PRM-50-84
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OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

August 14, 2007

Ms. Annette L. Vietti Cook
Secretary
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555-0001

Attention: Rulemaking and Adjudications Staff

PRM-50-84 is Long Overdue

Dear Ms. Vietti Cook:

I note that in its public comment regarding PRM-50-84 on August 3, 2007, the Nuclear Energy Institute produced the following bottom line:

"The Industry position is that the petition for rulemaking submitted by Mr. Leyse is not needed and should not be considered for action by the Nuclear Regulatory Commission."

To the contrary, detailed attention by the NRC to the matters of PRM-50-84 is long overdue. For a long time, the Industry has proceeded with crud-related practices that have had no NRC review. Among these is ultrasonic fuel cleaning that is performed within the reactor containment without any NRC review of the equipment design or the operating procedures. Another is the performance of an "innovative technique" for crud sampling that is performed within the reactor containment without any NRC review of the equipment design or operating procedures.

The Industry prefers to inform its public via an incomplete set of press releases that have no certification. Clearly there is a need to implement PRM-50-84. Following are three public documents in the fields of ultrasonic fuel cleaning and crud sampling that I have found via the internet.

Press releases

Bethesda, Md, February 15th, 2007

AREVA Employs New Fuel Cleaning Service Equipment
During Fall Outage

Template = SECY-067

SECY-02

AREVA today announced that it has added PWR Ultrasonic Fuel Cleaning (UFC) capabilities to its line of fuel services. UFC equipment is designed to effectively remove and capture corrosion products from irradiated fuel assemblies.

"Our Ultrasonic Fuel Cleaning equipment allows AREVA to provide a service that is more cost-effective for our customers than buying and maintaining the equipment themselves," said Vee Dunn, AREVA Fuel Services Product Manager. AREVA is an Electric Power Institute (EPRI) licensed user of the cleaning technology and authorized UFC provider for nuclear stations worldwide.

AREVA Fuel Services successfully used its new equipment to provide UFC services during the recently completed refueling outage at Tennessee Valley Authority's (TVA) Watts Bar Nuclear Plant in East Tennessee. AREVA's wealth of planning and on-site experience made the installation and operation of the UFC a success.

The UFC services exceeded TVA's expectations by both completing the job ahead of schedule and successfully removing and capturing a substantial amount of activated corrosion products.
Dunn said the activated corrosion deposits that form on the fuel can be transported out of the core during plant operation where they can redeposit on primary system components and increase plant radiation fields. UFC removes these deposits from the fuel, thereby reducing the risk of higher dose rates throughout the primary reactor systems.

Nuclear Energy Institute FOR IMMEDIATE RELEASE

- **Contact:**202-739-8000
- **For Release:**May 18, 2005

Employees at Entergy's River Bend Station Earn Top Industry Practice 'Best of the Best' Award

Other Companies Also Win Top Industry Practice Awards

WASHINGTON—Employees at **Entergy Corp.'s River Bend Station** in Louisiana have been awarded the nuclear energy industry's B. Ralph Sylvia Best

of the Best Award.

The team won for its first-of-a-kind approach for examining nuclear fuel to determine the cause of deposits that form on the fuel and interfere with heat transfer and the efficient production of electricity. The Top Industry Practice (TIP) award was presented at the Nuclear Energy Institute's (NEI) annual conference here.

The NEI TIP awards recognize industry employees in 13 categories for innovation to improve safety, efficiency and plant performance. The Best of the Best Award honors the late B. Ralph Sylvia, an industry leader who was instrumental in starting the TIP awards in 1993.

Other companies receiving awards were: American Electric Power, Dominion Nuclear Connecticut, Dominion Generation, Dominion Resources Services, Exelon Generation, FirstEnergy Nuclear Operating Co., Florida Power and Light, Nuclear Management Co., PPL Susquehanna LLC, Southern Nuclear Operating Co., STP Nuclear Operating Co., and Tennessee Valley Authority .

The River Bend Station entry was selected from 94 nominations for the team's innovative technique to obtain pieces, or "flakes," of residue from fuel rods while submerged in coolant water. This examination was necessary because workers had identified significant residue buildup as the primary cause for fuel failures.

