Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: 33rd Regulatory Information Conference
Technical Session - T8

Docket Number: (n/a)

Location: teleconference

Date: Tuesday, March 9, 2021

Work Order No.: NRC-1420 Pages 1-58

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

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

+ + + + +

33RD REGULATORY INFORMATION CONFERENCE (RIC)

+ + + + +

TECHNICAL SESSION - T8

CURRENT ACCIDENT TOLERANT FUEL ENVIRONMENT

+ + + + +

TUESDAY,

MARCH 9, 2021

+ + + + +

The RIC session convened via Video Teleconference, at 10:45 a.m. EST, Christopher T. Hanson, NRC Chairman, presiding.

PRESENT:

CHRISTOPHER T. HANSON, NRC Chairman

MARILYN DIAZ MALDONADO, Project Manager, Containment, Thermal, Chemical, and Fire Protection Branch, Division of Fuel Management, NMSS/NRC

STEPHEN COWNE, Chief Nuclear Officer, Urenco USA

ZACHARY MCDANIEL, Advanced Fuel Director, Westinghouse Electric Company

JOHN WILLIAMS, Nuclear Fuel & Analysis Director,

Southern Nuclear Operating Company

ROBERT DAUM, Senior Technical Executive, Electric Power Research Institute

P R O C E E D I N G S

10:46 a.m.

CHAIRMAN HANSON: This program began in 2013 and was started by Senator Dianne Feinstein in the aftermath of the Fukushima Daiichi accident. And it started as a small research and development program within the Department of Energy and within NRC's Office of Research. Since then, its grown to include enrichers, utilities, fuel vendors, and multiple offices at NRC, all working together to increase performance measures of nuclear fuel under accident conditions.

As part of my work for the Senator on the Appropriations Committee, I took a strong interest in this program and pushed DOE to better engage private sector partners in developing and testing a range of fuel concepts. And now in my new role at NRC I'm looking forward to seeing significant progress in this area, because this technology has the potential to improve reactor safety margins and, therefore, increase social acceptance along with the potential to increase plant economics.

I've been very impressed with staff efforts to date. The NRC is committed to enabling the safe

use of accident tolerant fuel technologies and their associated enrichment fabrication transportation and storage aspects. And I've been really impressed about how the different offices in the agency have come together to ensure we're ready for the future.

I don't want to take any more time because we have a great panel today, and I want to provide you with the opportunity to ask them questions. I'll ask the panel to start with brief five-minute statements and then in the course of an hour or so that we have together, I hope we can draw out from them some broad range of answers or thoughts on accident tolerant fuel.

We have a great panel for you this morning. We have Marilyn Diaz, a Project Manager with the NRC. We have Steve Cowne with Urenco. We have Robert Daum with the Electric Power Research Institute. WE have Zack McDaniel with the Westinghouse Electric Company, John Williams with Southern Nuclear Operating Company, and I think we're going to have a great discussion.

I'll invite first Marilyn Diaz to give us her thoughts on the current accident tolerant fuel environment at the NRC. As I mentioned, Ms. Diaz serves as a Project Manager in the Fuel Facility Licensing Branch, Division of Fuel Management, Office of Nuclear

Material Safety and Safeguards, what we refer to as NMSS. I want to take this opportunity to thank Marilyn for her efforts in planning and coordinating this session. She's done a great job getting us ready and I really appreciate it. Marilyn?

MS. DIAZ: Can you guys hear me? Great. Thanks Chairman Hanson for that introduction and good morning to everyone that is joining us today. I will be presenting on behalf of the great NRC team that continues to work to ensure the safe use of these accident tolerant fuels.

Slide 1. Let's start quickly with some of our major accomplishments in the last year, making sure that we cover the whole fuel cycle. The first thing, on the enrichment fuel, NRC approved a license amendment to Louisiana Energy Services allowing them to enrich up to 5.5 weight percent.

On the transportation of uranium hexafluoride, or UF6 as we refer to, we have held a couple of application meetings discussing a potential submittal of a design for transporting UF6 with higher enrichments.

On the field fabrication side, staff reviewed and approved GNFA's minimal margin of

subcriticality for enrichments up to eight weight percent. This is an interim step towards a future license amendment request to allow processing of ATF above the five weight percent.

On the side of the transportation of fresh fuel, we've completed several actions. For example, we completed a review to allow the transportation of fuel rods with chromium-coated cladding, doped pellets, and fuel rods enriched up to seven weight percent.

On the Part 50 area, we've completed several actions as well. To note, we issued the interim staff guidance on chromium-coated cladding and held a phenomena identification and ranking table, also known as PIRT, exercise for severe accidents.

On the spent fuel side, we approved a revision to a certificate of compliance to allow transportation of spent ATF rods.

Next slide, please. The NRC staff is approaching ATF fuels licensing differently than the past. To prepare for both near-term and long-term ATF designs, the staff has established a new paradigm as described in the project plan. The old paradigm, as shown in the slide, has industry and staff developing the technical basis. Then in a series of sequential

steps, staff would develop guidance, update confirmatory codes, and build on expertise so that we will be ready for any regulatory activity.

The new paradigm, as described in the project plan, takes on innovative approaches and has many of the steps being conducted in parallel. If you click on and turn on the slide, I think we'll see the new paradigm. Thanks. Right, there you have it.

We have the development of guidance, confirmatory codes, and staff expertise in parallel with industry efforts to develop the technical basis for ATF. We are also doing work in advance of regulatory actions. For example, we're conducting PIRTs to inform guidance and build staff expertise early. As mentioned in the previous slide, the staff completed a PIRT for coded claddings which led to the interim staff guidance on chromium-coated claddings.

In addition, in September, another PIRT was conducted to address the performance and severe accidents of the current ATF concepts, high burnup fuel and fuel enrichments above the five weight percent. The report is scheduled to be completed in April.

We are also being proactive in our activities by obtaining information we need via

research, literature reviews, and code enhancements to ensure readiness while we process topical reports and applications and use risk-informed approaches in making decisions. We have completed five literature reviews so far and there are more to come. We're communicating early and often. We're conducting public meetings, updating the project plan regularly, conducting pre-submittal meetings, and attending conferences and workshops to keep up with the latest information and continue early engagements.

The staff has and will continue to use innovative approaches to support licensing for ATF. One innovative approach used was the development of the critical timeline developed identifying when fuel cycle facilities and transportation packages, applicants and licensees will need to submit an application to support their accelerated schedule. This helped the NRC identify review times, resources, and prioritize the licensing actions.

