

UNITED STATES

NUCLEAR REGULATORY COMMISSION

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PUBLIC MEETING ON ACCIDENT TOLERANT FUEL ACTIVITIES

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TUESDAY,

FEBRUARY 25, 2020

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ROCKVILLE, MARYLAND

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The Commission met in the Commissioners' Hearing Room at the Nuclear Regulatory Commission, One White Flint North, 11555 Rockville Pike, at 9:00 a.m., Kristine L. Svinicki, Chairman, presiding.

COMMISSION MEMBERS:

KRISTINE L. SVINICKI, Chairman

JEFF BARAN, Commissioner

ANNIE CAPUTO, Commissioner

DAVID A. WRIGHT, Commissioner

ALSO PRESENT:

ANNETTE L. VIETTI-COOK, Secretary of the Commission

MARIAN L. ZOBLER, General Counsel

NRC STAFF:

JAMES CORSON, Reactor Systems Engineer, Division of
Systems Analysis, Office of Nuclear Regulatory
Research

MARILYN DIAZ, Project Manager, Division of Fuel
Management, Office of Nuclear Material Safety
and Safeguards

DAN DORMAN, Deputy Executive Director for Operations
for Reactor and Preparedness Programs

MICHAEL ORENAK, Project Manager, Division of
Operating Reactor Licensing, Office of Nuclear
Reactor Regulation

JOSH WHITMAN, Technical Lead for the ATF Working
Group, Division of Safety Systems, Office of
Nuclear Reactor Regulation

EXTERNAL PANEL:

ANDREW GRIFFITH, Deputy Assistant Secretary for
Nuclear Fuel Cycle and Supply Chain, Office of
Nuclear Energy, Department of Energy

EDWIN LYMAN, Director of Nuclear Power Safety, Union
of Concerned Scientists

PETER SENA, Executive Vice President and Chief

Nuclear Officer, Southern Company, Executive

Sponsor, Industry Accident Tolerant Fuel

Working Group

NEIL WILMSHURST, Vice President, Nuclear & Chief

Nuclear Officer, Electric Power Research

Institute

1 PROCEEDINGS

2 9:02 a.m.

3 CHAIRMAN SVINICKI: Good morning, everyone, and
4 welcome. To those of you who have ventured out and joined us on this soggy
5 Tuesday morning, thank you very much for being here. And for those who
6 might be participating and listening into the webcast, you might have picked a
7 very wise way to join us here today.

8 And for those in the room, I would note that Commissioner
9 Caputo is on her way and will probably come breathlessly into the room
10 momentarily, but had to address an unexpected other matter this morning.
11 So, she will join us in progress when she arrives.

12 But the Commission convenes this morning to hear an
13 update on the status and issues associated with the path to licensing what
14 we've all termed accident tolerant fuel. Occasionally, I hear it referred to as
15 advanced technology fuel and other things that fit the same acronym, but for
16 the purposes of our meeting, we're talking about what's termed accident
17 tolerant fuel for use in commercial nuclear power reactors.

18 This is not a new topic. The agency staff has been very
19 involved with operators and, also, with the fuel vendors for a number of years
20 now on this topic. But the Commission viewed that, since this is a very active
21 area, it would be a good meeting to have and just to check in to see how
22 everything is going and what the efforts are, and any issues that the
23 Commission may need to weigh-in on or bring to its own attention.

1 We will hear from two panels this morning. Already seated
2 at the table are the participants in our external panel. Following that, we will
3 have a very brief break, and then, we will hear from the NRC staff after that
4 short break. With each panel, we will hold questions until the end, and then,
5 we will hear questions from the Commissioners for the panel.

6 So, with that, we will begin with our external panel. But I
7 will ask, first, if the colleagues who have made it to the room, and aren't
8 rushing up from the garage and elsewhere, have any remarks to make.

9 Hearing none, we will simply begin with the panel's
10 presentation. I intend to proceed in the order in which you all are listed on
11 the public notice for the meeting that we put out. And you are seated. So, I
12 assume, unless you've arrived at any other agreement amongst yourselves,
13 we will begin with our interagency partner. We will begin with Mr. Andrew
14 Griffith, who joins us from the Department of Energy, Office of Nuclear Energy,
15 where he serves as the Deputy Assistant Secretary for Nuclear Fuel Cycle
16 and Supply Chain.

17 Mr. Griffith, welcome and please proceed.

18 MR. GRIFFITH: Great. Thank you, Commissioner.
19 Thank you, Commissioners, for having me here.

20 This is a very important topic and I think it's timely to check
21 in with you all on our progress. So, I'm going to speak briefly on the history
22 and background of the topic, bring us all up-to-date, talk a little bit about our
23 industry and other partners, in which they will go into detail more on their

1 portion of the presentation, and then, wrap up with a timeline and a brief recap.

2 So, this challenge really started with Fukushima. However,
3 there were some technologies that were being considered before then. I
4 think, reflecting back, the uranium-Zircaloy fuel at the time had been optimized
5 over decades of incremental improvements, and it was performing at a very,
6 very high level. I think one of the things that the events at Fukushima showed
7 us is that perhaps we can do better in the extreme conditions; and also, this
8 was an opportunity to take a look at that technology and move forward.
9 Fortunately, with the 2012 appropriations, Congress agreed and they
10 supported us beginning this program.

11 So, the next slide recaps one of the first things we did at the
12 time is define what do we mean by accident tolerant fuel. This is slide 4. So,
13 looking at the range of conditions that were experienced at Fukushima as well
14 as other postulated conditions that could exist in light water reactors, what
15 types of things do we mean by the ability to tolerate or survive, add coping
16 time, et cetera, in these extreme type of events?

17 And so, this is how we defined it, with improved reaction to
18 kinetics with steam, improved fuel properties, improved cladding properties,
19 and enhanced retention-efficient products. And there's more detail on the
20 slide. These have pretty much held constant throughout the program so far,
21 and they kind of remain the performance areas that we look for improvement
22 as we proceed.