"Such examinations were previously only possible through use of shielded enclosures known as hot cells, an expensive and time-consuming technique that requires two to three years from start to finish and an investment of $2 million to $3 million. Entergy's innovative method can be completed in six months, at a substantial cost saving. More importantly, worker radiation exposure is reduced three rem to 300 millirem," said Skip Bowman, NEI's president and chief executive officer.

"All U.S. power reactors can use this technique. Indeed, River Bend's efforts are now serving as a basis for additional incentives that will further the entire industry's knowledge of residue formation and behavior," Bowman said.

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Fuel Crud Formation and Behavior

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Fuel Crud Formation and Behavior

By Charles Turk, Entergy.

The following team members at Entergy's River Bend Station are the recipients of the 2005 Top Industry Practice, Fuel Process *Award: David Smith, Entergy Senior Staff Engineer BWR fuel, Charles Turk, Entergy Manager Nuclear Engineering Analysis, John Maher, Entergy Senior Lead Reactor Engineer, Dr. Mike Pop, AREVA Senior Principal Engineer, Plant Chemistry and Corrosion Engineering, and Dr. Bo Cheng, EPRI fuel Project Manager.*

The Top Industry Practice (TIP) Awards highlight the nuclear industry's most innovative techniques and ideas. They promote the sharing of innovation and best practices, and conseuently improve the commercial prospects and competitive position of the industry as a whole. In 2005, the TIP Awards recognized excellence in 13 categories, a special reognition award, and the grand prize -- the B. Ralph Sylvia Best of the Best Award. The awards were sponsored by AREVA, GE Energy, Nuclear, Westinghouse Design and Westinghouse-Combustion Engineering Design.

Charles Turk

Charles Turk is a graduate of Texas A&M University and has an MBA from University of Arkansas at Little Rock. He is currently Manager of Nuclear Engineering Analysis and Design for Entergy Incorporated which includes responsibility for Nuclear Fuel, Probabilistic Safety Analysis, and Engineering Programs. He was formerly the Manager of Nuclear Engineering, Manager of Mechanical Engineering, and Manager of Design Engineering for Entergy's ANO plant site and also spent time as ANO's Licensing Manager.

Summary

The nuclear power industry has experienced a wide variety of adverse behaviors associated with design and operation of nuclear fuel. The resulting increase in the incidence of fuel failures has led to increased concern among utilities, the Institute of Nuclear Power Operations (INPO) and the Nuclear Regulatory Commission (NRC). INPO's Significant Operating Experience Report (SOER) 03-02 focused on several precursors or contributing causes to the fuel related problems; however, one area of frustration to engineers is the difficulty associated with examining fuel and obtaining

pertinent information to support root cause analyses. Very often the only means to obtain the type of data needed is to pursue the time consuming and very expensive process of Hot Cell examinations.

During the River Bend Station Cycle 11 refueling outage, significant crud buildup was identified as the primary cause for multiple fuel failures. Members of Entergy and the Fuel Vendor staffs decided to attempt a "first of a kind" poolside technique to obtain actual pieces or "flakes" of crud from the fuel rods. Success at obtaining the flakes would allow possible study of crud morphology using advanced chemical and physical analysis techniques which were previously only possible through hot cell campaigns.

The efforts to establish new tooling to obtain crud flakes and combine the methods of analyzing damaged fuel rods succeeded through the coordinated efforts of the utility, the fuel vendor (Framatome), and experts from the Electric Power Research Institute (EPRI). The resulting knowledge base of crud morphology and the implications for plant Chemistry and Operations staffs were significant. Several advanced examination techniques were combined to provide insights into key relationships between reactor coolant chemistry constituents and fuel rod heat transfer mechanisms. A flake typical of those obtained is shown in Figure 1.

Nuclear Safety is inherently tied first to the integrity of the primary fission product barrier, the fuel cladding. Advancing the state of the art techniques for rapidly evaluating and understanding the nature of crud on fuel pins provides direct input to better understanding means for protecting the fuel.

Cost savings are considerable when considering the value of poolside work compared to the alternative. Hot Cell examinations typically require 2 to 3 years from start to finish and total investments required are typically in the range of 2 to 3 million dollars compared with the initial crud flake analysis which was an order of magnitude lower. As indicated before, the efforts to obtain flakes and the resulting analytical analysis are first of a kind and represent clear application of innovation in both "thinking" and execution.