A second innovative approach is the NRC's participation in at-risk craft research framework to address ATF behavior and performance. All of these activities have an ultimate goal of ensuring preparedness, to review licensing actions for the

near-term technologies, increase enrichment and high burn up.

That's all from the NRC. I'll turn it back to you, Chairman Hanson. Thank you.

CHAIRMAN HANSON: Thanks, Marilyn. Now let me turn to Steve Cowne. Steve has over 30 years in the nuclear industry and he's currently the Chief Nuclear Officer for Urenco USA, also known as LES. Today he's going to provide us a quick overview of Urenco USA's efforts in the ATF area. Steve?

MR. COWNE: Thank you, Chairman Hanson, appreciate the introduction. Again, this is Steve Cowne, CNO with LES, and we own and operate the only operating enrichment facility in the United States in Eunice, New Mexico. We provide enriched UF6 for the fabricators to make fuel for customers, the utilities.

Now back in 2020, our company, Urenco, initiated two projects; one at our LES facility and one at our sister facility in Great Britain, Capenhurst, England. And this is the LEU+ project, we call it. Now we define LEU+ as the gamut of enrichments between 5 weight percent and 10 weight percent. Anything above 10 weight percent, we define has HLEU, and that's a different project altogether.

From a plant standpoint, the core technology that we use for centrifuging of former centrifuges will efficiently produce just about any assay that you need. Our plant may need some slight modifications to produce accident tolerant fuel for the industry, but most of the effort will really be licensing and analytical in nature. We expect that we may have to change or revise some of our IROFS, or Items Relied On For Safety, and those will be the core consideration and licensing amendments that submit to the NRC.

Next slide, please. There's three main challenges that Urenco USA sees in producing accident tolerant fuel, specifically for the enrichers and fabricators. Number one, we see competing resources occurring at the NRC when they have to concurrently review the license amendments from both the utilities, the fabricators, and the enricher. We're also needing more information from our customers, the utilities, providing the quantities of material that they would need, the assays of the material, and any target reload dates that they have an as objective.

Finally, one of the most challenging issues that we've got, and Marilyn referred to this, is the

transportation of the UF6, of the enriched uranium hexafluoride. Currently, the industry does that in 30B cylinders which are only licensed up to 5 percent. So to ship LEU+, we need a different transportation package, or we need to prove and to re-license the existing 30B.

Now, Urenco's been working with an outside vendor to potentially modify a 30B cylinder and the DN30 overpack that goes with it so we can ship the LEU+, but we're also looking at the existing 30B cylinders to see if they can re-licensed for greater than five weight percent. Regardless, we think that's going to be an industry effort that's needed in order to address the transportation issue.

So Chairman, those are the only comments I had this morning. I appreciate the minutes. Thank you.

CHAIRMAN HANSON: Thanks very much, Steve. I really appreciate it. Now we'll hear from Zachary McDaniel from the Westinghouse Electric Company. Zach is leading technology development for the Westinghouse accident tolerant fuel program and has held multiple leaderships at Westinghouse since 2006. Today he is going to talk to us about Westinghouse's ATF efforts.

Zach?

MR. McDANIEL: Thank you, Chairman Hanson, appreciate the opportunity to share with the group here today and participate on this panel and provide you with an overview of the advancements Westinghouse has made as part of this overall industry effort to develop accident tolerant fuel products.

Next slide, please. We'll start with an overview of the portfolio of our EnCore fuel program. So these are the real drivers, the real products that result from this program. We broke this up in two primary areas that we're working on, and the fuel is comprised of the cladding and the actual fuel material. So we're working in both of these areas on short-term and long-term products with the ultimate goal of providing both economic performance for the utilities and for Westinghouse and also increase that safety performance, which was the initiating cause which Marilyn discussed in her initial comments.

So we'll start with the initial products we're developing, the short-term products which we are -- we have experience with now through some commercial campaigns with some utilities and also working to get licensing documents into the NRC for review and get

these products to market quickly in the next few years.

So the cladding short-term product is a chromium-coated cladding. This is similar to the other fuel vendors, but we are working here to increase the safety and operational margin and also really tying this into the current industry drive towards high burnup. So we feel that this could provide additional margin there, and we're currently exploring that with EPRI, NEI, the utilities and others.

For the near-term advanced fuel product, we're looking at ADOPT pellets. So this is where we get ADOPT. So this really provides some of those economic and safety benefits as well in that we get the higher density, so we get more uranium in the core, allows more fuel management options for the utilities. So that supports the fuel cycle cost and may also enable this high burnup drive to help implement these fuel products in the short -- near-term.

In longer term, we're partnering with General Atomics for the silicon carbide development. They have a product here, the SIGA, silicon carbide cladding, so this is of interest to us. We're also partnering with utilities here to have a short-term demonstration to get this product in the reactor, get

some commercial irradiation experience. And longer term for the advanced fuel pellet material, we are looking at uranium nitride.

So again, these are also efforts that we're interested in engaging and driving forward but really focused on the interactions with the NRC right now on the short-term products for the ADOPT and our chromium-coated cladding.

Next slide, please. All right. So the crux of the Westinghouse engagement are overall strategic driving area. So mentioned before, we're really focused on the near-term products, so we want to get these towards commercialization as quickly as possible to provide value to the industry and to Westinghouse.

So, how we are getting there is we're demonstrating our performance through the testing of these materials and commercial irradiation experience and outside of the commercial reactors, additional test experience, and getting that post irradiation examination to feed into the topical reports to demonstrate the value that we anticipate from these products.

So we have campaigns underway. We have

some experience recently from material that has went through a cycle of irradiation, performed well, according to our expectations and even saw some benefits that were not expected outright. And we have other irradiations planned in commercial experience anticipated, so working through finalizing those contracts now.

So mentioned before, we have topical reports into the NRC. We recently submitted -- the past year, we submitted a topical report for our ADOPT product, so that is currently under review by the NRC. And also, the first step in moving to the higher burnup, we have an intermediate burnup extension topical report which has also been accepted and is under review by the NRC. So, working closely there to build these products up for implementation, ultimately get to this higher burnup and the higher enrichment strategy that the industry is investigating right now, which is that last bullet here under those near-term product development, is really working closely with the DOE to incorporate the industry goals and drive toward this regime and demonstrating the benefits that these products we've developed under the accident tolerant fuel portfolio can provide assistance in bringing us

there safely through the NRC review.

I'll mention briefly, mentioned on the previous slide where we're developing the silicon carbide with GA, working closely with the National Labs for uranium nitride development. So we're really focused as well on driving advancements in these revolutionary ATF materials, so see what operational benefits they may open up for the utilities. So we'll stay engaged with utilities there as we develop these products and see how they fit into their operational strategy.