23 Next slide, slide 5.

1 We've been fortunate in that we've partnered with a lot of
2 really excellent organizations, excellent people, from the fuel vendors to
3 National Laboratories, reactors owners/operators, universities, and our
4 international colleagues. Without this collaborative partnership, I don't think
5 we would be where we are at, where we are making, I think, solid progress
6 and making a difference in advancing the technology for light water reactors.

7 And, of course, we couldn't be where we're at without the
8 constant engagement with independent regulatory oversight. The NRC staff
9 has been excellent and asking excellent questions, engaging in areas
10 appropriate, and I think making us all better.

11 The next slide summarizes the areas of focus for the three
12 fuel vendors. Clearly, the evolutionary improvements that are now in play,
13 the coated cladding with doped pellets, those are making good progress.
14 However, they are all pursuing longer-range technologies that could play an
15 even greater role in the future.

16 Next slide.

17 The National Laboratories, clearly, the key contribution from
18 the Department of Energy, we have a range of test facilities that are helping
19 this program progress, not only creating long-term or steady-state type of
20 conditions for this technology, but also pushing them to the extremes of either
21 temperature or reactor dynamics, transients. The Accident Tolerant Fuel
22 Program was the key driver for resuming operations of the transient reactor
23 test facility in Idaho National Laboratory, and it will be playing an absolutely

1 critical role as we go forward.

2 Also important are the advancements we've made in post-
3 radiation examination. In examining these experiments when they've come
4 out of the test reactors, the range of technologies that we now have in play
5 help us not only understand the performance of the experiments that they're
6 examining, but they also provide a significant amount of data that feeds into
7 high-performance computers that will enable us to predict the performance
8 more accurately.

9 Next slide, slide 8.

10 So, here's a range of contributions from our universities and
11 our international partners. Clearly, the universities are able to contribute in
12 early-stage type of conceptual evaluation and development, but they also help
13 educate and prepare the scientists and engineers in our universities for
14 entering the workforce in the future. So, we see this as a really double benefit
15 to engage with the universities in this important technology.

16 Clearly, nuclear energy is a global technology.
17 Engagement with the international community is essential, especially if we're
18 developing advanced light water reactor fuel. Clearly, there are global
19 implications and the clear potential for global deployment of this technology
20 that, again, will contribute to the better application of the technology around
21 the world. And we've gotten a lot of benefit, I think, from the engagement of
22 these international partners and their questioning why we're doing what we're
23 doing, and so forth.

1 Slide No. 9 is an overview of the schedule. It starts at 2018,
2 several years into the program. NEI did a great job of capturing and
3 summarizing the steps we're currently engaged in and those steps remaining.

4 The Hatch experiments were pulled out earlier this month,
5 lead test assembly, and I understand they'll be shipped to the Idaho National
6 Laboratory at the end of this calendar year. And that's just one example, I
7 think, of the excellent teamwork between the industry partners, both the fuel
8 vendors and the utilities, and our National Laboratories.

9 Clearly, we have a ways to go before we get into batch
10 reloads and full core reloads, but we're learning a lot as we go. And clearly,
11 NRC is playing a prominent role in the schedule going forward, as you see.

12 To wrap up -- I'll be brief here -- I think we've got a really
13 good team that's making good progress. I can't overemphasize the
14 constructive nature of the NRC engagement along the way. They're asking
15 really hard questions. Clearly, we have to meet the standards to go forward.
16 I think we're making great progress, but, clearly, we have more work to do.
17 Funding is always a challenge for the federal government programs.
18 However, hopefully, we can sustain continued congressional support.

19 Affecting the integration of high burnup enrichment fuels is
20 going to be a challenge, and then, defining that final step of commercial
21 deployment will be a challenge. There's a point at which DOE has to let go
22 and let industry take over. I think everyone in the program recognizes that.

23 So, thank you. I look forward to your questions.

1 CHAIRMAN SVINICKI: Thank you very much, Mr. Griffith.

2 Next, we will hear from Mr. Pete Sena, who currently is the
3 Executive Vice President and Chief Nuclear Officer for Southern Company.
4 He also is here, or predominantly here today, in his role as executive sponsor
5 for the industry Accident Tolerant Fuel Working Group.

6 Pete, please proceed.

7 MR. SENA: All right. Thank you. And good morning.
8 We very much appreciate the opportunity to brief the Commission on the
9 industry's development of accident tolerant fuel.

10 And ATF really represents an innovative technology where
11 cycle efficiency and safety are coupled together, and that these are not
12 mutually-exclusive concepts.

13 Next slide, please.

14 This is an overview of the ATF Working Group established
15 in 2016. And you can see it's comprised of utilities, National Labs, fuel
16 vendors, and EPRI. And essential to the progress is the independent
17 research being done by EPRI, and Neil Wilmshurst will provide a briefing next.

18 There are two main task forces within the Working Group.
19 There is the External Affairs Task Force and the Fuel Licensing and Safety
20 Benefits Task Force. Now the External Affairs Task Force is essentially
21 providing messaging to the external stakeholders, media, Congress, on the
22 benefits of accident tolerant fuel, while the second task force is focused on the
23 identification and resolution of generic issues for the development and

1 deployment of accident tolerant fuel.

2 And really, the biggest benefit, the generic benefit that we've
3 identified by these efforts thus far is the utilization of higher burnup and higher
4 enrichment, which is really enabled by the safety enhancement of accident
5 tolerant fuel. Our goal is to deploy batch reload quantities of ATF with
6 increased enrichment by the mid-2020s.

7 Next slide, please.

8 Like you see, this is a little bit of a busy chart, but there are
9 essentially five different applications of accident tolerant fuel test leads
10 installed today between Southern Company, Entergy, and Exelon, with all
11 three vendors, all with various combinations of doped fuel pellets and coated
12 cladding.

