

## **KHNPDCDRAIsPEm Resource**

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**From:** Ciocco, Jeff  
**Sent:** Wednesday, November 04, 2015 7:54 AM  
**To:** apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource; Harry (Hyun Seung) Chang; Andy Jiyong Oh; James Ross  
**Cc:** Widrevitz, Dan; Mitchell, Matthew; Olson, Bruce; Vera, John; Lee, Samuel  
**Subject:** APR1400 Design Certification Application RAI 291-8347 (04.05.02 - Reactor Internal and Core Support Structure Materials)  
**Attachments:** APR1400 DC RAI 291 MCB 8347.pdf

KHNP,

The attachment contains the subject request for additional information (RAI). This RAI was sent to you in draft form. Your licensing review schedule assumes technically correct and complete responses within 30 days of receipt of RAIs.

Please submit your RAI response to the NRC Document Control Desk.

Thank you,

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**Hearing Identifier:** KHNP\_APR1400\_DCD\_RAI\_Public  
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# REQUEST FOR ADDITIONAL INFORMATION 291-8347

Issue Date: 11/04/2015

Application Title: APR1400 Design Certification Review – 52-046

Operating Company: Korea Hydro & Nuclear Power Co. Ltd.

Docket No. 52-046

Review Section: 04.05.02 - Reactor Internal and Core Support Structure Materials

Application Section: 4.5.2

## QUESTIONS

### 04.05.02-1

APR-1400 Final Safety Analysis Report (FSAR) Section 4.5.2.1 states, "Reactor internals and core support materials satisfy the requirements of ASME Section III NG-2000. Code Case N-60-5 is acceptable per NRC RG 1.84." The NRC staff understands this statement to mean that all reactor internals and core support materials will comply with ASME Code, Section III, NG-2000 requirements. This is beyond the minimum application of ASME Code, Section III, Subsection NG provisions which specifically apply to only core support structures.

Confirm if the staff's understanding of the intent of this FSAR statement is correct.

### 04.05.02-2

APR-1400 FSAR Section 4.5.2.1 links materials specifications to the corresponding reactor internals and core supports at the assembly level. This level of detail is insufficient for the NRC staff to make an adequate safety finding.

The staff requests that the applicant revise FSAR Section 4.5.2 to contain a comprehensive table of reactor internals and core supports organized by assembly, with entries for sub-assemblies and components listing their corresponding material specification and whether that component is a reactor internal or core support component. An example of how such a table may be effectively organized for the staff's review is given below:

Component	Material Specification	Component Type
<i>Core Support Barrel Assembly</i>		
<i>Upper Guide Structure Assembly</i>		
...		
Fuel Assembly Upper Support	SA-###, Grade X	Core Support
...		
<i>Lower Support Structure Assembly</i>		
...		
Fuel Insert Pin	SA-###, Grade X	Core Support
...		

In addition, the staff requests that the applicant provide accompanying assembly diagrams for all components in the table specifying where welds are located and of what material they will be made.

### 04.05.02-3

ASME Code, Section III, Subarticles NG-2160 and NG-3120 describe how materials must be selected for compatibility with the reactor coolant environment. APR-1400 FSAR Section 4.5.2 does not contain an explanation of how the reactor internal and core support structure materials were selected to ensure compatibility with the reactor coolant.

The staff requests that the applicant revise FSAR Section 4.5.2 to address how reactor internals and core support structure materials were selected to ensure compatibility with reactor coolant.

## REQUEST FOR ADDITIONAL INFORMATION 291-8347

### 04.05.02-4

APR-1400 FSAR Section 4.5.2.5 cites identical heat treatment requirements for both SA-638, Grade 660 and SA-453, Grade 660 material. However, the specifications for SA-453, Grade 660 and SA-638, Grade 660 are not identical in ASME Code Section II.

The staff requests that the applicant revise FSAR Section 4.5.2.5 to justify why the heat treatment requirements are appropriate for both materials or to add separate language for SA-453, Grade 660 consistent with ASME Section II Code specifications.

### 04.05.02-5

APR-1400 FSAR Section 4.5.2.6 details evaluations conducted concerning irradiation-assisted stress corrosion cracking (IASCC) and void swelling. Significant detail is provided concerning the calculation of neutron fluence and temperature. The staff requires additional information regarding the specific criteria used to evaluate the components for IASCC and void swelling to make a safety finding.

The staff requests that the applicant provide the report(s) that evaluate the reactor internals and core support structures using specific criteria including neutron fluence values, stress values, and temperature. Alternatively that the applicant revise FSAR Section 4.5.2.6 to include a complete discussion and enumeration of the criteria applied to determine whether individual components would be susceptible to IASCC and/or void swelling.

### 04.05.02-6

APR-1400 FSAR Section 4.5.2.3 states that:

For the reactor internal and core support structure materials, nondestructive examination (NDE) is performed in accordance with the requirements of ASME Section III NG. For other materials that are not defined as ASME Section III NG, NDE examinations are performed in accordance with the applied material specification.

The staff notes that the only material specified that is not defined as ASME Code, Section III, Subsection NG is A511, Grade 304. However, the applicant cited ASME Code Case N-60-5 to justify the use of A511, Grade 304 material. This Code Case specifies that, "All other requirements of Subsection NG of Section III, Division 1, shall be met." Therefore, the NRC staff interprets this to mean that the NDE requirements of ASME Code, Section III, Subsection NG would apply to components made of A511, Grade 304 material as well.

If the staff's understanding is correct, the staff request that the applicant revise FSAR Section 4.5.2.3 to specify that all reactor internal and core support materials are to have NDE performed in accordance with ASME Code, Section III, Subsection NG.

### 04.05.02-7

APR-1400 FSAR Section 4.5.2.3 does not address the cold working of materials. While FSAR Section 4.5.2.4 references Section 5.2.3.4 with regard to austenitic stainless steels, FSAR Section 5.2.3.4 addresses the cold working of reactor coolant pressure boundary materials only.

The staff request that the applicant revise APR-1400 FSAR Section 4.5.2 to address the cold working of reactor internals and core support materials.



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