And lastly, coordinating the ATF activities for the DOE alignment. So this is essential. This is a very aggressive schedule that we are on. It's manageable for sure and we have engagement with all the key parties developed, frequent contact with the NRC. They're aware of our risk and the real drive to expand to these higher burnup conditions. Marilyn mentioned before the risk-informed approach that we hope to do partnering with Rob and our EPRI colleagues and NEI and our colleagues in the industry to really drive that analysis for the high burnup evaluation.

I also want to stress it is important and

due to the contributions from DOE that we're able to continue at this pace and develop these products in this timeline. So that continued funding from the DOE is necessary and needed to keep these products developed at the schedule they're currently on. So that's all for me Chairman. Appreciate the time.

CHAIRMAN HANSON: Thanks very much, Zach. So now let me turn to John Williams who is the Nuclear Fleet and Analysis Director for Southern Nuclear Operating Company. In his role, he's responsible for nuclear fuel and safety analysis for the Southern Nuclear fleet of generating plants. Mr. Williams' presentation is titled, "The Case for Accident Tolerant Fuel: A Utility Perspective." John?

MR. WILLIAMS: Hey, good morning. Let me begin by thanking you, Chairman Hanson, and the NRC staff for the opportunity to speak today regarding utility interest in accident tolerant fuel. I'd invite participants to use the Q and A feature to submit questions while I'm speaking.

Next slide. The last several years, I have had the privilege to be part of a team of utilities, fuel vendors, engineering firms, EPRI and other research groups with the purpose of evaluating the

performance of accident tolerant fuels. During these evaluations, we've learned that ATF has the capability of improving operational fuel reliability. It provides operators critical time during the early portions of a postulated event and has shown that it can improve the core damage frequency of our fleet by as much as 10 percent.

So given the added robustness of the fuel, we turn to look at how that margin could be sued to provide operating flexibility to the plant and perhaps reduce cost. Fuel cycle improvements including increases in enrichment and burnup emerges the benefit that had the most generic application to the fleet and provided the magnitude of savings necessary to encourage and accelerate implementation.

My EPRI colleague, Rob Daum, will show you in just a minute how U.S. plants have been pushing the limits of enrichment and burnup with our core designs. So U.S. pressurized water reactor today, their core designs for 60 percent of that fleet are currently limited by the enrichment limit of five weight percent. So by increasing enrichment and the subsequent burnup limit, we can lower our fuel cost to our customers, we can reduce the amount of spent fuel being produced

by the U.S. fleet. Additionally, higher enrichment and burnup can finally allow for large high-power density PWRs, like our Plant Vogtle, to transition to 24-month operating cycles which will increase the carbon-free electricity generation of a U.S. fleet.

Next slide, please. Given the benefits both in safety and economics, utilities have been actively loading lead test assemblies into reactors since 2018. That's four years ahead of the original timeline. This work furthers our understanding of the technology and provides the needed information for licensing. Last year Southern Nuclear harvested AFT samples that operated for two years in Plant Hatch and shipped them to Oak Ridge National Lab for detailed examination.

Wider adoption and participation of ATF by utilities is occurring as shown on this slide. By the end of 2021, nine different ATF technologies will be in operation in eight reactors by four different utilities. I think it's important to note for utilities to continue to move forward, it is imperative that we see a successful licensing path for this innovative fuel technology and a successful licensing path for the implementation of the benefits.

Specifically, we need a line of sight to the resolution of the challenges to implementation of higher burnups.

I am often asked where I think the industry will end up with this program. It's going to be difficult to predict as I expect this program will continue to evolve to meet the needs of the industry. What I do know is that significant innovation and development has gone into nuclear fuel in the last 10 years. Our fuel will be higher performing and safer when we finish, and these benefits will ultimately improve the safety of our plants but also bring improvements to operating flexibility and cost effectiveness.

Thanks for the time this morning, Chairman Hanson, and I look forward to our discussion.

CHAIRMAN HANSON: Thanks very much, John. I appreciate that. Next, we'll go to -- our next panelist is going to be Dr. Robert Daum from the Electric Power Research Institute, better known as EPRI. Dr. Daum is a Senior Technical Executive in the Fuel and Chemistry Department within the nuclear sector at EPRI. He leads a research development and demonstration program associated with advanced technology fuel including accident tolerant fuel. Dr. Daum is going

to provide us an overview of EPRI's perspectives and research activities. Ron?

DR. DAUM: Good morning and thank you, Chairman Hanson, and thank you to the NRC for inviting me to participate in this panel. I would briefly to present some take-aways from the studies that EPRI has conducted to understand the benefits and risks associated with accident tolerant fuel for light water reactors. John referenced some of those studies in his opening remarks, so let me give you a little bit more detail.

If you would go to the next slide please? EPRI worked closely with key industry stakeholders in the research community to analyze the potential safety, performance, and economic benefits as well as assess any risks of accident tolerant fuel relative to the current fuel technologies. In doing so, these collaborations and the resulting conclusions helped to inform the business case for the industry to consider accident tolerant fuel deployment. One of the key conclusions indicated that improvements to safety and performance margins are likely to result with the deployment of ATF over the current technologies during normal operations, anticipated operational

occurrences, and postulated accidents, both design basis and beyond design basis accidents.

By considering how fuel technologies have innovated since the beginning of nuclear power generation, near-term ATF technologies along with increased uranium-235 enrichment may also enable higher fuel discharge burnup similar to how the other evolutionary changes resulted in the current technologies being used today. More revolutionary or longer term ATF technologies may further extend these possibilities.

Combining all of these findings indicate that improvements to safety, performance, and efficiencies may be realized through ATF deployment. Of course, these and many other studies have identified various gaps to further quantify these margins as well as refine the conclusions from these benefit and risk analyses. There are numerous public-private collaborative partnerships in the U.S. and internationally with the ultimate goal to perform targeted research to further inform the technical and licensing bases for deploying ATF with increased enrichment and higher discharge burnups according to the needs and timelines of the industry submittals and

the NRC's review of those submittals.

And then to the next slide, please. Here I've listed in no particular order several high-priority generic issues that are gaps for ATF with increased enrichment and higher burnups as identified by both the industry and the NRC. First, how does ATF with increased enrichment and across the entire burnup spectrum behave during severe accidents or beyond design basis accident conditions? As I mentioned, this research would help to refine the various analytical safety studies performed over the past two years.