13 The next major milestone will be the submittal of topical
14 reports later this year. NRC approval of the topical reports will pave the way
15 for the industry to, then, submit the licensing documents to support the batch
16 reloads.

17 There is a path forward here, but it's predicated not just upon
18 the research and testing, but also upon the regulatory clarity, predictability,
19 and stability.

20 Now we do appreciate that the NRC staff is working on
21 potential transformative changes to the NRC's regulatory framework and
22 culture and infrastructure, so that the agency can be more agile and adopting
23 to new and novel technologies such as accident tolerant fuel.

1 In particular, we do want to thank the staff for their work on
2 issuing the Coated Cladding Interim Staff Guidance. We believe that this ISG
3 does provide the necessary guidance to the industry to assist in the
4 development of the topical reports.

5 But it's also equally critical that the staff stick to the guiding
6 themes of the project plan that states that no confirmatory testing outside of
7 the post-irradiated lab testing is needed. Per the project plan, the NRC has
8 adopted the position that near-term ATF actions can move forward using the
9 exemption process. Should widespread adoption of these technologies
10 become apparent, the longer-term strategy of rulemaking would be needed
11 for more predictable and stable licensing process.

12 Historically, the fuel licensing process has been a 20-year
13 evolution. Now there have been considerable advances in modeling and
14 simulation capabilities to allow for the safe, accurate, and timely review of the
15 design specifications and testing, and thus, allowing for the timely deployment
16 of ATF within the next five years.

17 Next slide, please.

18 Now you can see here the benefits enabled by ATF can be
19 grouped into the following broad categories: whether it be enhanced fuel
20 performance, improved coping times, enhanced fuel reliability, improved
21 operational flexibility, improved fuel cycle optimization. The improved safety
22 margins of the ATF concepts would, then, allow for the increased burnup and
23 enrichment, and then, thus, reduce reload sizes; reduce spent fuel pool waste;

1 allow plants to transition to a 24-month cycle.

2 Next slide, please.

3 Now you can see here at our Hatch Plant, after two years of
4 service, the lead test assemblies at Plant Hatch have now been removed and
5 they will be shipped to Oak Ridge, not Idaho, this coming fall. The lead test
6 assemblies from Plant Vogtle will, then, also be removed this fall. Several of
7 the test assemblies will remain at Hatch for the next operating cycle for
8 additional irradiation.

9 In closing, to support the deployment of ATF in the mid-
10 2020s, it will require sustained, coordinated, and well-managed effort between
11 the industry, NRC, and DOE. And I truly believe that we have an awesome
12 opportunity in front of us, but only if we all embrace it.

13 Thank you.

14 CHAIRMAN SVINICKI: Thank you very much.

15 Next on the panel, we will hear from Neil Wilmshurst, who is
16 the Vice President of Nuclear and the Chief Nuclear Officer of the Electric
17 Power Research Institute.

18 Neil, welcome, and please proceed.

19 MR. WILMSHURST: Thank you. Good morning. Thank
20 you for this opportunity.

21 As Andrew said, this accident tolerant fuel effort really has
22 its basis coming out of Fukushima and is really one of the longer-term actions,
23 and one which is being engaged in globally. And certainly, the work being

1 done in the U.S. is being watched globally. And I can tell the Commission
2 that EPRI is fully engaged globally in the accident tolerant fuel work, and we're
3 certainly very engaged with IEA, OECD, and NEA in this work.

4 As I was preparing for this, I read a paper that one of the
5 team, who's actually in the room here today, wrote, and I thought it was
6 appropriate to quote it. "The ideal ATF will improve plant safety while also
7 reducing plant operating costs."

8 And that is really the context that I am coming to this briefing
9 with, and really consistent with what Pete and Andrew have both said. I think
10 the progress to date shows that that objective about improving safety and
11 reducing plant cost is very likely achievable through the safety effort.

12 So, next slide, please.

13 The discussion today will give insights into where we are
14 and what needs to be done to bring this effort to conclusion. As Pete just
15 said, the near-term concepts are being tested for deployment in the mid-2020s.
16 And this, to date, has been a substantial collaborative win between DOE, the
17 utilities, EPRI, NRC, the vendors, where tremendous, probably
18 unprecedented in some ways, progress has been made in the timeframes that
19 we've come so far. So, I really want to give credit where credit is due, to
20 everyone who has been involved in this.

21 The benefits. We have run simulations, done studies and
22 analysis, to show that the concepts that are being deployed and that are being
23 tested in some of Pete's plants will very likely have an increase in safety.

1 Talking about increased coping time in a case of loss of cooling of maybe one
2 to two to maybe three hours, and that, at first, sounds short, but in those
3 situations, one, two, or three hours can make all the difference. It gives time
4 to deploy flex equipment, gives time to take compensated reactions.

5 And we've shown from analysis a reduction in CDF of the
6 order of 10 to 15 percent with no additional actions, and maybe an additional
7 10 to 15 with mitigating actions. So, my message would be there is safety
8 benefit in these early deployed technologies, even though we may at first
9 blush say one to two to three hours, that doesn't seem much.

10 Other benefits we're seeing: increased operational safety
11 margins by virtue of the fact of the materials being used. Potentially, the fuel
12 is more reliable due to greater debris resistance. And also, the fuel could be
13 fundamentally stronger to support more flexible operating strategies. So,
14 those are what we're seeing already, studying the concepts that are being
15 tested.

16 So, next slide, please.

17 But the challenge is deploying ATF will not be a low cost.
18 The current fuel is accepted as safe, and the widespread adoption of ATF will
19 need an economic driver. To put it simply, if there's no market, there won't
20 be supply for it. So, that really is the question which Pete teed up very well.
21 It is, if we believe the safety benefits are there, what can be done to bring an
22 economic driver to enable the safety benefits be realized?