Improvements and efficiencies in worker productivity were realized through the rapid acquisition of information relative to fuel failure root cause analysis. Any results that potentially affect fuel design, chemistry practices or operating regimes can feasibly be addressed during the upcoming cycle rather than possibly not being brought to light for years (if ever).

The methods involved in applying the crud flake technology are relevant and directly transferable to all nuclear plants. Crud formation on fuel has been a problem at both PWRs and BWRs. The methods used following the River Bend efforts are now serving as a basis for additional initiatives that will further the entire industry's knowledge of crud formation and behavior.

Safety

The first Nuclear Safety barrier from fission products is provided by the fuel cladding. Advancing the state of the art techniques for rapidly evaluating and understanding the nature of crud on fuel pins provides direct input to understanding the means for protecting the fuel. In this case, significant insights were obtained regarding the nature of Zinc, Iron, Copper and Silica deposits. This knowledge is important in understanding the impact on plant chemistry as well as insights possibly affecting the management of several Plant Chemistry programs.

Radiological safety is also enhanced by the significantly reduced personnel exposures in two areas. First, the poolside efforts using the new tooling for obtaining and handling crud flakes when compared to total dose from removal, packaging, and handling failed pins for shipment to a hot cell is much lower. The total exposure from the River Bend campaign has been estimated at less than 300 mrem. Secondly, typical hot cell campaign exposures have been measured at levels exceeding 3 rem. By contrast, the total doses in the laboratory associated with the crud flake analyses for River Bend were less than 400 mrem, a reduction by a factor of 8. The campaign to obtain the flake samples was also performed without impacting outage schedules and completed safely, with no First Aid events, OSHA recordable events, or Lost Time Accidents.

Cost Savings Impact

The Advanced Poolside Techniques for Fuel Crud Flake Sampling and Analysis produces a cost avoidance associated with root cause evaluation of fuel failures that can be approximately quantified as being $800,000 up to $1,000,000 per failed rod assuming that the bounding selection of the flake scraping location avoids totally a Hot Cell Analysis to obtain similar information.

Due to difficulty of removing a defective rod from a fuel assembly, using the scraping method to obtain flakes also avoids the potential of large expenses which could occur should undesirable problems be encountered attempts to remove a failed fuel pin. Severing damaged rods is not unusual in such cases.

Productivity/Efficiency

The ability to more rapidly and efficiently acquire information that is paramount to fuel failure root cause analysis represents real improvements in worker efficiencies and productivity. By choosing the proper location for scraping, the flake analysis will represent a bounding condition for analysis and may totally replace the need for additional efforts. The ability to obtain the final analysis results in 6 to 12 months from the moment of crud scraping operation is perhaps the most important aspect of all. Resulting insights from the failure analyses potentially affect fuel design, chemistry practices and even operating regimes. Therefore, the analysis of results may allow implementation of appropriate changes as soon as the next operating cycle Such knowledge provided through this new approach may otherwise not be obtained for years (if ever).

Improvements and efficiencies in worker productivity were also realized in the RBS campaign by keeping the amount of work during the poolside inspection to a minimum and avoiding the complication of dismantling the fuel bundle and transferring failed rods in preparation for shipment to a hot cell facility should that option have been necessary.

Transferability

The methods developed are relevant and transferable to all nuclear plants. Crud formation on fuel has been a problem at PWRs as well as BWRs. The methods used following the River Bend efforts are now serving as a basis for additional initiatives that will further the entire industry's knowledge of crud formation and behavior. For example, methods developed to determine the number and distribution of chimneys and capillaries

on fuel crud surface, essential in understanding the adequacy of heat transfer within the crud deposit have large applications for both PWR and BWR fuel depositions. Additional research is currently being pursued to further the knowledge of differential crystal growth in crud flakes, a critical phenomenon seen in crud across the industry, but not well understood.

Contact: Charles Turk, Manager, Nuclear Engineering Analysis, Entergy, 1340 Echelon Pkwy, Jackson, MS 39213; telephone: 601-368-5462, fax: 601-368-5394, e-mail: cturk@entergy.com.

The technique described in this article is Nuclear Energy Institute's 2005 Top Industry Practice, Fuel Process *Award Winner (ID# 4315).*

Clearly there is a need to implement PRM-50-84. Crud deposits are ubiquitous among the worldwide fleet of LWRs, and the issues are of very high safety significance.

Robert H. Leyse