Fuel fragmentation, relocation, and disbursal, also known as a FFRD, is a phenomenon that has been observed in higher burnup fuel during simulated LOCA conditions, so there are ongoing research efforts to further investigate FFRD and its consequences.

There is a need to analyze the enrichment, transportation, fabrication, and storage capabilities across the entire fuel cycle for increasing uranium-235 enrichment above the five weight percent that we have today. And you heard Steve mention some of that in his opening remarks.

Next, how does ATF and high burnup behave under normal reactor operating conditions, and how does

it avoid fuel failures due to reactor water chemistry interactions, FFRD, pellet clad interaction as well as other operational issues due to CRUD deposition and distortion?

And lastly, how does ATF and higher burnups affect back end issues during wet and dry storage as well as spent fuel transportation and eventual disposal?

You heard in past conferences, even other sessions during this year's conference, and perhaps read recent publications that there are opportunities to evolve strategies, methodologies and technological advancements towards streamlining the development of technical bases and fuel licensing. First, with the closure of some irradiation and post irradiation examination facilities around the world, there is a need to collaborate, cooperate, and coordinate research activities to not only lower costs across all stakeholders but also to provide more timely research results and lessen the burden on those surviving but over-prescribed facilities around the world; development and adoption of risk-informed methodologies for fuel licensing beyond the traditional deterministic and best estimate methods, some of which

you've heard today during this session. But there was a very good session led by Mirela Gavrilas yesterday on this topic and particularly how the NRC is using risk-informed decision-making.

And then lastly, coupling past, present, and future experimentation with modeling and simulation tools that have leverage, advancements, and computational material science methods.

Those -- I hope that gives you some perspectives of the benefits and risks associated with ATF, increased enrichment, and higher burnup while also highlighting the research needs and activities to help the industry and the NRC improve the safety performance and economics of the LWR fleet now and for years to come.

Thank you, Chairman. Those are the end of my remarks.

CHAIRMAN HANSON: Thanks, Rob. I really appreciate that. We've had a series of questions come in while folks were presenting, and I -- you know, it's -- I think we're going to have a very interesting discussion. Oh, good, there's everybody on the screen.

So let me get started here. This is kind of a two-parter. I think the first part of this is

going to be for Marilyn, and the second prat is for Zach. And it's, you know, what is the NRC doing to prepare for ATF, increased enrichment, and higher burnup; and how is the industry enabling the safe use of ATF? Marilyn?

MS. DIAZ: Thanks, Chairman Hanson. As I mentioned through my presentation, we're making progress to ensure efficiency in our reviews. We're effectively implementing strategies identified in the ATF project plan. We're also encouraging early engagement and frequent communication related to future submittals. And we're continuing frequent communications and interactions with the nuclear industry, DOE, members of the public and other stakeholders to make sure that -- to ensure our readiness and be prepared for the licensing actions for ATF, increased enrichment, and high burnup. Thank you.

CHAIRMAN HANSON: So let me United States jump in here real quick before we go to Zach. Marilyn, you know, John mentioned earlier the need for kind of a regulatory line of sight for licensees on ATF. Are those project plans that you mentioned kind of the -- you know, is the objective of those to provide that

line of sight both kind of within the NRC but also externally?

MS. DIAZ: So the project plan, what it presents is the new paradigm, how are we making sure that we are ready. It presents our strategies on how do we ensure readiness by assessing the regulatory framework, assessing our guidance, and really communicating to the industry how do we intend to approach this. And really, it's a lot of early engagement is what we encourage to make sure that we understand what they're planning to submit and we ensure our readiness by either communicate -- them communicating to us their basis, their technical basis or whether we need to go out and do some research. So that's all presented in the ATF project plan to ensure that our regulatory framework is -- it's there to be able to license those ATF applications.

CHAIRMAN HANSON: Great. Thank you. Zach, let me go over to you then for kind of the second part of that question about how industry is enabling the safe use of ATF.

MR. McDANIEL: Sure, yes. And I would like to echo a lot of the comments that Marilyn just made. It's the early interaction with the NRC

presenting the strategies that we have laid out that aligns with the implementation schedule that we have coordinated through EPRI, through the utilities, through NEI.

So there's a two-part way that we work with NRC to ensure that we are approaching safely. There's Westinghouse specifically where we go in one-on-one, and it's also through the industry collaborations led by EPRI, led by NEI that we work through to help develop the criteria for FFRD, the risk-informed approach which we're currently discussing which Rob mentioned as well as going to that higher burnup and how we plan to do that at Westinghouse specifically.

So we just briefly about how we're doing it as an industry through the groups and coordinating those joint proposals. Also, through Westinghouse specifically, we've broken it up into two stages. Our strategy there was the intermediate burnup extension which we submitted last year. L So we laid out the strategy with the NRC. We put that plan in place to take a smaller increment of that burnup extension to extend that to demonstrate that we understand the phenomenon that happens beyond the current licensed burnup limits, which helps facilitate the framework

in the structure that we'll use ultimately to get to the higher burnup goals that the industry is currently after.

CHAIRMAN HANSON: Very interesting. Thank you, Zach, very much for that. The next question we've got is for Rob Daum.

And, you know, Rob, you laid out a number of kind of research needs, important areas to look at, but what do you think are the biggest challenges you see to actual deployment of ATF and higher burnup and higher enrichment fuels?

DR. DAUM: Yeah, that's a very good question. You know, certainly, as EPRI is a research organization, we work closely with the research arm of the NRC. And as I mentioned earlier in my remarks, there have been challenges in terms of various facilities being shut down over the past several years, particularly irradiation test reactors, as well as the hot cell facilities for conducting post-irradiation examinations. And those facilities are very much needed to help fill those material behavior data needs, as well as those material property needs.

And so, in this country, of course, the Department of Energy has stood up a number of new

capabilities, as well as resurrected older capabilities. In particular, TREAT and access in ATR, as well as HIFR, have allowed some of those irradiations to go on and get a sufficient amount of neutron fluence as well as burnup achieved so that we could better understand, well, what are those changes in margin relative to the new technologies.

So as more materials become available from the commercial reactor irradiations such as the ones in Hatch that John referenced, those materials will go to those post irradiation examination facilities, and there will be challenges in performing all the PIE that is needed. So that is one aspect of challenges going forward.

CHAIRMAN HANSON: Yes, very helpful. Thanks, Rob. I really appreciate that. So Steve, you mentioned that increased enrichment is predominantly a licensing issue, but aren't there technical challenges that need to be addressed with regard to criticality, safety and, you know, if there are, can you say some more about that?