23 So, next slide, please.

1 We have done some studies, working with our industry
2 partners, looking at the impact of higher burnup and higher enrichment,
3 utilizing the benefits of the ATF design, which all indications are will be
4 fundamentally stronger and more reliable when deployed. This shows the
5 benefit of looking at enrichment above 5 percent, maybe as high -- I believe
6 the numbers we're talking up to 5 to maybe 6, 7, 8 percent.

7 Better fuel utilization, getting the fuel cycle costs down due
8 to the improved reliability, reduces the reload cost, reduces the throughput of
9 fuel assemblies, gives longer cycle lives. And there are hundreds of millions,
10 if not billions, of dollars of fuel cycle savings the industry could realize if the
11 combination of high burnup and high enrichment with the ATF technology was
12 deployed. So, that is the opportunity I think we need to look at, as a group of
13 people collaborating on this effort, to see how we can bring the ATF fuels to
14 fruition.

15 So, next slide, please.

16 And the ultimate thing that does, that deploys accident
17 tolerant fuel with the safety benefits and the economic benefits which should
18 support the sustainability of the current fleet.

19 So, next slide, please.

20 What has EPRI done? Pete referred to the research we've
21 done to support the discussions. We've looked at those feasibility studies on
22 accident tolerant fuel, produced reports on the effectiveness of the coated
23 clads, and technologies like that. We've done economic analyses on the high

1 burnup, high enrichment, and documented those. And we've hosted many
2 technical workshops. So, this work has really informed the discussion.

3 And if we go to the next slide, please, again giving credit
4 where credit is due, our work has informed the NRC staff. And actually, our
5 work on coated clads supported the NRC Staff Guidance on Coated Clads,
6 which gave regulatory confidence to the vendors and the utilities to move
7 forward. So, again, this work has been a very strong collaboration across all
8 the stakeholders and shows all the hallmarks of being able to continue to
9 actually move this deployment further forward.

10 So, next slide, please.

11 This is a slide we showed last time I had the pleasure to brief
12 the Commission over the traditional means of studying fuel and deploying fuel.
13 It shows about 20 years to get the fuel in. And we were discussing last time
14 I was here the benefits of a parallel path to actually work these ideas and
15 concepts in parallel with the benefits of utilizing modeling and simulation
16 technologies that are now mature.

17 The progress to date shows that that approach has worked.
18 All the parties have collaborated together, and we've actually gotten to a
19 position where accident tolerant fuel technology is close to deployment. The
20 potential is there for this parallel path to work, working on high enrichment,
21 high burnup. And I would urge us all to look at what we can do to work in a
22 similar framework around high enrichment and high burnup.

23 Next slide, please.

1 And again, this is a slide I showed last time to show on one
2 picture what I'll call the early deployment fuel technologies, and then, the fact
3 of the later deployment fuel technologies. You'll see the later deployment fuel
4 technologies which have greater safety benefits, the bars are red. Those are
5 showing that the work and R&D and the gaps are greater in those
6 technologies. There are big benefits from going to the later deployment
7 technologies, but we should all remember that there's a lot more gaps to close,
8 a lot more work to be done to get what I'll call the ultimate prize which could
9 be realized from the later deployed options.

10 And my final slide, please.

11 So, in conclusion, the near-term ATF and high enrichment,
12 high burnup has safety and economic benefits. We still have to all work
13 together to actually do the research needed to enable that deployment. And
14 the benefit of the longer-term deployment of the more advanced technologies
15 will need us to continue to work beyond the mid-2020 timeframe we've talked
16 about to actually get the final prize of the biggest safety benefits.

17 Thank you.

18 CHAIRMAN SVINICKI: Thank you very much, Neil.

19 For the final presentation on this panel, the Commission will
20 hear from Dr. Ed Lyman, who is the Director of Nuclear Power Safety for the
21 Union of Concerned Scientists.

22 Ed, welcome or welcome back. Please proceed.

23 DR. LYMAN: Good morning. And once again, we

1 appreciate the opportunity to brief the Commission on this very important
2 topic.

3 So, may I have the second slide, please?

4 We heard from the previous speakers about that accident
5 tolerant fuel development, there are two potential sides to it. One is
6 improving safety and increasing safety margins, and the other is improving
7 reliability and economics for the industry.

8 As Mr. Griffith pointed out, the original Consolidated
9 Appropriations Act did only specify that this was for enhancing the safety of
10 light water reactors, but the industry has made it pretty clear that their priority,
11 to put it mildly, is improving their economic performance. And I provide the
12 quote from Mr. Holtzman from NEI that said, "There is no safety imperative for
13 why we're going to be implementing ATF." So, that concerns me.

14 Now the Nuclear Energy Innovation and Modernization Act,
15 NEIMA, has redefined, essentially, congressional authorization for what
16 accident tolerant fuel is, so that it covers both, but it's still unclear to us that
17 they can be realized at least at the same level. And I do appreciate Mr. Sena
18 saying they aren't mutually-exclusive, and I hope that's true.

19 Next slide, please.

20 So, we do believe the primary purpose and focus of ATF fuel
21 is to increase reactor safety margins, and since the taxpayers have been
22 funding some of this work through the Department of Energy, we think that
23 that's really the public's goal, rather than enhancing the industry's bottom line.

1 And our concern again, as I discussed two years ago, is we're worried the
2 NRC could undermine this goal if it undertakes measures that try to qualify
3 and deploy this fuel too quickly before the safety analysis has had a chance
4 to catch up.

5 So, if the licensing standards for enabling the program to go
6 forward continue to take shortcuts, we're concerned about that. If batch
7 loading is approved before obtaining and reviewing sufficient and
8 representative safety data, both under normal and accident conditions, has
9 been performed, there could be risks. And if credit for ATF for reducing safety
10 margins in other areas for the economic benefit of the industry is granted, it
11 could end up being a wash or even reducing safety.

