ArevaEPRDCPEm Resource

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Sent: Thursday, April 08, 2010 7:54 AM
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Subject: U.S. EPR Design Certification Application RAI No. 380 (4506), FSAR Ch. 9
Attachments: RAI_380_CIB1_4506.doc

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on March 17, 2010, and discussed with your staff on April 7, 2010. Draft RAI Questions 09.01.02-33 and 09.01.02-35 were modified as a result of that discussion. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,
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Request for Additional Information No. 380(4506), Revision 0

4/08/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.01.02 - New and Spent Fuel Storage
Application Section: 9.1.2

QUESTIONS for Component Integrity, Performance, and Testing Branch 1 (AP1000/EPR Projects) (CIB1)

09.01.02-33

Background

In order to assure compliance with GDC 61, the Standard Review Plan (SRP), NUREG-0800 Section 9.1.2, recommends that the staff verify the compatibility and stability of neutron absorbing materials in the SFP environment, to ensure no unacceptable reduction in the neutron absorbing properties of these materials. Preventing degradation of the neutron absorbing materials also supports compliance with GDC 62, which requires preventing criticality in the fuel storage and handling system through the use of physical systems or processes.

Proprietary Report TN-Rack.0101, Rev 0 in Section 2.2.1 paragraph 10 it states that "The neutron absorber material used in the construction of the fuel storage rack modules provides a minimum service life …". The staff requests clarification of the service life of the MMC.

Requested Information

1. Provide the means of measuring minimum service life in addition to the neutron capture capability of the MMC™.
2. Provide a more complete description of the definition of "minimum service life" that is used here so that there is a quantitative measure of the determination of the service life.
3. Identify other parts of the racks that:
    a. Have shorter "service lives".
    b. If so provide the shorter service lives.
    c. Provide a description of the testing program of the service life of the other parts.
    d. Describe the monitoring of the service life of these other parts of the assembly during operation.
4. Provide the basis for the acceptance criteria for the thickness increase limit and the edge corrosion limit of the coupons

09.01.02-34

Background

The Standard Review Plan (SRP), NUREG-0800, Section 9.1.2 recommends that licensees have a program for monitoring the effectiveness of neutron poison present in the neutron absorbing panels. Additionally, to meet GDC 61, SRP 9.1.2 also recommends that provision for testing to detect degradation of any strong fixed neutron absorbers.

The coupon removal and testing frequency is stated in Section 6.2.2 of Report TN-Rack.0101 Rev. 0. The frequency intervals are stated to start with the *commissioning* of the fuel storage racks.

The timed of removal of coupons should start with the first fuel offload. The commissioning of the racks will likely be 18 months to two years prior to seeing the first spent fuel.

Requested Information

As the with the MMC material in the spent fuel racks will probably not be exposed to irradiated fuel until 18-24 months after the plant is commercially operable, justify not commencing the coupon removal cycle 2 years after the first irradiated fuel is inserted.

09.01.02-35

In order to assure compliance with GDC 61, the Standard Review Plan (SRP), NUREG-0800 Section 9.1.2, recommends that the staff verify the compatibility and stability of neutron absorbing materials in the SFP environment, to ensure no unacceptable reduction in the neutron absorbing properties of these materials. Preventing degradation of the neutron absorbing materials also supports compliance with GDC 62, which requires preventing criticality in the fuel storage and handling system through the use of physical systems or processes.

The proposed corrosion coupon testing from TN-Rack.0101, Rev. 0 and the environment used in EPRI 1003137, “Qualification of METAMIC for Spent-Fuel Application” (2001) which contains < 10 ppb of chloride, no fluoride, no sulfate and no peroxide does not match realistic chemistry conditions encountered in the spent fuel pool.

Experience with water chemistry at US PWR SFPs shows that the nominal contaminant levels will be chloride (20-50 ppb), fluoride (5-10 ppb) and sulfate 20-150 ppb), as well as hydrogen peroxide (5-10 ppb).

The proposed testing of MMC cited represents a short term test at a range of temperatures only nominally above the temperature in the SFP (100-120 ^{0}F), and using a boric acid solution with no contaminants present.

Requested Information

1. Provide a calculation or other technical justification demonstrating that the test temperature and time of testing (less than one-half year) is equivalent to a 40 year exposure period at the expected normal operating temperature of the SFP.

2. Provide a technical justification that the corrosion rate of the MMC determined in the tests will provide a bounding limit for the existing operating conditions in the spent fuel pool when it contains the maximum allowable contaminant levels of chloride, sulfate and fluoride, plus hydrogen peroxide up to 5 ppm.

3. Given that the MMC specimens were not exposed to radiation during the corrosion testing, justify not assuring that there are no synergistic effects between the radiation field and the chemical environment in the SFP on corrosion or other degradation mechanisms of the MMC.

09.01.02-36

Background

In order to assure compliance with GDC 61, the Standard Review Plan (SRP), NUREG-0800 Section 9.1.2, recommends that the staff verify the compatibility and stability of neutron absorbing materials in the SFP environment, to ensure no unacceptable reduction in the neutron absorbing properties of these materials. Preventing degradation of the neutron absorbing materials also supports compliance with GDC 62, which requires preventing criticality in the fuel storage and handling system through the use of physical systems or processes.

Trace contaminants, such as iron or iron-containing particles, either on the material surface or included in second-phase particles within the material, has been linked to pitting corrosion observed in aluminum-based neutron absorbing materials including both Boral and Metamic. Additionally, testing for other localized corrosion mechanisms, specifically crevice and galvanic corrosion, has been performed as part of qualification of other aluminum-based neutron absorbing materials for spent fuel pool service (Reference 1, 2). Section 6.4.1 of TN-Rack.0101, Rev 0 identifies material specifications for MMC™.