MR. COWNE: Yes, Chairman, that is correct. There are some challenges from a criticality safety standpoint. For example, some facilities like

ours will use for criticality safety something called safe by design components within the plant. If you increase the assay, the enrichment level of those safe by design components, you may have to change the physical characteristics of the components by replacing them with smaller or different geometry, etcetera.

So when I said there might be some slight modifications, that's the type of thing that could be seen, you know, at a facility like ours, is changing out pumps or chemical traps or something like that to make them, you know, safe from a higher assay standpoint.

There's also analytical ways to address those issues, and there's also, with our IROFS, or Items Relied On For Safety, we can look at what we call administrative IROFS which are a procedure base, performance base type IROFS and replaces some others that are currently being used.

So there's a bunch of tools in our toolbox that we can use to address those, but overall, the piping system, the centrifuges, and everything else, they can easily handle, you know, a few percentages higher for the fuel. Right now we can make up to 5.5 percent, and we see for ATF going up a couple more percentage

points in order to help the industry out.

CHAIRMAN HANSON: Thank you, Steve. Yes. I really appreciate that. Zach, this -- I think this had questions for you, but I think it's also going to be partly a question for Rob as he talked about kind of international testing capabilities. But the primary question I think I have is, you know, what kind of international experience is there with ATFs that we can draw on here in the U.S.?

MR. McDANIEL: Yes. This is a good question. Thank you, Chairman Hanson. It is something that we have fielded interest from globally, and there are developments globally if you look at the global fuel vendors. They're all developing some form of accident tolerant fuel product. It is a global product and a global demand.

One thing that we have encountered through our experience is there's different industry drivers that are pushing for the need for accident tolerant fuel in the different regions of the world. So what we're looking for in Europe, country-to-country, is something slightly different than what the drivers are in the U.S. In the U.S., we are looking for that improved safety analysis but also the economic benefit,

so the economic benefits are key to drive, and that's really pushing us towards the how we can enable the higher burnup and the higher enrichment product.

In Europe, the operational needs of the utilities are not the same as in the U.S., so there's not that same drive towards a longer fuel cycle, but it's focused more on ironing out the safety analysis benefits; so what can we get there in additional safety margins.

And then in the other regions of the world, they're also looking at the technology and still determining what the market need is for that and the safety benefits they want to capture. So yes, it is definitely specific to the utility, the market that utility is in, and what benefits they're after. But our global program is set such that our single product can provide those benefits for all of the regions globally so, yes, thank you, Chris. Great question.

CHAIRMAN HANSON: Thanks, Zach. Rob, did you want to add anything there?

DR. DAUM: Yes. I agree with Zach and, of course, particularly with the aspect that various countries, the utilities, regulators have different understanding of ATF technologies and what they can

do in terms of bringing added safety. So there is a growing interest in ATF around the world. And with that, there is a growing interest in performing research as well. So, of course, we've enjoyed our relationship with the industry and the NRC in collaboratively pursuing research around the world, particularly through OECD, NEA, and IAEA, and that certainly is going to expand over the next several years to help provide more data. So yes, there is a much -- a growing interest from the international community as well.

CHAIRMAN HANSON: Okay. Great. Thank you. You know, we've had kind of a series of specific questions for each of you, and I've got some more that are kind of coming in on my other screen over here. But I did kind of want to back up, and I want to start with John on this question. You know, as I'm listening to each of you speak, and I think about the supply chain for fuel and how highly optimized it is, right, from enrichment to fabrication to the plant and how far and advanced, you know, plant managers have to make orders, thinking about their next series of outages, it almost appears to me to be kind of a complex set of chicken and egg problems. And I'm wondering John, you know, how do you start to make those decisions at the plant

or even at the fleet level, right, which is kind of where you sit about how to transition to these technologies? Certainly, the regulatory aspects are going to be part of this but you know, as we know, fuel fabrication facilities are highly optimized, enrichment facilities are highly optimized, and we're talking about making not insignificant changes to those facilities as we go along. So how are you thinking about that problem as we move potentially into this space where, you know, we've got fuel with higher performance margins, higher burnup, higher enrichment, etcetera?

MR. WILLIAMS: Well, I find it funny you refer to it as a chicken and egg problem, because I've referred to as the greatest chicken and egg problem we've ever faced. You know, if I'm an enricher and I'm a fabricator, I'm not going to make capital investments or licensing investments in my facility until I know that I have a customer that's going to take that product. So they're going to wait for us to come and lead the way.

What we do know about this change is it's really -- it's too big for any one utility. So take the enrichment problem alone, we -- enrichment and

change, we believe there's a critical mass -- forgive the pun -- of about 15 units that are needed to foster the investment necessary for that change. So that's where we are.

You know, each of the -- and that's kind of why we've been working together on this problem as part of NEI is to understand the benefits so that each utility can assess what will be their cost and the benefits to their customers and make decisions, really, on a plant-by-plant basis and then provide that input to the fabricators and the enrichers. And if there are enough utilities that are interested, then we'll see them make that investment and we're going on.

But again, you know, I mentioned this in my talk. It's more than just a cost-benefit. There's a lot of regulatory changes that have to be made here, so we have to see that the technology, the benefits, all of those things, that there's line of sight to getting all of those before the utilities are going to make an investment.

But we are coming up on the time -- you know, we're looking for deployment in mid-2020's. We are at the time where the utilities are going to have to start thinking about making those investments and

making those commitments to the enrichers and the fabricators for the products. And so, you know, it's a critical time in the juncture for the utilities to get the right signals from the fabricator and the right signals about a licensing success path so that we feel comfortable making those commitments to move forward.

CHAIRMAN HANSON: Yes. That's very helpful. From the NRC standpoint, we're often in receipt mode, right, for technical reports and other kind of licensing actions. Certainly, I think Marilyn spoke well about the project plan and about how we're kind of getting ready. So I -- my hope is that -- and I think Marilyn's nodding along, too on this -- that we're sending the right signals about that even if we don't have a fully kind of laid out and detailed roadmap. So that's -- thanks. That's very interesting.

Zach or Steve, do you want to jump in here on this?

MR. McDANIEL: I'll let Steve take it. My initial thought on this was if there is an interest from the utilities, that we'll find a way to make it happen; right? In the best interest of the industry and moving forward, I think we'd work with Steve and Steve and Urenco would build out those capabilities

if there is sufficient market demand. But yes, and that's the way we see it at Westinghouse, as a big picture type thing.

CHAIRMAN HANSON: Sure -- sure.

