activities, the plant saved roughly $350,000 in manhours alone. Another $26,000 was saved in laundry costs. In addition, the work was completed a full week ahead of schedule.

Taken From, "Radiological Protection," pg.31, The Nuclear Professional, Winter, 1996.

Comprehensive Low-Cost Reliability Centered Maintenance

Utilities can reduce preventive maintenance costs by applying systematic reliability centered maintenance (RCM) principles on a plantwide basis. The streamlined RCM methods described in this report are designed to optimize maintenance programs by controlling the scope without sacrificing documentation or technical quality. These cost-effective methods have been validated on a large number of plant system and offer a payback of one year or less.

Prior to this project, many nuclear plants had found that although RCM enabled them to reduce maintenance costs significantly, the nonrecurring costs were so high that the techniques could not be employed economically for large numbers of systems. A few utilities pioneered their own modified versions of the RCM approach with some success, but the methods differed substantially and their technical validity was uncertain. This project was designed to demonstrate a factor of two reduction in nonrecurring RCM costs through streamlining the RCM process while maintaining a high quality product.

EPRI organized a workshop in which a number of utilities described the most economical approach to RCM. Information was reduced to three RCM methods. They were easily implemented and provided the same sets of critical components as standard RCM. The methods provided varying degrees of documentation and offered a range of cost savings. However, all were much more efficient than standard RCM.

One significant additional tool was developed during this project to speed the selection of preventive maintenance tasks. Maintenance templates offer a convenient way to represent standard maintenance tasks for a given type of equipment. In practice, maintenance personnel preselect and approve standard maintenance tasks. RCM analysts then use these tasks to achieve consistency in more rapid assignments of preventive maintenance tasks to critical components.

Taken From, "Comprehensive Low-Cost Reliability Centered Maintenance," EPRI TR-105365, Final Report, September 1995.

Chromium Coatings To Reduce Radiation Buildup

Surface preconditioning of reactor components can reduce the incorporation of radiation that contribute to occupational radiation exposure. Significant reductions have been achieved by electroplating thin layers of chromium onto the base metal of a component, which is then preoxidized before exposure to primary coolant. Small test coupons exposed in the Doel-2 PWR showed greater than a factor of 10 reduction in activity pickup compared with an electropolished surface. Similar reductions were found in two chromium-coated manway seal plates, examined after exposure for one fuel cycle in the Millstone-2 PWR.

For the past several years, EPRI has been intensively investigating new methods to mitigate radiation buildup on out-of-core surfaces in LWRs in order to reduce occupational radiation exposure. As a result, a new surface preconditioning method known as stabilized chromium has been developed for pretreatment of reactor piping and other components. This treatment has been showing very favorable results in retarding radiation buildup.

The test in the Doel-2 PWR showed that thin preoxidized chromium films were extremely effective in reducing activity pickup compared with an electropolished surface. Reduction factors ranged from 5 to 150. Thinner chromium films proved more effective than thick ones. Furthermore, specimens preoxidized in moist air typically showed higher reduction factors than those that had been coated only with chromium. Finally, high reduction factors were found for stainless steel than for Inconel substrates.

Consistently high reduction factors were found in the chromium-coated coupons that were exposed at Doel-2 during cycles 15, 16, and 19. The much lower reduction factors measured in cycle 17 were consistent with subsequent surface characterization measurements showing little chromium remained at the end of this fuel cycle.

A reduction factor of about 12 in activity pickup was measured on chromium coated manway seal plates that were exposed in Millstone-2 for one fuel cycle. A more modest reduction factor of about 2.5 was measured on the section of the RHR system piping at Diablo Canyon-2, the lowest activity pickup measured of the various treatments that were evaluated.

Stabilized chromium treatment is an exciting new surface preconditioning method that can reduce activity buildup by an order of magnitude or more. The results from the chromium-coated manway seal plates exposed in Millstone-2 steam generator are especially encouraging and suggest that utilities should have spare manway seal plates chromium-coated so they can be installed as needed. The program is being implemented to develop and evaluate techniques for applying chromium coatings to large and more complex shaped components.

Taken From, "Chromium Coatings to Reduce Radiation Buildup," EPRI TR-105813, Final Report, December 1995.

NOREM Application Guidelines

Wire products have been successfully fabricated and new procedures developed for machine and manual gas tungsten arc welding (GTAW) of the iron-base NOREM hardfacing alloys. These developments enhance the

attractiveness of NOREM alloys both in replacement valves and in field repairs of installed valves.

An earlier EPRI report described the results of the first attempts to develop GTAW procedures for NOREM hardfacing alloys. However, utility personnel reported some difficulty in independently qualifying these procedures. Additional studies were therefore undertaken to see if more flexible welding procedures could be identified for NOREM wire products. The project team obtained some 75 variants of metal-core NOREM weld wire from a source that used standard commercial practice in fabricating the wire. They used the GTAW process to deposit these alloys on carbon and stainless steel plate and piping. Welds were inspected in accordance with ASME standards. For variants where sound deposits were obtained, the team used the GTAW process to again deposit NOREM on pins and plates, which were used to evaluate galling wear resistance. Plasma transferred arc welding (PTAW) procedure were developed by two independent organizations.

