



CONVERSATION RECORD

9/19/2017

NAME OF PERSON(S) CONTACTED OR IN CONTACT WITH YOU James Harrison, et al.		DATE OF CONTACT 08/16/2017	TYPE OF CONVERSATION <input type="checkbox"/> E-MAIL <input checked="" type="checkbox"/> TELEPHONE <input type="checkbox"/> INCOMING <input checked="" type="checkbox"/> OUTGOING
E-MAIL ADDRESS james.harrison@ge.com		TELEPHONE NUMBER (910) 620-1826	

ORGANIZATION Global Nuclear Fuel - Americas (GNF-A)	DOCKET NUMBER(S) 07109309
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LICENSE NUMBER(S) NA	CONTROL NUMBER(S) NA
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SUBJECT
NON-PROPRIETARY INFORMATION---8/16/2017, 10:00 AM CONFERENCE CALL TO DISCUSS THE STATUS OF THE REVIEW OF THE LETTER AUTHORIZATION REQUEST FOR THE MODEL NUMBER RAJ-II (CAC NO. L25239)

SUMMARY
Attendees:

NRC	GNF-A
John McKirgan	James Harrison
Travis Tate	Justin Lamy
Norma Garcia Santos	Christopher Kmiec
Tae Ahn	James Fawcett
Andrew Barto	Robert Rand
Kim Yong	Mine Yilmaz
Joseph Borowsky	Brian Eber
Caylee Kenny	Russ Fawcett
Daniel Forsyth	

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ACTION REQUIRED (IF ANY)
See Summary.

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NAME OF PERSON DOCUMENTING CONVERSATION
Norma Garcia Santos, et al.

SIGNATURE
Norma Garcia Santos

CONVERSATION RECORD (continued)

SUMMARY: (Continued from page 1)

On August 16, 2017, NRC and GNF-A participated on a phone call to discuss status of the review of the letter authorization for the Model No. RAJ-II for transporting accident tolerant fuel (ATF) lead test assemblies (LTAs), gain a common understanding about the licensing action requested, communicate challenges associated with the review, and discuss a possible path forward to continue the review of the application. The following items summarize the discussion during the August 16 telephone call.

The staff started the meeting by going over the main aspects of the cover letter submitted with the application to ensure that the staff and the applicant had a common understanding of the licensing actions being requested. The participants agreed on the following:

1. The licensing action request consisted of up to 16 ATF lead test rods inside of two GNF2 fuel assemblies (a maximum of 8 ATF lead test rods per assembly) per package with a maximum of two packages per shipment.
2. The ATF rods may contain Type A fissile fuel and the GNF2 fuel will contain previously approved Type B quantity fuel.
3. The ATF will be transported in a Type B shipment.
4. The applicant is requesting one shipment per year from 2017 to 2019.

In terms of the number of ATF assemblies to be shipped per year, on the top of page 2 of the cover letter, the applicant mentioned that there would be maximum of 4 ATF lead tests assemblies per shipment. The statement on the top of page 2 of the cover letter seemed to be in agreement with page 3 of the cover letter in which the applicant stated (in proposed condition 4) that "There shall be a maximum of two RAJ-II packages on single truck, each containing a maximum of two LTAs." On the proposed condition 5, the applicant mentioned that "RAJ-II packages with GNF ATF LTAs shall commingle with other RAJ-II packages..." Therefore, it was not clear for the staff the maximum number of ATF FeCrAl rods per package and the number of packages that will be shipped at any given time on a truck, including GNF ATF LTAs. The applicant indicated that the following:

1. The maximum number of ATF rods in a package will be 16.
2. The maximum number of packages per truck (including the packages containing ATF LTAs) will be 13-14 packages.
3. The near term plan is to ship two RAJ-II packages containing ATF LTAs commingling with other packages containing GNF fuel.
4. The applicant requested the flexibility to ship GNF fuel with GNF fuel containing ATF FeCrAl rods.

The wording of the proposed Condition 4 was clear that a maximum of two packages could be loaded per truck. When one member of the applicant's organization mentioned that the condition did not preclude additional packages on a truck, another GNF-A member rightly stated that the wording could be improved to express the application's clear intention.

