Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards
Open Session

Docket Number: (n/a)

Location: Rockville, Maryland

Date: Thursday, December 5, 2019

Work Order No.: NRC-0726 Pages 1-16

NEAL R. GROSS AND CO., INC.
Court Reporters and Transcribers
1323 Rhode Island Avenue, N.W.
Washington, D.C. 20005
(202) 234-4433

DISCLAIMER

UNITED STATES NUCLEAR REGULATORY COMMISSION'S ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

The contents of this transcript of the proceeding of the United States Nuclear Regulatory Commission Advisory Committee on Reactor Safeguards, as reported herein, is a record of the discussions recorded at the meeting.

This transcript has not been reviewed, corrected, and edited, and it may contain inaccuracies.

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

+ + + + +

669TH MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

+ + + + +

THURSDAY

DECEMBER 5, 2019

+ + + + +

ROCKVILLE, MARYLAND

+ + + + +

The Advisory Committee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2D30, 11545 Rockville Pike, at 10:45 a.m., Peter Riccardella, Chairman, presiding.

COMMITTEE MEMBERS:

PETER RICCARDELLA, Chairman

MATTHEW W. SUNSERI, Vice Chairman

JOY L. REMPE, Member-at-Large

RONALD G. BALLINGER, Member

DENNIS BLEY, Member

CHARLES H. BROWN, JR. Member

VESNA B. DIMITRIJEVIC, Member

WALTER L. KIRCHNER, Member

JOSE MARCH-LEUBA, Member

DAVID A. PETTI, Member

DESIGNATED FEDERAL OFFICIAL:

WEIDONG WANG

P R O C E E D I N G S

10:47 a.m.

CHAIRMAN RICCARDELLA: Okay, so the meeting will come to order. We are going to discuss the GE/GNF control rod drop accident methodology, and the initial part of the meeting is open.

MEMBER MARCH-LEUBA: Yes. We will start off with a few minutes of open, then we will close because most of the information is proprietary. So now is --

CHAIRMAN RICCARDELLA: Okay. I'll turn the meeting over to Jose March-Leuba, who is chairman of the appropriate subcommittee.

MEMBER MARCH-LEUBA: It's called thermal hydraulics.

CHAIRMAN RICCARDELLA: Thermal hydraulics.

MEMBER MARCH-LEUBA: Okay. So we're going to have some introductory remarks by NFC.

MR. OTTO: Okay. Good morning, ladies and gentlemen of the Committee. We're just grateful for the opportunity to present the staff's review of the Global Nuclear Fuel Topical Report. Sitting beside me here is Scott Krepel; he'll be providing the staff's review. We look forward to finishing up today in the full committee.

We can have the subcommittee on Tuesday, and we look forward to receiving your letter at the end of your review. So thank you, and we also appreciate working with GE/GNF during the review in closing out all the technical issues associated with this review. So thank you.

MEMBER MARCH-LEUBA: So in the interest of time and the GNF/GE, I made the same joke on the subcommittee. Please tell us who you are, and who you work for. Go ahead.

MR. HALAC: Hello, my name is Ken Halac. I'm the licensee for fuel licensing for Global Nuclear Fuels, GE Hitachi, and I'm here with Scott Pfeffer, who is our technical lead in the area of control rod drop, among other things at PDH.

MR. PFEFFER: Okay, and I'm Scott Pfeffer. As Ken said, I'm the technical leader for the radiological side of the stability and radiological team at GE/GNF. Prior to that I was senior engineer on the stability side of our team as well for a number of years.

So without further ado, we'll get into it. So we'll start with an overview of the licensing topical report; just really briefly talk about the drivers, and then the approach we took. And then

we'll go over very briefly the remaining milestones we got and, obviously, the meetings today and Tuesday, the final licensee and the issuance of the approved LTR. Next slide.

Also, the drivers for our development of the LTR here, we're to align with the latest reactivity-initiated accident fuel damage guidelines and more thoroughly evaluate possible CRDA scenarios. So the staff has recently released new guidance, and we wanted to bring you all up to date on that.

Improve plan operations: so, allow for more flexibility during startup, which is a critical time for plant operation, and then prevent inadvertent subcriticality events which have been met with LaSalle --

MEMBER MARCH-LEUBA: I know we discussed the possibilities. Can you tell us what the subcriticality event is?