Researchers successfully used GTAW processes to deposit sound weld overlays on SA-516 carbon steel and TYPE 304 stainless steel piping without any preheating. Metal-core wire using prealloyed gas-atomized powder as filler material and featuring a lower nitrogen content than earlier investigated consistently provided sound welds and greater flexibility to the welder and could be used to perform a local weld repair. Powder with the high nitrogen content was successfully deposited by two other organizations using PTAW with a modest preheat of 200°F. Such a moderate preheat will remove residual moisture and help maintain consistent cooling rates. Preheat should be considered anytime hardfacing is applied to carbon steel substrates. Wear measurements showed that changes in alloy composition of the wire did not adversely affect the galling wear resistance of the NOREM alloys.

Loop tests under simulated reactor operating conditions and laboratory evaluations of small valves hardfaced with NOREM show that its performance matches or exceeds that of the long-established cobalt-base Stellites. Because valves with NOREM hardfacing have been purchased or installed by some 25 nuclear utilities, a NOREM product form and welding procedures suitable for field applications were needed. This study resulted in a NOREM chemistry that can be deposited more easily and more consistently using the GTAW process than the previously identified composition. In addition to its "welder friendly" status, the NOREM alloy also exhibits wear resistance equivalent to that of cobalt-base hardfacing alloys. Additional welding procedures and lessons learned from plant experience will be incorporated into revision 1 of these guidelines to be issued in about one year.

Taken From, "NOREM Applications Guidelines," EPRI TR-105816, Final Report, November 1995.

TVA Saves Critical Outage Time For Examination Of RPV And Internals Lifting Device

Tennessee Valley Authority (TVA) saved an estimated $600,000 by using acoustic emission (AE) monitoring in lieu of conventional NDE surface techniques to inspect reactor pressure vessel (RPV) head and internals lifting rigs.

With careful planning and minimal impact on the refueling activities, the utility performed AE monitoring to meet the NDE requirements of ANSI N14.6-1978, "American National Standard for Special Lifting Devices for Shipping Containers weighing 10,000 Pounds or More for Nuclear Materials." With AE monitoring, the utility satisfied compliance with NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants."

NUREG-0612 requires compliance with ANSI N14.6-1978 to perform either (1) a 10-minute 150% load test of the lifting device in conjunction with a visual inspection of critical areas and welds for deformation and flaws or (2) dimensional testing, visual inspection and nondestructive examination of major load carrying welds and critical components of the lifting device. To perform a 150% load test, the lifting rig would have to be moved outside at a substantial cost since the reactor and auxiliary building cranes are not rated for the required load. Also, it was cost prohibitive to disassemble, prepare parts, including welds for dimensional and surface testing of these components, without incurring damage or impacting reassembly maintenance activities. As a result, the utility selected an alternative inspection approach to satisfying the NDE portion of the ANSI requirements, thus complying with NUREG-0612.

To reduce impact on the refueling activities while minimizing the overall inspection cost, TVA's inspection Services organization elected to apply AE monitoring in lieu of liquid penetrant, magnetic particle, and ultrasonic testing. These conventional examination methods require labor-intensive preparation of parts and areas to be tested. The multiple examination techniques are required to detect both surface and internal flaws possibly present in clevis pins and root areas of fillet welds. In contrast, AE monitoring constitutes a single volumetric examination technique for 100% inspection coverage of the entire lifting rig components. Any active flaws identified and located by AE would then be sized and characterized by ultrasonic inspection methods. Fracture mechanics would ultimately determine the acceptability of any such identified flaws.

No unusual emission activity was noted from the RPV head or the upper internals lifting rigs. Based on the AE monitoring, no active flaws were found in the RPV head and internal lifting rigs.

Taken From, "TVA Saves Critical Outage Time For Examination of RPV and Internals Lifting Device,"

NUREG/CR-3693. For further information, contact EPRI NDE Center, P.O.Box 217097, Charlotte, NC 28221.

Experience With Inhibitor Injection To Combat IGSCC In Steam Generator

Laboratory testing has verified the potential for inhibiting caustic intergranular stress corrosion cracking (IGSCC) of alloy 600 by injecting titanium compounds into the steam generator feedwater stream. IGSCC of alloy 600 steam generator tubes results in expensive repairs and loss of availability in the industry. Analysis of field chemistry indicates that most steam generator IGSCC initiates in caustic environment. As a result of field experience, EPRI developed IGSCC inhibitors that have been effective in laboratory tests. These inhibitors include several forms of titanium oxides and hydroxides. Investigators also developed analytical chemistry methods suitable for plant implementation. A series of tests were conducted to determine hideout as well as the purity and stability of the inhibitor when heated in an aqueous environment with other construction materials. In parallel with laboratory test, field tests have been conducted at three utility sites - Northern Stats Power Prairie Island unit 1, Wisconsin Electric Point Beach unit 2, and Electrobel Doel unit 3 in Belgium. Investigators helped the participating utilities design an injection skid and injection location. In turn, the utilities prepared the required regulatory documents for injecting a test chemical into the secondary system. Investigators were on site for the tests and assisted with sample taking and analysis. Research resulted in the following key observations:

- In field testing, the analytical methods proved challenging but reliable.
- Hideout of the inhibitor was very high, as expected, but a low level of the inhibitor was maintained in the steam generator blowdown.
- Particulate and soluble species carryover of the inhibitor around the secondary circuit was negligible, as measured on cation and anion heat exchange membranes.
- Except for a chloride impurity in one titanium compound, the other compounds were free of potentially detrimental impurities.
- Interms of inhibitor stability, one titanium dioxide compound had a tendency to develop an iron-titanium-oxygen compound called ilmenite, which may form a more tenacious deposit.

The field test program revealed no new concerns, and testing for short periods was conducted without difficulties. However, while no major side effects appeared during testing, long-term injection is required to demonstrate efficacy against IGSCC. At present, Northern Stats Power has begun low-level titanium injections in a long-term test, which amy demonstrate that effect. Taken From, "Experience With Inhibitor Injection to Combat IGSCC in PWR Steam Generators," EPRI TR-105003, Topical Report, March 1995, 80 pages.

Effect Of Nuclear Power Plant Decommissioning Costs On Plant Life Cycle Decision

Nuclear utilities implementing Life Cycle Management (LCM) Programs and facing run-relicense-retire decision need to evaluate the financial cost/benefit of such decisions. Baltimore Gas and Electric (BGE) is responsible for assuring sufficient funds are available for decommissioning Calvert Cliffs Nuclear Power Plant (CCNPP) when the units cease operation. Costs and financial factors that must be considered include the actual cost of decommission costs must be evaluated in regards to determining a strategy for future plant operation.

Prior to beginning the study, BGE had selected DECON (immediate dismantlement and decontamination) as the preferred decommissioning method. The project team used the commercially available software, DECAS, to calculate decommissioning costs. The team calculated costs according to two different time periods: (1) Preparation for decontamination and dismantlement; and (2) Dismantlement and decontamination.

The estimated cost for decommissioning both Units 1 and 2 at CCNPP is $536 million. The estimate assumes that both units operate for their current license life and that BGE will use current technology for decommissioning under present federal regulations. If the decommissioning cost estimated is totally funded through rate recovery and investment compounding by the end of the current license term, the busbar cost impact is about $0.002 per kWh when a recovery rate of approximately $20 million per year is authorized. Compared with overall busbar costs for generating units on the east coast in a typical range of $0.05 to $0.20 per kWh, this rate for accumulating a decommission fund is small. A 20-year life extension has the potential to decrease this recovery rate, but the effect will be minimal and a prudent financial plan would call for continuing to recover at the current rate at lease until there is some assured situation of achieving a substantial extended operating period.

For BGE, the financial benefit gained by deferring the expenditure of the decommissioning fund by 20 years is not a significant consideration in the decision process for life extension.

Taken From, "Effect of Nuclear Power Plant Decommissioning Costs on Plant Life Cycle Decisions," EPRI TR-104829, Final Report, November 1995.

Hydropower Stops Run Short Of Plant Record

Day-to-day uncertainty in the flow of water through the Federal Columbia River Power System meant fluctuating demand for power from the Washington Public Power Supply System's (WPPSS) WNP-2 nuclear plant in February. The Bonneville Power Administration (BPA) asked WPPSS to shut down the reactor because it did not need the power, a month after praising the plant for staying on-line while plugging a leaking tube in the main condenser. On March 2, with WNP-2 just 15 days short of a new plant record generating run, WPPSS shut down the plant. BPA had all the low-cost electricity it needed from the region's hydroelectric plants.

WNP-2 had operated for 242 continuous days since finishing its annual maintenance and refueling outage on July 3, 1995, making this the plant's first-ever operations period between refueling outages with no unplanned shutdowns.

WPPSS avoided a shutdown early in February - when BPA needed its power - by plugging a leaking tube in the plant's main condenser while the plant remained on line. The repair team identified the one leaking tube out of 48,000 and plugged both ends with rubber stoppers. The successful plugging operation halted sulfate leakage from the cooling tower water into the reactor water, reducing the sulfate level in the reactor water from 12 parts per billion down to 1ppb.

WPPSS has performed similar condenser tube plugging several times before, but had to shut down the reactor to do it, most recently prior to refurbishing the plant's 96-in. circulating water valves. WPPSS attempted to repair the tube with the reactor on-line, but had to abort the operation because the unrefurbished butterfly valves would not seal sufficiently to drain the waterbox.

Taken From, "Hydropower Stops Run Short of Plant Record," pg.17, Nuclear News, April 1996.

Health Physics Society: Low-Dose Effects May Be Nonexistent

Health risk assessment for doses less than 5 rem per year above background or 10 rem lifetime should be limited to qualitative expression, according to a new Health Physics Society (HPS) Position statement. Published in the March 1996 HPS Newsletter, the statement says that adverse health effects are well documented for doses greater than 10 rem delivered at high dose rates. The comments state that risks of health effects are either too small to be observed or are nonexistent when below 10 rem, including occupational and environmental exposures.