12 Next slide, please.

13 So, I won't repeat these numbers, which we also heard from
14 EPRI just now, but you could look at these in different ways. These are
15 actually the safety benefits are fairly marginal so far in most cases. And I
16 would read from an EPRI document that was presented late last year where it
17 said, "It is noted that at the time these analyses were performed" -- that was
18 coping time studies -- "these results were considered surprising, as industry
19 expectations had been that ATF would be capable of extending these coping
20 times by much larger amounts." So, the benefits seem to be more modest
21 than originally anticipated, and that's fine, but one should also recognize that
22 maybe there isn't as urgent a driver to deploy them.

23 In addition to the studies that have done analytical work,

1 there are also issues associated with reduced safety or increased uncertainty
2 in the performance of some of these materials. For instance, as the Interim
3 Staff Guidance on Coated Fuel points out, if the clad coatings are delaminated
4 or if there are interactions between the clad and the substrate, those introduce
5 new mechanisms of concern. And also, if you're looking at more advanced
6 fuels other than uranium oxide, there's a breakaway oxidation of the silicides
7 and nitrides, which is the reason why Framatome is not pursuing alternatives
8 to uranium oxide fuel; they are only looking at new claddings in their own
9 program.

10 Next slide, please.

11 So, the economic benefits to industry I think still seem
12 unclear. It seems like there's been a bait and switch since this process
13 started, that originally the motivation was greater safety. And now, it's trying
14 to increase enrichment burnup for economic benefit. Again, that's okay, but
15 there has to be a documented safety case for that. And it's not clear, looking
16 at the numbers that NEI has generated, that the actual benefits are going to
17 be that significant on a per-reactor basis.

18 We also are concerned that the safety criteria may have to
19 be changed to enable some of these features to be credited. And in addition
20 to what I pointed out on the slide, EPRI has said you may have to go to a
21 cladding strength criterion to evaluate certain accidents instead of the current
22 minimum departure in nucleate boiling, because, otherwise, the benefits of
23 ATF wouldn't show up in the regulatory analysis.

1 NEI has also pointed out that, to get the full benefit of higher
2 enrichment and higher burnup, they may need more aggressive changes to
3 design limits to obtain that full benefit, including peaking factors/moderator
4 temperature coefficient shutdown margin as one. So, again, we are
5 concerned that the focus has to be on increasing safety margin. That's what
6 the public and taxpayers paid for, and any economic benefits to the industry
7 should be secondary.

8 Next slide, please.

9 So, in that context, what is the rush? We think the
10 timetable for batch loading of ATF by 2023 is unrealistic and may compromise
11 safety. The lack of any real specific and standardized testing requirements
12 raises questions. Traditionally, you would want to have at least some LTAs
13 in representative conditions in a reactor for the full campaign, the full number
14 of cycles and burnup that you're planning batch loading for. And in this case,
15 there's going to be an overlap between batch loading and LTA irradiation.
16 And again, that could be okay, but it would the NRC in a difficult position if
17 data suggested that the industry would have to pull the batch because the
18 data did not support safe irradiation for another cycle. And the industry, of
19 course, would have to pay or provide for alternative fuel for that cycle. That's
20 the risks on the industry, but the NRC should be wary of that.

21 And again, we think there should be pretty well-defined
22 standards for representative fuel irradiation to the burnup and, also, at the
23 enrichment that would be used for the batch campaign. So that fairly long

1 process, as we know, could take more than just a few years that we've already
2 had for LTA irradiation and PIE. And then, there's the issue of transient and
3 LOCA testing. And no one has mentioned the fact that the Halden Reactor
4 shutdown really disrupted the original timetable for LTA development, except
5 the schedules haven't seemed to change, and it's not clear that capability will
6 be adequately compensated for.

7 Next slide, please.

8 So, there are a couple of things the industry is also pushing
9 the NRC to do. The staff did not agree to do them in revising its Interim Staff
10 Guidance on the Coated Fuel. And we support the staff on those. We think
11 that the fuel integrity needs to remain a fundamental safety objective and, also,
12 that the NRC certainly should have the opportunity to review manufacturing
13 parameters for coated fuels because of the potential sensitivity of the fuel
14 performance to the way the coating is applied. So, we think that's perfectly
15 reasonable.

16 Next slide, please.

17 I brought this up two years ago, and the Commission still
18 has before it the 50.46(c) draft rule. And it would seem that approving that
19 rule would help to clarify and, in fact, enable the ATF vendors to get the credit
20 for the main benefit of, for instance, the coated cladding, which would be to
21 reduce oxidation and hydriding at high burnup. So, this would provide a
22 structured process, instead of having to go to exemptions for evaluating this
23 fuel. And we would urge you again to approve that rulemaking in a timely

1 fashion.

2 Next slide, please.

3 UCS was disappointed that the NRC staff followed through
4 with issuing its LTA reinterpretation that allowed for LTAs to be used or to be
5 deployed without necessarily seeking review and approval from the NRC or
6 applying for an exemption. There are a number of staff who objected to that
7 reinterpretation, and we stand by those comments.

8 So, we believe that licensing approaches for anything, but
9 also for accident tolerant fuel, should maximize opportunities for public input.
10 And that means favoring rulemakings and license amendment requests and
11 formal topical report reviews instead of more informal processes or things that
12 the public does not have any opportunity to actually participate in with regards
13 to the licensing process.

14 And with that, I'll stop, and I apologize again for exceeding
15 my time.

16 CHAIRMAN SVINICKI: Thank you very much. Dr. Lyman.
17 And thank you to all the panelists for their presentations.

18 We will begin the questions today with Commissioner
19 Caputo.

20 Good morning.

21 COMMISSIONER CAPUTO: Good morning.

22 Thank you all for coming.

23 Mr. Sena, the scope of work needed to support the

1 industry's goal of batch loading in 2023 is substantial. What activities do you
2 think have a potential to delay achieving that goal?

