

April 19, 2002

MEMORANDUM TO: Leslie Barnett, Acting Director  
Project Directorate IV  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

FROM: Drew Holland, Project Manager, Section 2  
Project Directorate IV **/RA/**  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF MARCH 7, 2002 MEETING WITH WESTINGHOUSE  
ELECTRIC COMPANY ON CREEP/GROWTH TESTING OF NUCLEAR  
FUEL

The Westinghouse Electric Company (W) met with the NRC staff to discuss issues related to its tests of nuclear fuel to observe the effects of creep and growth. The meeting focused on ZIRLO tensile/compressive stress in-reactor creep data, an investigation of certain chemistries that impact in-reactor creep, and an evaluation of the effects of low tin ZIRLO being employed. The content of the presentation was mostly proprietary.

W explained that the test samples that were irradiated did not contain fuel and that each of the four samples had been irradiated for up to four cycles. Samples discharged for measurement will not be reinserted. Samples have been disassembled by shearing after the refueling outage in the spent fuel pool and then shipped to the laboratory for examination. The parameters of the testing include fluences of approximately  $5 \times 10^{21}$  n/cm<sup>2</sup> E>1 MeV during each cycle, burnups of greater than 75,000 Mwd/MTU, constant fluxes of approximately  $1.06 \times 10^{14}$  n/cm<sup>2</sup>-sec E>1MeV, and operating temperatures of approximately 576-607 °F.

At this point W provided the bundle testing schedule. Replicate samples were done for all key tests to provide verification of measurements. Two sample designs were employed to evaluate gamma heating effects. Other key test matrix features were discussed. Alloy compositions were described for ZIRLO, low Sn ZIRLO, Alloy A, and key mechanical design features were discussed. Also, it was explained that most samples are internally pressurized with helium but that some (unstressed samples) are open to coolant. It was explained that inserts are irradiated in 1-cycle burned fuel assemblies and that new host assemblies are used for each irradiation cycle. Test assemblies are placed in symmetric locations to obtain flux symmetries and have the same flux values from cycle-to-cycle.

It was explained that the irradiation effects of creep and growth were not strongly dependent on test temperatures. Fluence measurements are accomplished using dosimetry capsules that house different material wire segments with cross-sections sensitive to different neutron energies. Post irradiation examinations measure oxide thickness, diameter change and length change. Hydrogen pickup analyses were also performed on selected samples, and an extensive statistical evaluation of 1-cycle creep/growth test data was discussed.

The creep/growth tests will be licensed under 10 CFR 50.59 with no changes to technical specifications required. The design function of the host fuel assemblies and the reload core is not adversely affected by the creep/growth Test. No exemptions to 10 CFR 50.44 and 10 CFR 50.46 are required for the advanced test material. Advanced test material does not surround the fuel.

The creep/growth test is considered by W to be the most comprehensive program undertaken to evaluate irradiation creep and growth. The program was described by W as enabling the characterization of standard ZIRLO with high accuracy. It also provides for the monitoring of hydrogen strengthening, fabrication processing and gamma heating. It will provide a reliable methodology to evaluate advanced alloys. The testing program has been described by W to be extremely comprehensive with a schedule that extends for over a decade. The stated goal of the meeting was for W to brief the staff on its long-term plans to execute creep and growth testing, which was accomplished. No regulatory determinations were made during the meeting.

Project No. 700

Attachment: Meeting Attendees

cc w/att:

Mr. H. A. Sepp, Manager  
Regulatory and Licensing Engineering  
Westinghouse Electric Company  
P.O. Box 355  
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Mr. Gordon Bischoff, Project Manager  
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**MEETING WITH WESTINGHOUSE ELECTRIC COMPANY  
ON CREEP AND GROWTH TESTING IN NUCLEAR FUEL**

**MARCH 7, 2002**

**ATTENDANCE LIST**

**WESTINGHOUSE**

R. Sisk  
T. Smentek  
J. Killmayer

**SOUTHERN NUCLEAR COMPANY**

R. Hoyland  
R. Florian  
K. Turnage

**PACIFIC NORTHWEST NUCLEAR LABORATORY**

C. Beyer

**NRC**

S. Wu  
D. Holland  
U. Shoop  
F. Orr  
M. Kowal  
S. Colzo