The statement advises that the possibility of health effects at small doses should not be entirely discounted, but that risk assessment for such does should be expressed as a range of possible health effects, including the possibility of zero health effects. It also notes that collective d0se remains a useful index for quantifying dose in large populations. It notes, however, that for populations in which all persons receive lifetime doses of less than 10 rem above background, collective dose should not be quantified to estimate population health risks.

Taken From, "HPS: Low-Dose Effects may be Nonexistent," pp.18, Nuclear News, April 1995.

NRC Examines Sticking Control Rod

Control rod drop problem at two nuclear power plants prompted the Nuclear Regulatory Commission to issue, on February 15, an information notice to all nuclear plant licensees. The rods were slow to drop after reactor trips at Westinghouse pressurized water reactors. The control rod were all in Westinghouse fuel assemblies in their third generating cycle, with burnup greater than 42,800 megawatt days/metric ton uranium (MWD/MTU).

On December 18, 1995, South Texas-1, a 1250-MWe PWR near Palacios, Tex., tripped from 100 percent power. The operator, Houston Lighting & Power Company (HL&P), noted that the rod position indicators showed three rods had stopped six steps short of full insertion. One rod drifted into position within an hour, the others had to be manually inserted. Subsequent testing yielded the same results, plus a fourth rod was slow to insert, also indicating six steps withdrawn. This time, two of the rods drifted into position within an hour, but the other two had to be manually inserted. All four control rods were in fuel assemblies in their third cycle with burnup greater than 42,800 MWD/MTU.

The second incident took place at Wolf Creek, a 1160-MWe PWR. On January 30, 1996, five control rods failed to insert fully. Two rods stuck at six steps withdrawn, two at 12 steps, and one at 18 steps. Three of those rods drifted into the fully inserted position within 20 minutes, one within 60 minutes, and the last one within 78 minutes. All five rods were in fuel assemblies with burnup greater than 47,000 MWD/MTU.

Westinghouse, who designed and fabricated all the control rods involved, is working with Westinghouse Owners Group and HL&P to determine the root cause of the control rod problem. The information notice suggests several possible causes: debris, control rod or drive line degradation, corrosion production, thimble tube bow, fuel assembly bow and/or twist, reduction in thimble tube diameter, adverse alignment of guide tube cards, and/or design tolerances.

The information notice requires no specific action or written response from nuclear utilities.

Taken From, "NRC, Others Examine Sticking Control Rods," pg.19, Nuclear News, April 1996.

France And Japan Record Large Boost In Generation

Substantial increase in the already large quantities of nuclear electricity produced in France and Japan are recorded in official figure for 1995.

Electricité de France announced a 4.9 percent increase over 1994 to bring the total production from its 55 reactor units to 358.2 TWh. This represents 81 percent of EdF's total electricity production and 76 percent of total generation in France. A large increase of 10 percent in exports of electricity contributed an impressive 17.7 billion Fr($3.6 billion) to EdF's massive sales total of 188.6 billion ($37.8 billion), which was up 2.8 percent from 1994. Nuclear plant performance was good with an average availability of 81 percent.

The Japan Atomic Industrial Forum has reported a large increase of 12.7 percent in the output from the country's 50 reactor units. This boosted the output from 253.79TWh in 1994 to 286.04 TWh in 1995. The increased output from nuclear plants was particularly welcomed by Japan's electric utilities, which had a shortage of water supplies for their hydropower plants during the year. Official figures are not yet available for total electricity production, but the large nuclear increase and shortage of hydro means that the nuclear share will probably exceed the 30 percent figure of 1994.

Much of the interested output from Japanese plants was due to substantial increase in capacity and availability factors. The average capacity factor was up from 74.8 percent to 79.9 percent, while availability was up from 75.3 percent to 79.3 percent.

Taken From, "France and Japan Record Large Boost in Generation," pg.28, Nuclear News, April 1996.

Safety Assessment

Entergy Corporation's Arkansas Nuclear One (ANO) received superior ratings in three of four areas during the U.S. Nuclear Regulatory Commission's (NRC's) recent Systematic Assessment of Licensee Performance (SALP). Plant operations and plant support areas continued to reflect superior safety performance, and engineering improved from a 2 rating to a 1. The maintenance area which was rated superior during the previous SALP period was rated as good and assigned a category 2 rating.

For additional information: Phillip Fisher, Entergy Operations: telephone; 501-858-4861

Capacity Factor

Tennessee Valley Authority reports that its Watts Bar Nuclear Plant has generated power for 63 consecutive days and exceeded nuclear industry standards for power production. Since it began commercial operation May 27, the plant has operated at approximately 97 percent capacity factor. The industry average for a first-year plant is about 65 percent.

For additional information: Tom Tohill, Tennessee Valley Authority Watts Bar; telephone 423-365-3033.