Requested Information

1. Discuss the minimization of the potential for localized corrosion, particularly pitting, of the MMC due to trace contaminants or contaminant particles (either on the surface or in the bulk of the material) in the MMC material. Discuss the control of contaminant particles through the design specification.

2. Described the testing program for the crevice corrosion testing and galvanic corrosion (as has been done with other materials for this service), or provide technical justification to demonstrate that crevice and galvanic corrosion will not occur.

References

1. Safety Evaluation By The Office Of Nuclear Reactor Regulation Related To Holtec International Report HI-2022871 Regarding Use Of Metamic® In Fuel Pool Applications Facility Operating License Nos. DPR-51 And NPF-6 Entergy Operations, Inc. Arkansas Nuclear One, Unit Nos. 1 and 2 Docket Nos. 50-313 and 50-368; Transmitted Via Letter From Thomas W. Alexion To Mr. Craig T. Anderson (ANO) Dated June 17, 2003, Subject: Arkansas Nuclear One, Units 1 And 2 - Review Of Holtec Report Re: Use Of Metamic® In Fuel Pool Applications (TAC Nos.

MB5862 and MB5863). Agencywide Documents Access and Management System (ADAMS) Accession No. ML031681432

2. Qualification of METAMIC® for Spent Fuel Storage Application, EPRI report 1003137,prepared by Northeast Technology Corp, Oct 2001, cosponsor Reynolds Metals Company

09.01.02-37

Background

In order to assure compliance with GDC 61, the Standard Review Plan (SRP), NUREG-0800 Section 9.1.2, recommends that the staff verify the compatibility and stability of neutron absorbing materials in the SFP environment, to ensure no unacceptable reduction in the neutron absorbing properties of these materials. Preventing degradation of the neutron absorbing materials also supports compliance with GDC 62, which requires preventing criticality in the fuel storage and handling system through the use of physical systems or processes.

Evidence presented in "Resolution of Generic Safety Issue 196: Boral Degradation" shows that exposure of Boral to SFP chemistry and gamma radiation causes blistering of the Boral. One potential cause is from "gamma ray heating" of the Boral. Gamma ray heating is caused by the energy of the spent fuel gamma rays being trapped by the Boral casing causing temperature to increase above 212 ^{0}F in localized areas. This specific condition is not tested for using the coupon test program cited in the EPRI document. From GSI 196:

As stated in GSI 196:

> "The Boral sheets were sandwiched (clad) within seal-welded stainless steel cover plates, apparently to keep water from contacting the Boral. Nevertheless, there were several instances (dating back to 1983) where the stainless steel cover plates experienced bulging, to the point where mechanical interference with the fuel assemblies became a problem. It was discovered upon investigation that there had been water ingress into the stainless steel sandwich, and the aluminum in the Boral had reacted chemically with the water to produce hydrogen gas and aluminum oxide. The hydrogen gas pressure had built up to the point where the stainless steel cladding bulged."

From the same GSI the NRC stated:,

> "Possible Solution:
>
> The proposed solution for this generic issue is in two steps. The first step would be to test samples of Boral under conditions duplicating the environmental conditions that would be experienced in these MPC units. This experiment can be done quite readily, and at a modest cost. If there is no evidence for crumbling or relocation of the B_4C-Al composite material, the issue would be considered resolved."

Requested Information

1. The description in the Technical Report and the accompanying drawings are not clear as to how or if the MMC material will be encased in aluminum or stainless steel. Provide more detailed drawings or figures showing the details of the materials in these racks, specifically the MMC and any sheathing material surrounding it.

2. If the MMC will be sheathed in stainless steel, provide test data such as that recommended by the NRC in GSI-196 that shows that the integrity of the MMC^{TM} will be maintained under duplicate environmental conditions to those experienced in the SFP [i.e., the test conditions had the MMC^{TM} sheathed in stainless steel as it will be in the SFP].

09.01.02-38

Background

In order to assure compliance with GDC 61, the Standard Review Plan (SRP), NUREG-0800 Section 9.1.2, recommends that the staff verify the compatibility and stability of neutron absorbing materials in the SFP environment, to ensure no unacceptable reduction in the neutron absorbing properties of these materials. Preventing degradation of the neutron absorbing materials also supports compliance with GDC 62, which requires preventing criticality in the fuel storage and handling system through the use of physical systems or processes. Further, the Standard Review Plan (SRP), NUREG-0800, Section 9.1.2 recommends that licensees have a program for monitoring the effectiveness of neutron poison present in the neutron absorbing panels. Additionally, to meet GDC 61, SRP 9.1.2 also recommends that provision for testing to detect degradation of any strong fixed neutron absorbers.

Although Technical Report TN-Rack-0101 contains a full description of the material properties, proposed qualification testing program , production material acceptance testing program, and coupon surveillance program for the for the metal matrix composite (MMC) neutron absorbing material, none of this information is included in the current revision of the FSAR.

Requested Information

The staff therefore requests the applicant revise the FSAR to incorporate the critical aspects of TN-Rack-0101 related to:

a. The coupon surveillance program for the MMC. The description of the surveillance program description should provide the types and numbers of coupons, withdrawal schedule, tests to be performed, and acceptance criteria

b. The MMC material properties.

c. The quality assurance program for the MMC, including the design specification, qualification test program, and acceptance testing program.