3 MR. SENA: Well, to me, we have the testing regimen
4 already established. We have alignment between the industry and the staff
5 on the ISG topical reports. To me, it's the predictability of the regulatory
6 process. So, I think the technology is there. It's really about can we jump
7 through all the hurdles, all right, and not just on the regulatory process, but on
8 the fuel manufacturing, too. There needs to be that certainty from the fuel
9 manufacturers that they have customers. For the customers to be there, we
10 need to see the regulatory process with predictability.

11 COMMISSIONER CAPUTO: So, is that a matter of making
12 sure that there's a timely review of the topical reports, so the industry can file
13 license amendments to allow batch loading?

14 MR. SENA: Correct. Correct. Because we're looking at
15 2025.

16 COMMISSIONER CAPUTO: So, there's a little bit of a
17 chicken and egg there with you folks filing license amendments on the utility
18 side and fuel vendors making investments to proceed --

19 MR. SENA: Correct.

20 COMMISSIONER CAPUTO: Okay. And how long do you
21 expect or have we said how long we anticipate review of those license
22 amendments to take?

23 MR. SENA: I'll give that to you. What's the timeline?

1 Twelve to 24 months on the topical.

2 COMMISSIONER CAPUTO: Okay. Okay. I'm trying to
3 think through. I know there's a timeline for --

4 MR. SENA: So, if we're looking at topical by the end of
5 2020 --

6 COMMISSIONER CAPUTO: Right.

7 MR. SENA: -- then review completion, at the latest, the end
8 of 2023, which, then, allows for the license amendments.

9 COMMISSIONER CAPUTO: But it feels like the facilities
10 will need to be filing amendments to modify their plants --

11 MR. SENA: Yes.

12 COMMISSIONER CAPUTO: -- prior to that?

13 MR. SENA: That's correct. This is not an easy process,
14 to be clear, and it is multifaceted. And the more predictability we have in the
15 regulatory process, I think the more predictability we can have between the
16 licensees and the fuel vendors.

17 COMMISSIONER CAPUTO: Okay. So, obviously --

18 MR. SENA: I would like to say it's A plus B equals C, but I
19 think this is more of calculus.

20 COMMISSIONER CAPUTO: That things are proceeding in
21 parallel. And obviously, this becomes, with topical reports being one of the
22 first points, it's incredibly important that the vendors are turning in high-quality
23 topical reports.

1 MR. SENA: And that's on us, correct.

2 COMMISSIONER CAPUTO: Okay. Mr. Wilmshurst, from
3 what you know of our research efforts here at the NRC for near-term ATF
4 technologies, do you believe our research efforts are sufficient and proceeding
5 at a pace to support these licensing reviews with a goal of batch loading in
6 2023?

7 MR. WILMSHURST: I don't have the up-close information.
8 I'm going to call Al Csontos, please, if you're in the room, to answer that.

9 CHAIRMAN SVINICKI: I'm sorry, could you introduce
10 yourself and your organization?

11 MR. CSONTOS: Al Csontos, EPRI.

12 CHAIRMAN SVINICKI: Thank you.

13 MR. CSONTOS: And so, the answer is yes, with caveats,
14 just to watch what's being done with the project plan that NRC has created.
15 We've looked at that. We reviewed it, everybody in industry as well as EPRI,
16 and also, with the ISG. We feel confident that we have a path forward here.
17 But it's just what happens downstream. As more information comes in, are
18 there new items that come up? But, yes, we are aligned.

19 COMMISSIONER CAPUTO: Mr. Griffith, and perhaps Mr.
20 Sena, but I'll start with Mr. Griffith. So, you listed a number of test and
21 examination facilities available at National Labs. I know Mr. Sena mentioned
22 that the first LTAs are out of Hatch. As far as the rest of the LTAs go, where
23 and when do you anticipate doing the test and examination of those lead test

1 assemblies?

2 MR. GRIFFITH: While Mr. Sena corrected me in saying
3 that the first one was going to Oak Ridge National Laboratory, not Idaho, the
4 long-term plan does include our facilities at Idaho. We have compliance
5 challenges that we need to address there that should be addressed by the
6 end of this calendar year or early into the next calendar year.

7 COMMISSIONER CAPUTO: What do you mean
8 "compliance challenges"?

9 MR. GRIFFITH: So, there is a facility, an integrated waste
10 treatment unit, that needs to process a certain amount of waste before we are
11 allowed to bring in spent nuclear fuel into the Idaho site as part of our
12 compliance agreement with them.

13 COMMISSIONER CAPUTO: Okay.

14 MR. GRIFFITH: Once that is satisfied, we will have an
15 opportunity to bring a range of other follow-on experiments or lead test
16 assemblies into Idaho for post-irradiation examination.

17 COMMISSIONER CAPUTO: Okay. As a follow-on
18 question, my recollection is there were challenges associated with getting lead
19 test assemblies shipped to the plants because of lack of canisters. Now
20 we're going to be talking about canisters they're shipping irradiated lead test
21 assemblies. Do we have canisters available, certified for this?

22 MR. GRIFFITH: There are truck-qualified shipping
23 containers available. It's a matter of lining up the schedules.

1 MR. SENA: Yes, we don't see an issue on shipping any of
2 the test assemblies for the first one going out from Hatch this coming fall.

3 COMMISSIONER CAPUTO: Okay. So, we have
4 approved shipping containers for irradiated --

5 MR. SENA: That is correct.

6 COMMISSIONER CAPUTO: Okay. Mr. Sena, Dr. Lyman
7 stated in his slides that NEI has requested that the NRC weaken deterministic
8 standards for ensuring fuel and cladding integrity. I believe this is a reflection
9 on a public meeting that was held at one point. Would you please provide
10 some additional clarity regarding NEI's comment that he might be referring to?

11 MR. SENA: Certainly. If I can just provide some color, I
12 grew up on Long Island and I was within 10 miles of the Shoreham EPZ,
13 Wading River School District. So, in the seventies, I recall all the angst about
14 Shoreham being licensed. And in the end, LILCO lost the public trust of
15 Suffolk County. And to me, that was the death knell of that plant.