MR. COWNE: Yes. John hit the nail on the head about chicken or the egg and so did you, Chairman. We often use the phrase, "Who's going to jump first?" And so what we're trying to encourage the industry to do is to hold hands and jump together off the end of that pier.

So we haven't -- Urenco made some investments into the LEU+ project. We're going ahead with the licensing of that. We believe that there's going to be enough of an interest and a market in the U.S. that we will be able to enrich and sell accident tolerant fuel level assays and higher burnup assays. So you know, there is some risk associated with it.

When you start talking about small modular reactors and in HALEU, you know, assays between 10 and 20 percent, that has a little bit higher risk from a commercial standpoint. And that's another example of who's going to go first, the SMRs or the enrichers or the fabricators, whatever. So these are interesting times in the fuel cycle.

CHAIRMAN HANSON: Absolutely, yes, certainly it is. We could talk all day about all the different aspects of this. Marilyn, I've got kind of a technical question for you, but I think it's a really interesting one about the IAEA and about -- you know, we're looking at new claddings outside of kind of a long history of Zircaloy, and are these claddings being recognized by IAEA and the additional protocol.

MS. DIAZ: Thank you, Chairman Hanson. From NRC perspective, we would not expect that the designation of zirconium tubing would change due to the application of a thin chrome coating. However, my limited experience with AIEA particles, AIEA controls those particles. In my opinion, it will still be treated as steel. But as far as the NRC, we would apply our current regulation to ensure that the fuel performed safely. And it's up to the applicant to demonstrate safety and compliance with the NRC regulation.

CHAIRMAN HANSON: Okay. Great. Thank you. And John, what do you see as the spent fuel -- you know, one of the benefits of ATF and higher enrichment, higher burnup is potentially lest spent fuel generated. Is there a ballpark number around that

operators can see, you know, could look forward to in these scenarios?

MR. WILLIAMS: Yes. So, you know -- and I think there was a number on my slide and it's a big number. It's in the billions of dollars in terms of spent fuel cost reduction over the remaining life of the fleet. You know, that's a big number. And frankly, the big winner in that number is the American people, you know, as the Department of Energy has the responsibility to take and dispose of that fuel. And so, you know, our customers have the benefit of us generating less but also, you know, there'll be less to need permanent disposal.

So yes, it's a -- you know, in terms of number of assemblies, I mean it's a large number. It's, you know, a significant reduction, about 20 percent reduction in the spent fuel that will be generated.

CHAIRMAN HANSON: Wow. Yes, that is significant. Very, very interesting. So Zach, let me go over to you. You mentioned using a risk-informed approach for ATF. Obviously, it's something that Marilyn touched on as well. But can you talk about how kind of how Westinghouse is approaching risk informing its analyses on this subject, and kind of

what's the timeframe that you see for engaging in that and completing that -- those risk-informed analyses?

MR. McDANIEL: Yes. Very good. Thank you for the question. So this specifically, the risk-informed approach I was referring to is something that's being led by NEI and EPRI. So it's something they're working to put forth that we would build upon for our topical reports, specifically addressing the FFRD criteria that Rob discussed in his presentation. So our participation or interest in that is to see that move forward, for that to be further evaluated to change the way we can license our product and to get these products to market quickly in alignment with the industry goals. So it's really -- for this specific approach, it's a collaboration that benefits the whole industry, and we would take and build upon that for our specific topical report.

CHAIRMAN HANSON: Yes. Very good. Thank you. I appreciate that. You know, we talked about the chicken and egg problem, who jumps first problem as Steve put it earlier. But there is a potential opening there with the start of operations for Vogtle 3 and 4. So, you know, John, is this something that Southern may consider for Vogtle 3 and 4, or do you

think the timing is -- you know, isn't quite right, that you'll start on kind of one footing and maybe potentially shift down the road?

MR. WILLIAMS: So we're going to -- we're focused on finishing the construction of that plant and getting it online later this year, which is very exciting. And that plant is licensed with what I will say are the current fuels. And so we will -- we plan to operate that with the current fuels. Then we'll go through the process of evaluating the benefits relative to that plant and its technology. It has different technology, so we've got to make sure it would make sense to provide that benefit.

So I think the answer is we're going to -- it's licensed to operate with the current fuels. That's the plan and we'll evaluate changing to these fuels later on down the road.

CHAIRMAN HANSON: Yes. Great. Thank you for that. I appreciate that. Zach, Westinghouse has a history on kind of multiple portions of the fuel cycle. One of them is certainly the back end in spent fuel management. So, you know, how does future spent fuel management play a role in the design of ATF? Are you thinking about -- in a way, it's kind of -- how do the

after-use scenarios factor into the front end of fuel design for you all?

MR. McDANIEL: Yes, definitely. And as John mentioned, that's one of the key drivers to look at the higher burnup product that we're looking to develop. It's reduced those back end costs. But yes, it is factored in through all of our assessments and before we can even put the material in the core, so working closely with the NRC and internally as well to evaluate the materials that we're developing, the impact on the spent fuel pool criticality analysis.

Even for the initial test rods and the test assemblies that we're inserting, there is a very specific analysis we have to do and the impacts we have to assess for those campaigns. So we've experienced that through the two campaigns we already have underway, the two additional ones we're currently working on. So it is something we definitely factor into, and one of the key drivers in industry interest in that high burnup ultimate use for these products and how we can realize that benefit and demonstrate additional benefits for the product.

CHAIRMAN HANSON: Yes. Very good. Thank you. You know, one of the questions I want to ask all

of our panelists, and Zach, you touched on it in your presentation, is about silicon carbide fuel and the silicon carbide cladding and how that -- where does that kind of fall on the spectrum of activities or opportunities for, you know, accident tolerant fuel, high enrichment, higher burnup, does silicon carbide -- you know, we've seen, I think, in the presentations today that, you know, you go to chromium cladding or chromium-doped fuel, and you get to that what Steve calls LEU+ type of a situation. You know, and these things kind of fit together, and we're starting to understand plant operations and so forth. But then how does that look different for silicon carbide?

And that's kind of a question for all of you. I mean any one of you can start. Zach, you might start because you had it in your presentation, but I'd love to hear kind of Rob and Steve and John weigh in on this as well.

MR. McDANIEL: Yes. This is -- the silicon carbides, when you really drive into the ultimate accident tolerant benefits, you're going to get silicon carbide. So that's the end state, the end product that really delivers all the benefits this program set out to do.

We mentioned before that was a longer-term product, so it's something that's not going to be implemented in the next few years. There is still some technology readiness, technology development that needs to occur. We are working to get this in a reactor, so we're working closely with the utility here. It hasn't been formally announced, I believe, but we are working to get that commercial irradiation experience for this material and to further develop it.

