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September 4, 2008

I recently became aware that the NRC is soliciting Public Comments on Documents Under Consideration To Establish the Technical Basis for New Performance-Based Emergency Core Cooling System Requirements and that Comments on these documents should be submitted by September 5, 2008. The NRC announced the availability of Research Information Letter (RIL) 0801, "Technical Basis for Revision of Embrittlement Criteria in 10CFR 50.46" and NUREG/CR–6967, "Cladding Embrittlement During Postulated Loss-of-Coolant Accidents," and that it is seeking public comment on these documents.

It is interesting that the NRC solicits Public Comments related to crud deposition as follows:

II. Performance-Based Testing Requirements

3. Crud deposits on the fuel cladding surface may affect fuel stored energy, fuel rod heat transfer, and cladding corrosion.
a. What role does plant chemistry and crud deposits play on these items?
b. How should normal and abnormal levels of crud deposits be addressed from a regulatory perspective?

This is interesting because the word *crud* is not in RIL 0801 and it appears only once in NUREG/CR–6967. Each document has no discussion that focuses on crud.

Regarding item a, crud deposits play a very significant role in increasing fuel stored energy, in degrading fuel heat transfer and in accelerating cladding corrosion. NRC should apply its expertise including its tools such as TRACE and RELAP in determining the impact of crud in these areas.

Regarding item b, crud deposits must be recognized as a very significant item from a regulatory perspective. For example, several nuclear power reactors have deployed ultrasonic fuel cleaning without any oversight by experts within the NRC headquarters. Ultrasonic fuel cleaning has never received an evaluation by the ACRS. Ultrasonic fuel cleaning is basically unregulated. And, returning to TRACE and RELAP, those codes must be applied in determining the impact of crud on LOCAs or RIAs.

Regulations should require informing the public of the hazards to which they have been potentially exposed when crud is found. For example, the fact that a LOCA or RIA has not occurred does not mean that the public should not be told that the consequences of an accident could have been significantly different than licensing documents reveal.

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Fouling of Nuclear Fuel Elements is Ubiquitous

Fouling of nuclear fuel elements is ubiquitous among the worldwide fleet of light water reactors. The NRC has generally been oblivious to the impact of fouling on fuel element performance. The NRC has never performed analyses of the impact of fouling on the ongoing performance of LWR fuel; TRACE, RELAP, and other codes have never been applied.

Following are a very few of the records that reveal the development, the marketing and the field applications of Ultrasonic Fuel Cleaning. It is significant to note that the widespread applications of Ultrasonic Fuel Cleaning have only had in-house approvals via 10 CFR 50.59 schemes; there have been no evaluations by NRC technology groups and there has been no detailed evaluation of the technology by the ACRS.

Ultrasonic Fuel Cleaning: AREVA, EPRI, Westinghouse, Dominion and more

Go to GOOGLE and enter Ultrasonic Fuel Cleaning. Hunt a bit and you will find a lot: Areva, EPRI, 50.59 game,

Following is the text of Areva's advertisement, minus the photographs.

Ultrasonic Fuel Cleaning

Effective fuel cleaning technology to help assure performance and improve safety. AREVA NP offers patented Electric Power Research Institute (EPRI) Ultrasonic Fuel Cleaning (UFC) to prevent uneven crud deposits that can negatively affect fuel performance. With proven performance in applications at several domestic U.S. utilities, UFC can also reduce dose rates on primary components contaminated by the migration of activation products from core surfaces. Plus, we are an official EPRI licensee authorized to supply UFC equipment and services to nuclear stations worldwide. We can provide UFC for your next outage.

UFC was developed by EPRI to eliminate in-core flux depression by effectively

removing deposits from fuel assemblies during refueling outages. Ultrasonic waves cause small particles of crud to release from the fuel assembly. Fuel pool water cools the fuel and transports particles to the filter banks where they are collected for final disposal. The system employs disposable filters to remove radioactive corrosion and activation products. Customers can store the filters in their fuel pool or process them for immediate shipping.