Good Marks

The overall performance of Tennessee Valley Authority Sequoyah Nuclear Plant over a 19-month period was rated good by the U.S. Nuclear Regulatory Commission (NRC) in a report released recently. In its 1996 Systematic Assessment of Licensee Performance, the NRC gave Sequoyah good ratings in all four areas evaluated - operations, maintenance, engineering, and plant support. Sequoyah's capacity factor was above the industry average in 1995, and the plant is performing well again this year, reports the utility.

For additional information: Kay Whittenburg, Tennessee Valley Authority; telephone 423-751-7152.

Steam Generator Changeout

Framatome Technologies (FTI) has received a letter of intent from Public Service Electric and Gas (PSE&G) to assist with the first-of-a-kind steam generator (SG) changeout at Salem Unit 1. The four Westinghouse-design SGs from the unfinished Seabrook-2 plant will be used a replacements. FTI's workscope comprises inspection, improvement modifications, and removal of the SGs from Seabrook, and shipment to Salem. FTI will also be responsible for installation of the replacements; licensing for the changeout; and testing and inspection upon completion.

Refueling Record

A Spanish nuclear power plant, the CN Confrentes station, recently set a new world's record for the shortest refueling outage for a modern GE-supplied boiling-water reactor - 19 days and 15 hour, according to GE Nuclear Energy. This is also a record for all Spanish nuclear power plants. The achievement was accomplished in almost half the time the plant owner, Iberdrola, normally took to accomplish refueling and maintenance outages in the past.

Videoimagescope

Olympus America Inc., Industrial Products Group, has made available new literature describing the latest developments in their Videoimagescope systems for remote visual inspection of the internals of machinery, tanks, valves, heat exchangers, turbines, and other hard-to-see places. One highlight of the brochure is a new addition to the Videoimagescope line: the 6-mm-diameter Videoimagescope, Model IV6C5. Also described is the new Industrial Video Analyzer, Model IW-2. Other subjects covered include video/light source combination units that provide highest portability.

IAEA

ISBN 92-0-101496-1, Nuclear Power Plant Personnel Training and its Evaluation: A Guidebook and Executive Summary.

The above publication may be ordered from the International Atomic Agency (Austria); telephone +43 1 2060 (22529/22530), fax +43 1 2060 29302, e-mail: SALESPUB@ADPO1.IAEA.OR.AT.

New Products - Valve Packing Technology

DIVESCO announces plans to market a newly patented product, the Cornette Packing Method (CPM). CPM is a packing means and method for providing a seal around a valve stem. The CPM can be retrofitted on most valves in about the same time that is presently required to remove and replace current packing. Once installed, packing can be removed and replaced in a matter of minutes and requires no special tools, merely a single wrench.

Inspection Tool

GE Nuclear Energy's latest inspection tool, an ultrasonic testing (UT) scanner mounted on a unique, remotely operated vehicle - an "underwater submarine" - inspects core spray piping welds inside a nuclear plant's reactor vessel. Use of the tool enables users to conduct a major in-vessel inspection activity completely independent of the refueling bridge. The Vermont Yankee nuclear power station has ordered the new inspection service for use at a scheduled plant refueling outage.

Air Pilot Valve

Valcor Nuclear offers a series of compact, low weight, nuclear-qualified solenoid valves for air pilot control in nuclear power plants. Their principal function is to pressurize and vent pneumatic diaphragm actuators or air cylinders in harsh environments. These valves are designed specifically to prevent the chronic operational problems associated with previous commercial grade installations. The new models are direct acting, without diaphragm sealing, and are suitable for use in a wide range of safety-related applications.

Radiation Counter

The WALLAC MicroBeta ™ TriLuz is an all-in-one counter for counting beta, gamma, and luminescence radiation. The MicroBeta™ TriLux is a true LSC using the coincidence counting mode of opposing photomultiplier tubes for stability, efficiency, and reliability in both electrical and mechanical conditions. Counts may be done in vials, microvolume plates, filtermats, filter plates, and minitubes.

Pump Maintenance/Repair

Framatome Technologies offers reactor coolant (RC) pump maintenance and repair services for Westinghouse-design type 93A RC pumps, utilizing equipment especially fabricated for this pump type. The equipment supports such operations as disassembly, inspection, reassembly, alignment, and refurbishment. The equipment includes a lifting fixture and transit shield device for pump internals, an up-ending and disassembly device, shielding storage casks, and a flange resurfacing machine.

Video Measurement System

C-Map Systems, Inc. recently delivered a VideoRuler, PC based video measurement system to OKG's nuclear power plant in Sweden. Included with the VideoRuler package was an underwater LazrDot option that provided automated precision calibration. C-Map Systems also provided on-site training for the OKG personnel, with the assistance of their European representatives from Nordic Vision AB.

Inspection Service

Vermont Yankee has ordered GE Nuclear Energy's first application of its automatic ultrasonic testing (UT) service to inspect reactor vessel internal piping welds. Called the Core Spray Inspection (SCI 2000) system, GE views the UT technique as a major breakthrough in in-vessel inspection technology.