MR. PFEFFER: Right, yes. So for this event during startup, because of the current requirements in banking at BWRs, the top bank position is at four, dash four, and that doesn't have a lot of worth with a lot of new fuel designs. So during the startup the plant is trying to pull those blades; they've got to pull all the blades to four before they

can pull any blades further in Groups 3 and 4. When they do that, there's not a lot of worth there. They're just continuing to heat up at that point, and they can actually drop back subcritical if they reach criticality --

MEMBER MARCH-LEUBA: So this is --

MR. PFEFFER: -- prior to that.

MEMBER MARCH-LEUBA: -- going to put in a control role, generally so many (unintelligible) shut you down. Is that correct?

MR. PFEFFER: Correct, yes. So they can't get enough reactivity from those --

MEMBER MARCH-LEUBA: And it is probably periodic, you'd have pulses, right?

MR. PFEFFER: Just very little, because you're just not adding enough reactivity from those pulls to four. So the idea of the new LTR is that we'll be able to provide banks which are more impactful and actually more applicable to the new fuel designs as well, to allow those plants to move appropriately through their startups as well as protect against control rod dropbacks (phonetic).

And the last item, there's a dose improvement I just want to demonstrate the goal and the requirement of the LTR to demonstrate zero fuel

rod failures, and so we'll demonstrate that for CRDA and potentially allow some dose consequence improvements in plants as well.

Again, the approach that we took was to utilize previously approved methods, so PANAC or PANACEA is our core simulator. PRIME is thermal mechanical methodology, and TRACG is our BWR system code.

When implementing NRC guidance related to specifically hydrogen-efficient gas release models, and then the pellet cladding mechanical interaction and high temperature cladding failure enthalpy thresholds. The PCMI version was originally in Appendix B of Section 4.2. Both of those are now in Draft Guide 1327, which is the draft guidance on reactivity-initiated accidents.

And so all these base guidances are listed below. The memoranda is initially on the hydrogen uptake and reactivity initiated accidents 4.2 Appendix B, and then most recently Draft Guide 1327, which has been in development for the past number of years.

So documentation status: We had a subcommittee meeting on Tuesday. We were actually here for the full committee today. We expect then, pending this review, final IC in January 2020, and

then we'll issue the approved version of the LTR at that point in February 2020.

And along with that, we'll issue an update to GESTAR-II in 2020, and so the CRDA LTR was submitted with the modifications to GESTAR-II included as part of that package, and so with the approval of the LTR, those modifications to GESTAR will also be approved.

Quick background on GESTAR: It's the General Electric Standard Application for Reactive fuel, and it's their process and methodology for plants they have referenced in their tech specs, and as long as they follow the methodologies and requirements that are part of GESTAR, they can implement, for example, the next fuel product line according to those requirements and guidelines in GESTAR-II without additional review and approval by the staff.

MEMBER MARCH-LEUBA: Does the GESTAR cover mixed cores? You could take over a plant from Framatome?

MR. PFEFFER: So I would say a number of the methodologies specifically have requirements on mixed cores that are part of GESTAR-II.

And that's all I have for the open

session. Are there any other questions?

MEMBER MARCH-LEUBA: We'll now have an open session from the staff, and we'll go into closed session later. Remember, we are still in open session.

MR. KREPEL: Okay. So we only have a short time, so I'll get started here. My name is Scott Krepel. I will keep this brief. My background is that I graduated from Purdue almost 20 years ago, and then I spent about 10 years working in the industry at TVA.

I worked at Elite Analyst for fuel engineering, and then I came to NRC where I've been working ever since for the last 19 years as a safety analyst. I've worked with the research office and with NRR. Now I'm here to discuss GNF and the CRDA application methodology. Next slide, please.

So just a short background for everybody: The GE methodology is based on old guidance from about, I think, the '80s.

Hold on one second for the interpreter.

It was two 80-calorie per gram, and that was limiting from the old guidance. But more recently the research has shown us that NSRR and other facilities who have done simulations, they did rod

ejection simulations, and that demonstrated the limits were not very conservative.

And so with the more recent guidance in place, we have the SRP 4.2, Appendix B, and so that was able to give us a more current guidance for DG 1327, which has just been closed for public comment. That will be coming to you soon for review. So the new method that was proposed by GNR does fit the new guidance, DG 1327, much better. Next slide, please.

So their method uses their current approved code which you can see listed behind me. As they had different aspects of their analysis, and all of those codes have already been approved and verified by NRC and all significant phenomena.

There's been some additional verification that has been done and looked at for the impact of cold conditions for CRDA activities. Okay, next slide, please.

So the GNF did not conduct a formal PIRT, which you might be familiar with, but that's basically where they figure out which phenomena are involved in the accident or the incident, and then they assign a ranking of high, medium, or low importance. And so it's this nice, pretty table that we're able to show you. But GNF did not conduct that PIRT.