16 And as I operate Vogtle, Farley, and Hatch, I look at those
17 as my plants, my people, my local community. And I'm not going to put my
18 plant, my people, my local communities in jeopardy in Augusta, Georgia;
19 Vidalia, Georgia, or Dothan, Alabama. So, we, the industry, are not
20 advocating regulatory shortcuts or weakening of standards. We're looking for
21 regulatory predictability and efficiency. This is not the 1970s.

22 COMMISSIONER CAPUTO: Okay. One last quick
23 question for Mr. Wilmshurst. Just a little bit of a clarification. You mentioned

1 flexible operation and operation flexibility. What exactly is that a reference
2 to? And, Mr. Sena, chime-in, if you choose to. I'm guessing maybe load
3 following. Are there other aspects, though?

4 MR. WILMSHURST: That's really it. Load following and
5 some of the transients that may be predicted at the fuel could be more
6 sustainable with the increased strength of the new clad material. So, it's
7 really with reference to the flexible operation.

8 COMMISSIONER CAPUTO: Okay. That's all I have.
9 Thank you.

10 CHAIRMAN SVINICKI: Thank you very much.

11 Next, we'll hear from Commissioner Wright. Please
12 proceed.

13 COMMISSIONER WRIGHT: Thank you.

14 So, first of all, thank you all for being here today.

15 A couple of weeks ago, I was in Knoxville at the Advanced
16 Reactor Summit and it was quite impressive. There is a great collaboration
17 going on with people, government, you know, academia. They were all there
18 and fully participating. So, that was good to see.

19 And since you're our guest from another agency, Mr. Griffith,
20 I'm going to start with you. My understanding is that DOE is also supporting
21 the deployment of high-assay LEU fuel for advanced reactors. How, if at all,
22 do the two efforts, ours and yours, inform each other? And can you provide
23 me maybe some examples of where the two intersect or overlap?

1 MR. GRIFFITH: That's a good question. I think there's a
2 lot of synergy between the two programs, especially with our potential for
3 deploying advanced reactors into the future with high-assay low-enriched
4 uranium. In the near term, the accident tolerant fuel provides an opportunity
5 to touch all those regulatory, technical, logistical steps for considering greater
6 than 5 percent enrichment both in fresh fuel and in spent fuel, transportation
7 and the fuel supply chain, if you will.

8 So, I know the one enrichment operation in the U.S. that's
9 operating, that they have plans. I believe they've already engaged with NRC
10 formally to increase their enrichment capability there in order to meet the
11 expected demand for accident tolerant fuel. Beyond that, it gets into closer
12 to 19.7 percent enrichment for the future. And so, I think in the near term,
13 exercising the process will pave the way for addressing the longer term.

14 COMMISSIONER WRIGHT: So, thank you for that.

15 It was recently announce, also, that DOE's Office of Nuclear
16 Energy was funding a collaboration between Framatome and General Atomics
17 to develop nuclear reactor channel boxes for BWRs using the silicone carbide
18 composite. So, given that this technology was originally developed for
19 advanced reactors, but is being applied for fuel design for the current fleet, do
20 you see other future opportunities for your office to get involved in funding and
21 development in this area?

22 MR. GRIFFITH: I do. I think, both from a fuel perspective
23 as well as the structural aspects of extending the lifetime of the existing fleet,

1 it presents a range of opportunities.

2 COMMISSIONER WRIGHT: Thank you.

3 Mr. Sena, how are you this morning?

4 MR. SENA: Good.

5 COMMISSIONER WRIGHT: So, you're the one licensee at
6 the table. And I'm curious about your view on other potential licensing
7 impacts that the panel hasn't discussed. The staff identified in its draft Fuel
8 Burnup and Enrichment Extension Preparation Strategy that there could be
9 an impact on the staff's environmental review, specifically, with continued use
10 of the generic basis presented in the guides for license renewal.

11 So, have you engaged the staff on what those impacts might
12 be? And I guess, if so, can you share how that might factor into your
13 decisionmaking going forward for deploying?

14 MR. SENA: Yes. I'm going to have to -- John, let me
15 defer.

16 MR. WILLIAMS: Sure.

17 MR. SENA: John Williams is my Director of Nuclear Fuels.
18 Let me just defer to John.

19 MR. WILLIAMS: Good morning.

20 My name is John Williams. I'm the Director of Nuclear Fuel
21 and Analysis at Southern Company.

22 So, yes, we have engaged the staff and we had a public
23 meeting about the generic exemption. And I think, right now, the industry and

1 the staff are aligned that that can continue forward. And we're in dialog
2 with -- we would be open to any conversation with the regulator, if that
3 changes. But, at this time, we believe it's appropriate.

4 COMMISSIONER WRIGHT: Okay. All right. Thank you.

5 Also, Mr. Sena, one of the things that we've heard from NEI
6 before is that there should be a larger role in modeling and simulation. I know
7 we're going to hear more on the second panel about this, too, on their
8 approach. Can you share maybe how the industry is using modeling and
9 simulation to expedite the licensing process and what efficiencies, if any, have
10 been gained?

11 MR. SENA: And again, I'll have to defer to John, my
12 nuclear engineer.

13 MR. WILLIAMS: So, really, the intent of the modeling and
14 simulation is to inform our tests. As you know, we're working on an
15 accelerated timeline, and therefore, it's going to be critical that the tests that
16 we perform get us the answers that we need. And so, the purpose of the
17 modeling and simulation is really to give us where do we need testing and
18 make sure that that's very informative and very focused.

19 COMMISSIONER WRIGHT: All right. Thank you.

20 I'm coming again.

21 (Laughter.)

22 MR. SENA: All right. Don't sit down.

23 (Laughter.)

1 COMMISSIONER WRIGHT: So, Southern Company has
2 been on the leading edge as far as accident tolerant fuel with Hatch installing
3 IronClad and ARMOR lead test rods, and Vogtle-2, installing the world's first
4 complete. So, I have a couple of questions concerning that.