Condenser Cleaning

Henningan Engineering Co., Inc. was recently contracted by Wolf Creek Nuclear Operating Station to remove a tenacious, hard calcium/silica scale deposit from the main condenser tubes. Previous condenser cleaning attempts utilizing metal scrapers, on-line abrasive rocket scrapers, and chemical cleaning proved unsuccessful. Henningan Engineering successfully employed its custom designed cleaning nozzles to hydrolase the tube I.D. at 20,000 psi. The specialized equipment removed the scale layer from the main condenser without causing any base metal damage. Henningan Engineering provides specialized condenser, heat exchanger, piping and radiological decon services to the nuclear power industry.

Document Management

In conjunction with the U.S. Department of Energy (DOE), NUS has signed an agreement with Pacific Northwest National Laboratory for NUS' PRONET for Windows document management software to be used at nuclear power plants in Russia, Ukraine, and Eastern European countries. PRONET, which is written in Cyrillic language, is being provided as part of the International Nuclear Safety Program (INSP) managed by DOE.

Plutonium Assay

The Decommissioning In-Situ Plutonium Inventory Monitor (DISPIM) has been developed by BNFL Instruments Ltd. to provide total plutonium assay of redundant plant items prior to removal from plant process lines. DISPIM is a fully portable system with the flexibility to monitor a wide range of object shapes and sizes up to 5 cubic meters, such as gloveboxes, vessels, and pipework.

Regulatory Library

NUS' CARL (Computer-Aided Regulatory Library) can be accessed from any PC or network and allows users to search the full text and abstracts users to search the full text and abstracts of thousands of U.S. Nuclear Regulatory Commission (NRC) documents, including full text of all NRC Notices, Generic Letters, Bulletins, Regulatory Guides, Inspection Manuals, Enforcement Manuals, and LER abstracts.

Chemical Decons

PN Services successfully decontaminated the reactor recirculation systems at Carolina Power and Light's Brunswick Unit 2 and Georgia Power's Plant Hatch Unit 1 during their spring 1996 outages. The Decontamination Factors (DFs) achieved, which were the average reductions in radiation levels throughout the systems, were greater than 50 and 30 respectively using the Electric Power Research Institute (EPRI) Low Oxidation State Metal Ion (LOMI) process and Nitric Permanganate (NP) conditioning steps. Recently, PN Services has had excellent results applying these processes particularly to boiling-water reactor systems using Hydrogen Water Chemistry (HWC).

Application Of The Telbot Robot In Hazardous Environments

In recent years, the acceptable levels of worker exposure to environmental hazardous such as radiation, toxic fumes and asbestos has steadily decreased. As a result, the use of both tele-operated and computer-controlled robots has increased dramatically. A new tele robot system, trade named Telbot, has been developed by Hans Walischmiller GmbH and has been used for nuclear steam generator maintenance in Canada and for decommissioning glove boxes in Japan. The novel mechanical design of the Telbot robot enables that all the joints can be rotated over 360 degrees continuously. Joints and arms with different sizes are designed for meeting the requirements of different payloads. The manipulator can be easily protected from the dirty environment, and some of the parts can be quickly changed when a defect happens. The control system is designed as an open system, the hardware is the VME bus system and the software is based on the VxWorks real-time operating system. A 3-D simulation system is connected to the control system for real-time visualization and off-line simulation.

For additional information: W. Walischmiller and H.-Y. Lee, Hans Walischmiller GmbH (Germany); and N. Bains, B. Majarais, and D.A Scott; Atomic Energy of Canada Limited (Canada).

Decontamination For Decommissioning

A significant cost associated with the decommissioning of nuclear equipment is the disposal of large radioactively contaminated components. EPRI has developed a dilute chemical decontamination process to provide a more economical means of disposing of these large components.

Conventional methods of retiring large components require construction of on-site storage facilities or sealing, handling, and shipping to a licensed disposal facility. Successful development of a decontamination process could provide significant financial returns. Currently available dilute chemical processes used on operating plants do not generally achieve decontamination to the extent required for unrestricted release or recyling. On the other hand,

concentrated reagents that provide the required degree of decontamination produce radioactive waste in an intractable form that poses difficulties in management and disposal.

Using the same type of approach that resulted in the successful development of the LOMI (Low Oxidation-State Metal Ion) process some years ago, the project team developed a process which, like LOMI, is easy to apply and features efficient waste management characteristics but provides much higher levels of decontamination. Unlike processes to be used on operational plants, where avoiding corrosion is a key requirement for returning system to services, more aggressive solvents can be used on retired components. Complete removal of radioactive deposits can be achieved by dissolving a thin layer of the base metal from the surfaces of retired components. The project thus focused on dilute chemical systems that would be compatible with conventional ion exchange technology for collecting the resultant radioactive waste. The DFD (Decontamination for Decommissioning) process is designed to remove the radioactivity present in the surface layer of components to allow those components to be treated as nonradioactive waste for disposal or recycling. The process requires use of a dilute solution of fluoroboric acid, which is applied under conditions of controlled oxidation potential to remove contamination from surfaces. As a result of the process, the radioactive contamination is collected on ion exchange resin in a conventional manner. Decontamination factors of 8000 were obtained on stainless steel and 2000 on alloy 600 reactor artifacts.