But what they did do is, they identified the phenomena, and they created a report that was a comparison, and so it's another PIRT that's available, and so the NRC as able to review that.

And that phenomena was identified by GNF, and it was very consistent with other information that we receive, and it did address the uncertainties that we were looking for. So it was a different approach, but they were able to look using bounding values for parameters as well as demonstrating minimal sensitivity and then creating methodology for conservatism.

And there were a few uncertainties that were covered with conservatism, and I will be covering those later in the closed session. Next slide, please.

So in summary, I won't repeat everything to you, but everything has been listed in the safety evaluation. There are two important requirements: first, they needed to analyze the CRD events; they also had to look at the radiological release.

And so there are some additional requirements as well, such as cooling ability, but GNF and their methodology is actually based and demonstrated that there are no fuel incidents.

So we can assume from moving forward, that they meet all the requirements, because there are no radiological release and no loss of cooling.

The fuel fair probability evaluation is most useful because the criteria is very similar to the NRC guidance for SRP as well as DG 1327. So with either guidance, they are in compliance, and it is applicable for the licensee to do their analysis. Next slide.

So as mentioned briefly, GESTAR-II is a little bit unique. It's unique to GNF and their approach because their licensee is able to implement this methodology without getting further approval by the NRC. They also provide information as needed to support their changing of that fuel, and they will provide clarification as needed about how that methodology or how the information will be updated in the future. That will be discussed a little bit more in depth in the closed session. And that closes my open session of this presentation.

MEMBER MARCH-LEUBA: Thank you very much. Can we get --

MR. KREPEL: Just a second.

MEMBER MARCH-LEUBA: Okay. Can we have any open questions, please?

MEMBER REMPE: Yes. Just to make sure, because we're on the record, it's full committee, and it's hardly worth mentioning, but it is worth mentioning. You did agree in our subcommittee that you would correct a statement regarding Draft Guide 1327 in the SE before it's issued, correct? Thank you.

MR. KREPEL: Yes, that is correct. That is one comment that we are planning to make sure that we correct on the safety evaluation, absolutely.

MEMBER REMPE: Okay, thank you.

MR. OTTO: And I know we address it in the final safety evaluation, which we're going to complete after this meeting.

MEMBER KIRCHNER: Jose, I have two comments. The first, thank you. We will schedule a meeting on DG 1327 at some period. Now, as Scott pointed out, they've closed the public second round of public comments. But my real comment here is, I'm a little puzzled by the erratic blanket statement that GNF satisfies the requirement ensuring that no fuel failures occur as a result of a CRDA. Isn't that dependent on the actual plant application, not the methodology?

MEMBER MARCH-LEUBA: Did you want to

answer it?

MEMBER KIRCHNER: We'd prefer.

MR. KREPEL: I can answer, yes. Their methodology is specifically intended to allow the licensee to analyze specific plants and then confirm that there are no fuel failures happening at that plant.

MEMBER KIRCHNER: I understand that, but which plant? I just don't know -- am I missing something? Is this tied to a specific plant?

MEMBER MARCH-LEUBA: Let me -- no, it's not. The methodology is going to determine the bank withdrawal procedures that will be allowable. So if you drop a rod you will not fail any fuel. So if you drop a rod and fail fuel, the bank position is not allowed, and you have to iterate and get a new one. So at the end of the day, for every plant where this is implemented, they will have zero fuel failures by choosing the proper bank positions.

MR. KREPEL: Correct.

MEMBER KIRCHNER: Correct, I agree. It's just that the methodology doesn't ensure that. It has to be applied to a specific plant and fuel loading, and then you do the analysis. The methodology is being qualified and accepted as a means to make that

determination.

MEMBER MARCH-LEUBA: The methodology requires an interruptive procedure and the use of this further (phonetic) criteria.

MEMBER KIRCHNER: Okay.

MEMBER MARCH-LEUBA: So the methodology, as we said before, has nothing to do with codes, nothing to do with hydraulics. It's only how you iterate to get it done.

MEMBER KIRCHNER: Okay. All right. I missed that subtlety.

MEMBER MARCH-LEUBA: How you iterate, by the way, is proprietary, so when we have the letter, we will have to recap.

Okay. Can you hit the gavel for a moment? I want us to go into a short recess while we set up the closed session, okay? Are there any public comments from the room?

MR. BROWN: Thomas, we need to open the public line.

MEMBER MARCH-LEUBA: We don't need one together.