Cleaning Chamber Ensures Even Distribution A special cleaning chamber, similar to a fuel rack, holds ultrasonic transducers positioned on each face of the fuel assembly in an overlapping pattern. This configuration ensures even distribution of the ultrasonic energy into the fuel assembly. Reliable Console Controls the Process An operating console, located on the refuel floor near the edge of the spent fuel pool or reactor vessel, controls the process. The operator can easily observe the cleaning parameters and performance of the filtration unit. Underwater Filters Capture Removed Deposits. The underwater filters contain removed deposits while maintaining radiation to acceptable levels. A variety of filtration system designs are available to provide custom optimization.

BENEFITS
BWR or PWR application
Effectively removes crud
Improves fuel flux distribution
Improves fuel utilization
Reduces radiation source term
Reduces primary system dose rate

And here is the notice of EPRI's R&D award, also on GOOGLE:

October 05, 2005 09:00 AM Eastern Daylight Time
EPRI's Patented Nuclear Fuel Cleaning Technology Receives R&D 100 Award; Award Reception Slated for Oct. 20
PALO ALTO, Calif.--(BUSINESS WIRE)--Oct. 5, 2005--The Electric Power Research Institute (EPRI), three member companies, AmerenUE, Exelon Corp., and South Texas Project Nuclear Operating Co., and Dominion Engineering, Inc. (DEI) have earned a prestigious 2005 R&D 100 Award for ultrasonic cleaning of nuclear fuel, a promising new technology that safely removes deposits from irradiated fuel assemblies in nuclear power plants.
The annual awards are given by R&D Magazine for the most outstanding technology developments with commercial potential. The award reception will take place Thursday, Oct. 20 in Chicago; EPRI Senior Vice President and Chief Technology Officer Ted Marston is scheduled to attend.
"The future of the energy industry relies on pursuing innovative technologies that advance efficient, reliable and environmentally sensitive power generation and transmission," said EPRI CEO Steven R. Specker. "I applaud our team and member companies for their contribution towards this end."

The technology awarded delivers a patented process for removing corrosion products deposited on irradiated nuclear fuel pins using a unique form of ultrasonic technology. The technology was first applied at their nuclear power plants by the three EPRI member companies noted above, using equipment supplied by DEI.

"We were pleased to hear that our technology received an R&D Award," said Christopher J. Wood, a technical manager in EPRI's Nuclear Sector. "This breakthrough technology allows the full potential of current nuclear fuel designs to be achieved while maintaining excellent fuel reliability. Availability of a safe, reliable cleaning technology will also now allow utilities to further optimize fuel performance, core design, and reduce radiation fields and electricity generating costs."

This unique technology, developed in EPRI's Fuel Reliability Program, solves a significant emerging problem by removing deposits from nuclear fuel assemblies in nuclear power plants. Enhancing the performance of nuclear fuel is crucial to continue the improvement in electricity production from nuclear units. Over the past decade, nuclear power production has increased by over 20 percent, but this has placed additional demands on the fuel, as fuel temperatures have increased. Some of the potential problems with fuel reliability result from the buildup of deposits on the surfaces of the fuel elements, which produces an insulating layer that could result in corrosion of the fuel cladding material at increased fuel pin temperatures. Until EPRI's developed technology, there was no effective way of removing these deposits during the working life of the fuel. Including early development demonstrations, this ultrasonic fuel cleaning technology has been used successfully eight times at nuclear power plants in the USA through 2004, and has been licensed worldwide. Seven additional commercial applications have taken place in 2005, including one in Spain. The technology used cleans all the fuel elements in every fuel assembly without any adverse effects. The cleaning process does not extend the schedule of routine refueling outages and is very cost-effective in pressurized water reactors. It is expected to result in a major reduction in radiation fields in boiling water reactors.