This process offers several advantages. First, the fluoroboric acid can in principle, be applied by existing decontamination equipment. Second, the process retains the waste management characteristics typical of nuclear power plant subsystem decontamination. Third, the process may be applied continuously until the desired result is

achieved. Finally, the resulting waste does not contain chelating agents and no cationic reagent is used that would hinder continuous cleanup by ion exchange. This DFD process offers a cost-effective alternative to storage or burial for retired nuclear power plant components. The effectiveness of the process allows unstricted release or recycling of non-activated material. Testing of the process using reactor artifacts is completed. The product is now available for non-exclusive licensing from EPRI.

Taken From, "Decontamination for Decommissioning," EPRI TR-106386, Final Report, May 1996.

New Combination Probe Locates SG Tube Flaws

Wisconsin Public Services Corporation (WPSC) will probably have to do laser welding to repair some sleeves in the Kewaunee nuclear power plant's steam generators, based on preliminary inspection results.

A special eddy current probe, designed to locate flaws in the tubes, has identified some tube that WPSC can keep in service without repairs. WPSC placed the plant's two steam generator in classification "C-3,", meaning that more than 1 percent of the sleeved tubes were found to be defective.

The Westinghouse-designed sleeves were installed on about 2000 tubes in each of the plant's two steam generator as a preventive measure in the later 1980s and early 1990s using a hybrid expansion joint process. Each steam generator has a total of 3388 tubes. WPSC plugged 700 tubes during the plant's last refueling outage.

Over the course of the past year, WPSC designed a combination eddy current probe, in collaboration with Westinghouse and Zetec, to identify the location of flaws. The collaborates tested samples pulled out of the Kewaunee steam generators, as well as fresh samples.

The probe consists of Zetec's Plus-Point eddy current probe with a bobbin coil probe on either end of it. The performance of the combination probe was qualified to the appropriate standards, and WPSC received approval of its repair criteria from the Nuclear Regulatory Commission. At the press time on October 8, the steam generator inspections were not yet finished. The exact number of the sleeves that have to be repaired has not known yet.

As well as refueling the Kewaunee reactor, WPSC plans to overhaul the plant's high-pressure turbine during the outage. The utility will take apart the turbine, repair steam erosion areas, refurbish the components to make sure they are working properly, and put the turbine back together.

Taken From, "The New Combination Probe Locates SG Tube Flaws," pg.22, Nuclear Engineering International, November 1996.

NRC: Restructuring May Affect Funding, Safety

The Nuclear Regulatory Commission expressed a concern in a September 23 draft policy statement that the restructing of the electric utility industry could affect a nuclear utility's access to adequate decommissioning funding and also might affect the protection of public health and safety.

If rate deregulation and organizational divestiture occur concurrently with the shutdown of a nuclear plant, then the licensee may not be able to provide adequate assurance of decommissioning funds. Thus, the NRC believes that its concerns with deregulation and restructuring lie primarily in the area of adequacy of decommissioning funds, although it is also concerned with the potential effect that economic deregulation may have on operational safety. The

NRC issued a letter in June reminding power plant licensees that they are required to inform the NRC of any changes that would constitute a transfer of their license and report any new information affecting their financial resources for safe operation and decommissioning. The policy statement emphasizes that no license may be transferred without NRC consent, including mergers, formation of holding companies, and sales of facilities.

The policy statement declares that the NRC will, among other relevant actions, continue to conduct reviews of financial qualifications involving nuclear power plants; identify all owners, direct and indirect, of nuclear power plants; and reevaluate the adequacy of regulations in light of economic and other changes resulting from rate deregulation.

Taken From, "NRC: Restructing may affect funding, safety," Nuclear Engineering International, pg.22, November 1996.

Threshold Argument Continues At Annual Symposium

John Graham, immediate past president of the American Nuclear Society, expounded on the possible benefits of low-level radiation based on the increasing body of scientific evidence being gathered together in the United States and Japan. He stressed the concept of adaptive response - so common in nature - whereby repair mechanisms are promoted by exposure to low levels of abuse, thus providing some level of immunity to higher exposures. While acknowledging that early radiological protection measures assumed a prudent nonthreshold response for radiation effects, he maintained the regulators were now turning a blind eye to several recent studies that have indicated beneficial effects of low levels of radiation.

Morris Rosen, coordinator for environmental affairs at the International Atomic Energy Agency(IAEA), said he was not particularly concerned with whether or not there is a radiation effects threshold, but he vigorously attacked the current regulatory requirements, which are driven by the linear, nonthreshold hypothesis. Time and again he stressed that regulatory limits on exposure to radiation should bear a sensible relationship to the everyday exposure from background radiation. He noted that large variations in background radiation from place to place around the world make current limits on additional small increments of man-made radiation look ridiculous. He explained it was like trying to improve road safety by putting a speed limit on bicycles while ignoring cars.