Are there any members of the public on the phone line? If you would like to make a comment, please identify yourself and make a comment.

MR. HECK: This is Charles Heck of GNF. I'm just commenting so that you know whether or not you can hear somebody.

MEMBER MARCH-LEUBA: Thank you. We confirm that the phone line is open, and nobody else wants to make a comment, so at this time we will close the open session.

MR. BROWN: Okay. We're going to drop the public line now. GE, we're going to keep the GE line. If you happen to get dropped, please call back into that line, and we will call back in as well.

MEMBER MARCH-LEUBA: And GE, can you look around the room and make sure everybody here belongs? I see on this side are all staff members anyway. On that side it's all you.

(Whereupon, the above-entitled matter went off the record at 11:06 a.m.)

Global Nuclear Fuel

Control Rod Drop Accident (CRDA) Application Methodology

NEDE-33885P Review

December 5th, 2019

Contents for Open Portion

Licensing Review

- Licensing Topical Report (LTR) Development Overview
  - Drivers
  - Approach
- Remaining Milestones
  - ACRS Meetings
  - Final Safety Evaluation (SE)
  - Issuance of Approved LTR and GESTAR-II Revisions

LTR Development

Drivers

- Align with latest reactivity-initiated accident fuel damage guidelines
  - More thoroughly evaluate possible CRDA scenarios
- Improve plant operations
  - Allow for more flexibility during reactor startup
  - Prevent inadvertent subcriticality events
- Dose Improvements
  - Demonstrate zero fuel rod failures result from a CRDA

LTR Development (continued)

Approach

- Utilize previously approved methods
  - PANAC, PRIME, and TRACG
- Implement NRC guidance
  - Hydrogen and Fission Gas Release (FGR) models
  - Pellet Cladding Mechanical Interaction (PCMI) and High Temperature Cladding Failure (HTCF) thresholds
- Sources for NRC guidance
  - NRC Memoranda ML14188C423 (Reactivity-Initiated Accident Acceptance Criteria) and ML15133A306 (Hydrogen Uptake)
  - NUREG-0800, Sections 4.2, including Appendix B, and 15.4.9
  - DG-1327 (Control Rod Ejection and CRDA)

Current Status

Documentation

- ACRS Subcommittee – December 3rd, 2019
- ACRS Full Committee – December 5th, 2019
- Final SE anticipated January 2020
- Issue approved CRDA LTR expected February 2020
- Update GESTAR-II expected February 2020

Global Nuclear Fuel

U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

NEDE-33885P GNF CRDA Application Methodology

ACRS – 12/5/19

Scott Krepel

Office of Nuclear Reactor Regulation, US NRC

Background

- NRC guidance for RIAs has evolved significantly in recent years
  - SRP 4.2 Appendix B
  - DG-1327
- Current GNF/GEH methods are based on BPWS
  - NEDE-33885P provides an approach better tailored to current guidance

Background

NEDE-33885P only covers an analysis procedure; all codes have previously been reviewed and approved by the NRC

- TGBLA (lattice physics)
- PANACEA (3D core physics)
- TRACG (thermal hydraulics)
- PRIME (fuel rod performance)

Additional validation performed to confirm applicability of codes to limiting CRDA events

CRDA Phenomenology

GNF did not perform a formal PIRT, however, they did identify all key phenomena in a manner consistent with other references

For each phenomenon, the uncertainties were quantified or dispositioned by:

- Using bounding values for parameters
- Demonstrating minimal sensitivity
- Crediting methodology conservatism

Acceptance Criteria

Current regulatory requirements may be summarized as follows:

- CRDA event must be analyzed
  - GNF provides guidance to assure bounding results
- Any radiological releases must comply with regulatory limits
  - GNF satisfies this requirement by ensuring that no fuel failures occur as a result of CRDA
  - Possibility of fuel failures evaluated primarily via enthalpy based acceptance criteria consistent with NRC guidance (SRP 4.2 Appendix B, DG-1327)

GESTAR & Method Applicability

- GESTAR II updates to describe relevant documentation requirements (e.g., control rod withdrawal requirements)
- Clarifications regarding how methodology can be used
- New NRC approved models and codes may be used in lieu of those described in the LTR, subject to certain limitations

Nomenclature

BPWS – Banked Position Withdrawal Sequence
CRDA – Control Rod Drop Accident
DG – Draft Guide
GEH – General Electric - Hitachi
GNF – Global Nuclear Fuel
LTR – Licensing Topical Report
NRC – Nuclear Regulatory Commission
RIA – Reactivity Initiated Accident
SRP – Standard Review Plan