But there's benefits in developing it for the existing LWR fleet as well, because it builds that maturity for the product and ultimately will help better position the United States for the advanced reactor campaign. So we see these products as also being valuable to the advanced reactor designs and the fuel products that will ultimately support those. So it has multiple benefits. What we learn here for the existing fleet could help support the United States future fleet as well.

CHAIRMAN HANSON: Thank you. Rob or Steve or John?

DR. DAUM: Yes. If I can chime in? Yes, certainly, Zach hit the nail on the head with silicon carbide being probably the most resistant to accident

tolerant -- or accidents, so most tolerant to accidents. So that is, by far, the major benefit of it, but there are other benefits, so not only under severe accidents but AOOs and DPAs, so those -- behavior of silicon carbide is very stable after a certain amount of irradiation. You don't have to worry about corrosion. You don't have to worry about hydrogen pickup, and certainly dimensional stability or distortion is also well understood after a cycle or a cycle and a half. And so those are additional benefits that tend to allay any concerns during all operations through accident conditions.

CHAIRMAN HANSON: Okay. Great. Anyone else want to touch on that?

MR. WILLIAMS: Sure, Chairman Hanson. I'll just add that, you know, we've been evolving and developing our fuels for the 40 years that we've been operating our plants. And so I don't see that stopping and I think the -- kind of the timeline of the different products that Zach went through in his presentation really shows you I think we're getting a glimpse of what the future nuclear fuel might look like as we have some of the near-term products and the short-term and, you know, the middle part of this decade and then,

obviously, the more advanced projects like the silicon carbide perhaps in the early part of the next decade.

And so, you know, we are interested -- you know, from a utility perspective, we're interested in products that bring benefits and value to our customers. So we're going to continue to look at what benefits can come from these advanced fuels and, you know, we'll deploy them when the technology is ready and they're ready to go into our plants.

CHAIRMAN HANSON: Okay. Great. Thank you for that.

MR. COWNE: And Chairman, from an enricher standpoint, obviously, we don't get too involved into cladding or the silicon carbide, etcetera. That's more the area for Zach and other fabricators. We do work closely with fabricators to make sure that they get the type of UF6 that they want, they get the purity levels that they want. There is a quality associated with that and that can impact, you know, the fuel manufacturing process. But otherwise, from an enricher, not much impact on that.

CHAIRMAN HANSON: Thanks, Steve. I appreciate that. I want to -- you know, we've talked about some of the kind of operational benefits and

economic benefits, and well, there's the operational benefits and there are kind of two sides to that coin. One is potential economics. The other one really is kind of safety. And I think there is some concern out there in the world that the safety benefits achieved by these different doping or cladding, you know, technologies that we're adding to the fuel then are offset in a way by going to higher enrichment and higher burnout.

And you know, I guess my question is, is that a zero sum gain for your all's view, and how does kind of the net increase -- how do we maintain kind of the net increase in overall safety as a part of the use of these technologies? And that's kind of a question for Zach partly, I think for John, but also certainly for Rob, too. He may have some thoughts from EPRI's standpoint on this.

MR. McDANIEL: Sure. I'll go ahead and kick it off, Chairman. So yes, completely agree and that is something that we are keeping in mind and in our forefront as we develop these products and ensure that the safety analysis benefits or the safety margins that we're building into our products through the implementation of these is maintained throughout the

life of the burnup of these products that they're currently licensed too and that we wish to extend them to.

And we are doing that through collaboration, openness with the industry as a whole including the DOE, the NRC, the utilities, and EPRI, NEI, right. There's a wide array of partners, not to mention that national labs and universities we're partnering with to develop these products and to test these products. So we're all working together with the goal of improving the safety for the reactors, to demonstrate that, because that's going to be critical to nuclear success moving forward and to be sustained moving forward as well. So it's something I believe the industry, as a whole, and Westinghouse specifically, as our part, we're looking to develop and maintain these benefits throughout the extended burnup window that we are pursuing.

CHAIRMAN HANSON: Great. Thanks for that. John or Rob?

MR. WILLIAMS: Sure. I'll just add, you know, I think it's important to note that, you know, our plants are very safe today. You know, they're designed and constructed in a safe manner. They're

regulated by the gold standard of regulators. And so we -- you know, Senator Feinstein and Congress gave us a bold goal to go and try to improve our fuel. I think that's a great goal for us. And I have spent enough time working on understanding the performance and the benefits of these fuels going forward, that I am confident that at the end of the day, we will have -- we will achieve the safety benefits that have been requested by Congress and have been kind of that ambitious goal. We will achieve that.

And on the opposite side of that, we will also have some benefits for our customers as well. So, you know, this is really a win-win. We're going to improve the safety of our plants, but we're also going to improve the cost effectiveness of our fleet and improve that for our customers. So, you know, I am very confident at the end of the day, it will not be a zero sum gain, that we will achieve all of the goals that everybody has set out to achieve in this program.

CHAIRMAN HANSON: Great. Thank you for that, John. Rob?

DR. DAUM: Yes. I just expand on those two points a little bit more to say that, you know,

as John and I mentioned, the fuel technologies have evolved over the decades and with that the various safety margins. And so with ATF at even higher burnups and increased enrichment, those safety margins are going to be conservative, of course, but as we mature the deployment of the technologies and be able to understand their behavior more and more through pool-side examinations, through hot cell examinations, through testing, we'll realize the conservatisms within the current safety margins as well as any kind of extension to higher burnups.

CHAIRMAN HANSON: Great. Thank you for that. Kind of teeing off of this, I want to start this next question -- I think I want to start with Marilyn, and this is partly kind of about reactor licensing. And John, I think, and potentially Zach could kind of weigh in here, too; right? So higher burnups can mean a change or even an increase in potential source terms. So, you know, how is NRC looking at, you know, higher burnup with regard to considering the impact of both accident frequency and potential accident release size? How is that going into -- you know, this is really kind of on the nuclear reactor regulation side, but the house -- but how are we evaluating the use of these

fuels in kind of operating reactors with regard to, you know, different kind of accident scenarios?

MS. DIAZ: So I'll start. I'm not an expert on Part 50 but I'll try to say what the NRC team is doing for Part 50. And I think they've done a great job about looking at the source terms, what that means when it relates to the near-term concepts about chromium-coated, doped pellets, and FeCrAl.