He maintained that the real tragedy of Chernobyl lies not so much in the actual or potential health consequences, but in the social and economic consequences for the affected countries. Some 400,000 people from contaminated area around Chernobyl were relocated due to the use of radiation protection concepts based on the nonthreshold hypothesis. In reality, however, the sum of doses from background radiation and from Chernobyl received by these people is still less than the background radiation dose alone in many parts of the world.

Roger Clarke, present chairmen of ICRP and director of the U.K. National Radiological Protection Board, came to the defense of current redulations. He again challenged those who are proposing a radiation threshold with arguments he has earlier articulated. One of the points of Clarke's argument to support the nonthreshold theory is that a single track of radiation - the lowest possible dose - can cause DNA double-strand lesions, which are less susceptible to repair and thus a more likely cause of tumor-initiating mutations in a single cell.

Taken From, "Threshold Argument Continues at Annual Symposium," Nuclear Engineering International, pg.39, November 1996.

1995 Revision To DOT And NRC Transport Regulations And Their Impact On Nuclear Power Plants

This report highlights the key 1995 revisions to the DOT and NRC regulations governing the transport of radioactive materials and radioactive wastes. It is intended that utilities use the report as a guide to identifying the various procedures, forms, and computer codes requiring modification pursuant to the recent regulatory changes. To encourage such use, the report is extensively cross-referenced to applicable portions of both regulations. The report also discusses other appropriate and recommended actions involving contracts, package testing, and training.

Since 1968, U.S. regulations governing the transport of radioactive materials and radioactive wastes have been based principally on international standards developed and issued by the International Atomic Energy Agency (IAEA). Periodically, both the U.S. Department of Transportation (DOT) and the U.S. Nuclear Regulatory Commission (NRC) publish amendments to their regulations in 49 CFR 1001-178 and 10 CFR 71, respectively. On September 28, 1995, both agencies finalized their rulemaking to incorporate the most recent IAEA standards. Although most changes are not significant, amendments that are substantive could have an important impact on nuclear power plant radioactive materials and radwaste shipping programs.

Industry experts on the transportation materials and radioactive waste initiated a comprehensive review of the September 28, 1995, revisions to the DOT and NRC regulations. They identified significant revisions affecting nuclear power plants (and most other radioactive material generators) and then analyzed the revisions for their potential impact on shipping activities. These revisions were documented in a draft report and submitted to all utilities in

EPRI's Nuclear Business Group for review. Responses were incorporated into the final report. The Nuclear Energy Institute (NEI) also assisted in the report review process by conducting a workshop on implementation of the DOT and NRC transport rules. Key representatives of both agencies attended. Responses to questions from utilities participating in the workshop, including specific written guidance from NRC, were incorporated into the final report.

The report provides:

- A comprehensive review of significant revisions in the DOT and NRC hazardous materials regulations.
- A discussion of the likely impacts of the regulatory revisions on nuclear power plants and appropriate actions for incorporating revisions into plant radioactive materials/radioactive waste shipping programs.
- An analysis of significant remaining inconsistencies between the DOT and NRC transport regulations.
- Additional recent guidance from NRC on implementation of the DOT and NRC regulatory revisions.
- Comprehensive guidance on NRC expectations of licensees with regard to the new hazardous materials transportation regulations.

Taken From, "1995 Revisions to DOT and NRC Transport Regulations and Their Impact on Nuclear Power Plants," EPRI TR-106926, Final Report, October 1996.

SEP Says Dodewaard To Be Permanently Closed

The Dutch Electricity Generating Board (SEP) has announced that it is planning the permanent closure of its Dodewaard nuclear power plant "in the near future," probably in March 1997.

Ironically, the announcement at the beginning of October came at the same time as the small 55-MWe (net) boiling water reactor was enjoying a moment of glory at the European Nuclear Society's Topnux '96 meeting in Paris on Economic Power for the 21st Century. With natural circulation cooling and passive safety features, the Dodewaard reactor provides a working demonstration of key features of GE Nuclear's Simplified Boiling Water Reactor (SBWR) concept and the slightly larger European SBWR, which is still attracting active development support from a number of countries.

After 27 years of exemplary performance, the Dodewaard reactor, which was only ever considered as a demonstration project, has provided as much operating experience as could reasonably be expected of it while its size precludes an economic role in the increasingly competitive European market for electricity.

Behind SEP's closure decision, however, is the conclusion that the Dutch government is unlikely to make a firm decision on the further use of nuclear energy in the feature. At the end of last year, an energy policy document pronounced on indefinite postponement of any decision on new nuclear power plant construction. This year also sees the end of government funding for a project aimed at maintaining nuclear know-how that had been supporting the continued operation of Dodewaard.

The Dodewaard plan, built by General Electric in just four years between 1965 and 1969, has produced more than 11 TWh of electricity, with a life time capacity factor of about 80 percent. Dodewaard may still have a valuable role to play as a demonstration decommissioning project.

Taken From, "SEP Says Dodewaard to be Permanently Closed," Nuclear Engineering International, pg.44, November 1996.

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