Based on the evaluation section of the cover letter, the staff asked if the applicant was relying on the cladding as the containment boundary or not, since the evaluation section mentions that the structural and thermal evaluations demonstrated that the GNF FeCrAl fuel rods would not rupture. The applicant clarified that since the application limits FeCrAl fuel rods to Type A fissile content, the applicant is not relying on the cladding as the containment boundary, but as a barrier to maintain the pellets in a safe geometry (i.e., for criticality safety purposes). The applicant also indicated that it analyzed water entering into the pellet-cladding gap. The staff mentioned that a concern was failure of the cladding resulting in pellets getting out of the cladding and radioactive material reconfiguration. The applicant mentioned that if the cladding burst, the applicant does not have physical data to indicate that pellet migration outside of the rod is possible. The applicant pointed out that NUREG/CR-1458 and NUREG/CR-5892 document a transportation accident involving a shipment of GNF fuel assemblies (including a beyond design basis fire), which caused a breach of the cladding. These NUREGs concluded that there was no fuel or pellet migration outside of the fuel rod and that a criticality accident was not possible during the accident or after the fire. The applicant pointed out this was included in Section 6.6.2.2 of the Letter Authorization Request. The applicant pointed out that, currently, the structural and thermal analyses do not support migration of pellets outside of the cladding under hypothetical accident conditions. However, staff had comments/questions with the structural and thermal analyses provided. The discussion below includes the staff's initial comments and questions related to the application.

Materials Evaluation

The staff pointed out that the FeCrAl material is a ferritic steel. Therefore, the staff indicated that the applicant should use Regulatory Guide 7.11 as mentioned in the pre-application meeting. The staff asked if the assessment of the cladding integrity was based on the 9 meter drop test assuming zirconium material. The applicant responded that was correct. The staff also mentioned that Figure 2-1 of Attachment 3 of the application includes a strain curve at -20 F. The applicant stated that testing of the FeCrAl material was performed at a strain rate of [withheld per 10 CFR 2,390 (application)], to which the staff commented that it was high in comparison of a conventional strain rate. The applicant indicated that the strain rate was based on the following:

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ACTION REQUIRED (Continued from page 1)

1. the duration of the impact of the RAJ-II package in previous drop tests of zirconium alloy;
2. the strain rate of the cladding is "controlled" by the package design (since the package design did not change, the applicant assumed that the strain rate did not change); and
3. the assumption that the design of the zirconium alloy and ATF LTA fuel bundle designs are similar for the limited number of FeCrAl rods in an ATF LTA.

The applicant did not perform physical drop tests with FeCrAl rods and assumed these were bounded by (or equivalent to) the testing performed with zirconium alloy rods. Therefore, the applicant's approach is to use the testing to certify the RAJ-II package for the ATF application.

The staff indicated that the strain rate may be acceptable, but the staff still needs information to determine whether there may be a localized effect related to the FeCrAl material. The applicant noted that the FeCrAl survived from a high strain rate tensile test without a fracture. The staff pointed out that the cladding of the ATF FeCrAl rod is very thin and the staff would need the following:

1. confirm (from related literature data or testing) that the slope of stress-strain curve is higher for FeCrAl compared to that for zircaloy. (Otherwise, FeCrAl rods among zirconium alloy rods may be bulged out or broken during drop. Provide the stress-strain curves for FeCrAl and zircaloy claddings so that a comparison can be made.)
2. data related to microhardness testing, fracture testing, Charpy V-notch test, etc.;
3. strain curve at low temperature (to verify whether the strain rate is appropriate for FeCrAl); and
4. a temperature range to maintain the integrity of the cladding.

The application contains a requirement for the Young's Modulus in Attachment 2 Table 2-5 (also repeated in Attachment 3 Table 1-2) which requires a minimum Modulus of Elasticity for the GNF FeCrAl material to be used. The applicant stated that the lower temperature of the HAC is -40°C so that was the temperature that the test was performed to bound the necessary temperature range of operation. A Stress-Strain curve for the GNF FeCrAl material at -40°C is provide in Attachment 3 Figure 2-1.

The Regulatory Guide 7.11 requirements are based off material that is 0.025 inches and thicker depending on the category classification. The fuel cladding wall thickness is below 0.025 inches for this application. The applicant stated that the thin cladding wall provides an additional margin against brittle fracture in the material relative to the Regulatory Guide 7.11 requirements because the stress states would be geometrically forced to be in plane stress loading which has a higher fracture toughness than the plane-strain loading.

Creep Model Evaluation

The staff noted that it may have questions related to the following topics:

1. bases for the allowable hoop stress of 65.2 mega pascals (MPa);
2. reference and justification of the generalized creep equation;
3. some inconsistencies with units [e.g., kilo Joule per mol (kJ/mol) versus kilo Joule per Kelvin mol (kJ/K*kmol)] needs to be revised;
4. demonstrate that the 10% creep strain limit is conservative and provide the FeCrAl stress-strain curve at the high temperatures; and
5. discussion about how the hypothetical accident condition thermal tests and analysis consider the damage from other hypothetical accident condition tests (e.g., drop, impact). The staff asked similar questions in the recent revision to the Model No. RAJ-II (Certificate of Compliance, Revision 11).

At the end of the meeting the applicant expressed interests on having additional phone calls to discuss the staff's questions and a face-to-face meeting. Division of Spent Fuel Management staff and management noted that the applicant can also request a public meeting to have a detailed discussion of the staff's questions. The applicant also requested that if a meeting were to be scheduled, having NRC questions at least a week in advance would enhance the value of the meeting.