About the Electric Power Research Institute

The Electric Power Research Institute (EPRI), with major locations in Palo Alto, California, and Charlotte, North Carolina, was established in 1973 as an independent, nonprofit center for public interest energy and environmental research. EPRI brings together member organizations, the Institute's scientists and engineers, and other leading experts to work collaboratively on solutions to the challenges of electric power. These solutions span nearly every area of power generation, delivery, and use, including health, safety, and environment. EPRI's members represent over 90% of the electricity generated in the United States. International participation represents nearly 15% of EPRI's total R&D program.

And here is how NRC accepted Ultrasonic Fuel Cleaning under 50.59!

SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION

1 Ultrasonic Fuel Cleaning

From NRC Report 50-498/02-05
January 27, 2003

a. Inspection Scope

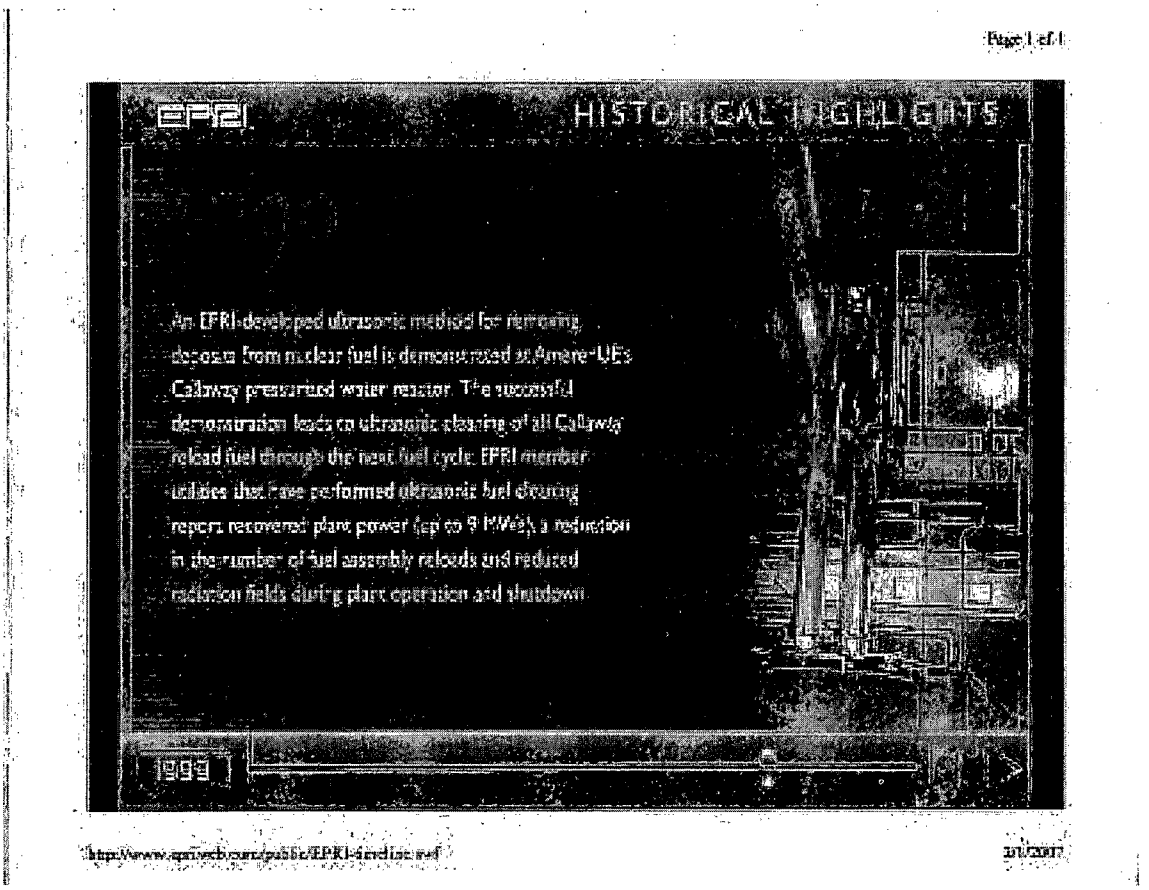
On October 21, 2002, the inspectors observed portions of work activities in support of the ultrasonic fuel assembly cleaning activities in Unit 2. This was a first-time evolution using equipment which was specially designed for South Texas Project fuel. The inspectors reviewed Plant Operating Procedure 0POP06-FH-0013, "Ultrasonic Fuel Cleaning System," Revision 2, and the associated work package used to control the work. The inspectors also reviewed the following documents to evaluate the testing used to establish the safe operating conditions and the impact on the fuel, as well as to compare the conditions between the tests and the actual plant procedure:

- "South Texas Project Ultrasonic Fuel Cleaner Qualification Test Report R-3712-01-1," Revision 0, dated May 2002 by Dominion Engineering, Inc.
- Electric Power Research Institute Technical Report 1001095, "Fuel Pellet Integrity Assessment for the EPRI Ultrasonic Fuel Cleaning Device," dated December 2000
- Electric Power Research Institute Technical Report 1003229, "Ultrasonic Fuel Cleaning Efficacy Campaign Results at Callaway"
- 50.59 Evaluation 00-17679

b. Findings

No findings of significance were identified.

And here we have EPRI, way back in 1999, highlighting its Ultrasonic Fuel Cleaning Process at Callaway as a 1999 payoff:



And, during September 2003, Westinghouse advertised its ultrasonic fuel cleaning service. "As a result, the plant safety review committee granted the application 10 CFR 50.59 approval."

Ultrasonic cleaning means fast, safe removal of fuel-assembly crud buildup

Crud — corrosion products that accumulate on fuel surfaces — can break loose and spread to other parts of the system, causing radioactive buildup. Over time, crud that builds up on fuel surfaces becomes activated by neutrons to form radioactive nuclides, making crud cleanup a high priority.

Ultrasonic fuel cleaning can break up crud deposits during normal refueling, trapping particulates in filters for storage in the fuel pool. Designed by Dominion Engineering, Inc. (DEI), and patented by EPRI, the technique blasts crud with ultrasonic transducers.

Ultrasonic cleaning reduces the risk of fuel damage and takes a fraction of the time required by other methods. Controlling crud and other particulate inventory

reduces out-of-core radiation fields and lowers radiation dosage levels. Eliminating crud also mitigates local in-core flux supression and decreases the likelihood of axial offset anomaly (AOA) caused by lithium and boron concentrations. Ultrasonic cleaning also helps prevent crud-induced power shifts that can reduce output by as much as 20 percent.

Ultrasonic fuel cleaning was first used and verified at the Callaway plant in Missouri in 2001. After a year, no evidence of core-wide AOA was found, and early ex-core dosage was reduced significantly with no impact on critical path time. Measurements of assemblies before and after cleaning, and of particulate discharge at the filters, showed that ultrasound cuts crud deposits by about 80 percent. **As a result, the plant safety review committee granted the application 10 CFR 50.59 approval.**

Ultrasonic cleaning is fast, too. During routine refueling, an assembly scheduled for reuse can be cleaned in as little as seven to ten minutes. Westinghouse is the first vendor to use this technique commercially. Our partnership with DEI gives utilities access to ultrasonic cleaning with minimal incremental costs.

Dominion (DEI), the inventors of Ultrasonic Fuel Cleaning, may have discussed Ultrasonic Fuel Cleaning Process/Success at a very recent meeting of PWR operators.

Sunday, July 20, 2008
PWR ALARA Association Board Meeting - Board Room
Wednesday, July 23, 2008
General PWR Session – Day 2
10:00 Ultrasonic Fuel Cleaning Process/Success – Dr. Robert Verrin (Dominion Engineering) Tentative

Submitted by:

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