We're assessing the information we have and whether we need to conduct additional research on that part. We've conducted two PIRTs so far and to identify any phenomenon that we've missed or that our guidance needs to supplement to make sure that we cover all the important and risk-significance phenomena. So I'll say to that much and let others talk about it.

CHAIRMAN HANSON: Great. Thanks, Marilyn. John, do you want to touch on that a little bit?

MR. WILLIAMS: Sure. So I'll add, you know, I know that the NRC is in the process of revisiting its regulator guide for the alternate source term, you know, and with the intent of increasing the burnup limit within that regulatory guide. You know, we're supporting that effort via the comment process and

working to ensure that the concerns of the industry are addressed as we update that.

But ultimately, you know, when we move forward to licensing our facilities with these new fuels, with high enrichment and higher burnup, we're going to meet the regulatory standards to ensure that we continue to operate safely for the folks that live and work at our facilities. So, you know, that is absolutely the goal and so we're going to continue to meet the requirements as we change the burnup limits on our fuel. And we're, you know, working through that process now with the regulatory guide update.

CHAIRMAN HANSON: Okay. Well, I'm going to transition ere. I'm just -- we're going to just probably a couple more questions and honestly, I'm saving the last one for myself. So kind of with that in mind, you know, we talked earlier about this -- and I keep coming back to this because I think it really, in a way, is kind of the crux of the matter, the who jumps first, the chicken and egg problem. We talked a little bit about the financial aspect of that, right? How do we kind of -- you know, where do people kind of band together to recreate the demand signal, to drive potential changes upstream, right?

But I think there's also -- you know, I touched on this, too, and part of what makes this a multidimensional, you know, almost science fiction chicken and egg problem is that there are kind of regulatory and technical challenges in this space, too. So I was wondering kind of if Rob and, you know, Zach, could kind of talk on, you know, outside of the financial aspects of this, kind of how you see some of these other regulatory and technical challenges as well?

DR. DAUM: I'll start. Thank you for the question. Yes, so any new technology, any new fuel technology has to be measured against the current regulation and, you know, those are the ones listed in the SRP Chapter 15.

And so you have to consider, as I mentioned before, corrosion of the clad, the hydrogen pickup within the clad, any kind of plastic deformation below 1 percent strain within the clad, and center line melting, preventing center line melting during various operational occurrences, and then of course, you know, going to the design basis accident criteria that are also tied to corrosion and hydrogen pickup as part of the current zirconium-based clad technologies.

And so any new fuel technology is going

to need to look at that, and the coated zirconium alloy cladding is, of course, as Marilyn said, a small iteration in all the series of iterations that have occurred throughout the industry. And maybe FeCrAl, the iron chromium aluminum alloy is something different, so we have to consider any new phenomena associated with it. And then, of course, going to the longer term ATF technologies like the silicon carbide, like the metallic fuels, the high-density fuels, there are undoubtedly going to be new phenomena that we have to understand and be prepared to develop the technical basis that will then drive to changing any kind of regulatory guidance and limits.

So those are the things that need to be first and foremost on our radar screen, because those are long lead time activities to help inform the industry and the regulator.

CHAIRMAN HANSON: Yes. That's great, Rob. Thanks for that. And I really appreciate your emphasis on the importance of research facilities at Department of Energy facilities, universities and other places as kind of part of the overall ecosystem that enables these potential changes. So I appreciate that very much.

Zach, I don't know if you wanted to weigh in here a little bit or not on this question.

MR. McDANIEL: Yes, I could. I want to leave you some time though so I'll be really brief.

CHAIRMAN HANSON: Don't worry about that.

MR. McDANIEL: All right. So the big gap for us to get to the higher burnup, high enrichment is, of course, the manufacturing facility and the modifications there needed. It's going to be a significant investment so as Steve mentioned and John mentioned, we need to make sure that there is that demand and we have the appropriate level of demand to move forward with that investment.

The next thing we need to do is really make sure that our schedules align in the development, so line out all of those key paths, those key interactions with all of the key players, with Steve and Urenco, with John and utilities, with Rob and the research that we're -- underlying research that goes in and then, of course, throughout with the NRC. When do we plan to put our licensing material to the NRC for review? When will we get those key pieces of data that are necessary to license our products and bring them to market. So that's really, at a big picture, my

perspective, so thank you.

CHAIRMAN HANSON: Yes Thanks for that, Zach. I really appreciate it. Anyone else want to weigh in on that?

(No response.)

CHAIRMAN HANSON: Okay. All right. Well, I think the last one was what does the Commission think about ATF and how are you, as the new Chairman, guiding staff activities on ATF, and is it a high priority for you?

So let me say this. I talked about it in my plenary speech yesterday that I had three priorities. And, actually, they're the exact same priorities -- I have the exact same priorities as Chairman that I had when I came in as Commissioner in June, what I call the three A's: and the first one being kind of advanced reactors, and the second one being accident tolerant fuels, and the third one being academic programs.

And those all kind of tie into this session together. And, you know, I was focused on certainly the accident tolerant fuel program, because it was started by Senator Feinstein when I worked for her and for others on the Appropriations Committee. It remained a high priority, but I also took a personal

interest in it. There was nothing saying that I had to bring that over into my tenure here at the NRC, but I did because I think it's an exciting program. I tend to be, as staff are learning, as I go out and talk more, I tend to be an optimist, one of the things I'm -- I tend to also be a technological optimist about a lot of these things.

And I'm very excited about the work that's been done, and as I learn more about what's being done in the NRC to get ready for this, I'm consistently impressed with the way the staff are adapting and using risk-informed techniques and really working together across the agency. This is something that, you know, may have started in the Office of Research but now has heavy involvement by NMSS as well as the Office of Nuclear Reactor Regulation as well as some participation by NSIR. And I think that kind of breaking down stovepipes, which is what we're seeing kind of across, you know, in the private sector as well on this effort, is really important and critical to success.

So I really couldn't be more excited about this effort in terms of safety and public confidence and really all of the aspects that we've talked about

today.

So how can I support that? I can support it by, you know, talking about it in my RIC speech and hosting sessions like this. When I saw this one, you know, all of the Commissioners kind of got to choose a little bit about which RIC sessions they wanted to share and, you know, there was no question. I was like, I'm all in on this, especially with the great panel that we've had today, you know, people on the utility side, on the fabrication side, research, enrichment and, of course, from the NRC itself.

And I'm just incredibly pleased to have done this. I appreciate you all very much for joining us today and for the great discussion. And I hope you enjoy the rest of the RIC. Thanks, everybody.

(Whereupon, the above-entitled matter went off the record at 12:02 p.m.)