5 Having been the first and involved in this process the
6 longest, are there any insights that you would share for future licensees?

7 See, I told you.

8 (Laughter.)

9 MR. WILLIAMS: I think we are encouraging our peer
10 utilities to pursue ATF. I think that some of the things we've learned being
11 first, you know, we did have some shipping concerns with the Hatch LTAs.
12 And so, I think the learnings that we have had is to, one, engage with the staff
13 early and often, make sure they are aware of what you're pursuing and what
14 your plans are, so that we can both be aware of the concerns and address
15 those in a timely fashion.

16 COMMISSIONER WRIGHT: Okay. And don't go
17 anywhere. We might need you again.

18 So, the last question that I have would be, for you, whether
19 the NRC's clarifying guidance on lead test assemblies, which was issued last
20 year, increased predictability on the licensing process? And are there areas
21 where maybe further clarification would be helpful?

22 MR. SENA: You're doing well.

23 (Laughter.)

1 MR. WILLIAMS: I'm happy to help, Pete.

2 So, yes, we do believe that did provide the clarity that was
3 very helpful for the LTAs. With respect to other licensing areas where they
4 would be helpful, rulemaking around 50.68. If that were to proceed and were
5 initiated by the staff, that would be very, very helpful because we do see that
6 as a challenge for us.

7 COMMISSIONER WRIGHT: Okay. Thank you. You did
8 a good job. Pete's hired the right people.

9 (Laughter.)

10 Mr. Wilmshurst, with the time I have left here, my final
11 question is going to be: so, my understanding is that EPRI has developed a
12 series of reports that highlight the safety benefits of ATFs. So, today, I think
13 you implied that EPRI has also considered maybe the economic cost of ATF.
14 So, this question has maybe three parts to it. Has EPRI also considered the
15 potential downsides of ATF, other than perhaps cost? And if so, do you plan
16 to issue reports on the topics or revise existing reports? And then, the last
17 part of that would be, are there any downsides that would affect the NRC's
18 review of ATF?

19 MR. WILMSHURST: Very good questions, which I'm going
20 to refer to Mr. Csontos, please.

21 So, Al, if you could go to the podium, please.

22 (Laughter.)

23 MR. CSONTOS: Al Csontos, EPRI.

1 Yes, there are some downsides. Neutronics penalty is one
2 of them, which it can be a cost-inhibitor to adoption. Okay? And to the
3 second part of your question, as research evolves, as we get more information
4 from the LTAs and other things, you know, things may pop up that we may
5 need to go follow up with. So, that's kind of what I was saying earlier, is that,
6 as we follow up with these PIE examinations, post-irradiation examinations,
7 other data collection efforts that we get from lead test assembly testing, there
8 may be things that we have to go and follow up. And that's just something
9 that typically happens with product development.

10 COMMISSIONER WRIGHT: Sure. Thank you very
11 much. I yield back.

12 CHAIRMAN SVINICKI: Thank you very much.

13 I have a few questions for the panel. Perhaps I'll begin with
14 you, Mr. Griffith, although other panelists may have a view on this. I had a
15 note here about Halden. Of course, Dr. Lyman mentioned it specifically. But
16 I think many of us expected Halden to be operating for a number of years. It
17 is only one part of the infrastructure that supports this type of work, and I know
18 that DOE is seeking Congress' support for the versatile test reactor and other
19 items in their budget, so that there is at least some requested effort to enhance
20 the R&D infrastructure in the United States to do this type of work.

21 Can you talk at all about kind of some of the atrophy over
22 the last 10 or 15 years in the laboratory and R&D infrastructure for doing
23 nuclear work of this kind and how you see Halden's closure kind of playing

1 into that? And then, maybe measures that the National Labs and DOE have
2 on the horizon to address it? Do you still think that getting to batch loads in
3 2023, I think, is possible with Halden's demise?

4 MR. GRIFFITH: Yes, I think it is. We are working to
5 incorporate some of those test capabilities that were lost when Halden shut
6 down into our programs in the Department of Energy. Specifically, transient
7 testing at the TREAT facility is in the works.

8 There is key testing capability that we need to use the
9 advanced test reactor for, which will require some adjustments to that reactor
10 during a critical phase in its maintenance cycle, if you will. In 2021, we have
11 a core internals changeout scheduled, which is just a routine replacement of
12 the structural components in the advanced test reactor that received high dose
13 over its lifetime. Those components are replaced, and that presents a
14 window for us to incorporate some important test capabilities that would
15 replace the Halden capabilities, if you will. And the key component there is
16 the top head plate on the pressure head which will enable some experimental
17 loop to be incorporated in its capabilities. So, we're working hard to
18 incorporate that.

19 The advanced test reactor is an absolute vital capability that
20 the Navy relies on. And so, we are doing appropriate diligence to make sure
21 those capabilities don't interfere or impact the Navy data collection process.

22 CHAIRMAN SVINICKI: Well, thank you for that. And I
23 know, obviously, from my time in Idaho, that ATR has been an absolute

1 workhorse for the United States for a long period of time. But there is
2 important other national security work to be done there which cannot be
3 displaced. So, thank you for that, and I know that those efforts could probably
4 consume their own meeting and it's a substantial, ongoing focus for DOE and
5 for the entire nuclear enterprise.

6 Neil's slides don't appear to be numbered, but he had this
7 slide he had presented previously and it has kind of the old model and the new
8 model, and the old model took 20 years. But I know ever since Secretary
9 Rumsfeld used the phrase, it's kind of overused, with the "unknown
10 unknowns". But, you know, what you got in that old system took a long time,
11 but you had a lot of data and testing that you did. And you had a lot of
12 knowledge before you -- excuse my language -- potentially fouled up a really
13 expensive asset like a power reactor with something that could have unknown
14 unknowns. Ed was kind enough not to use that phrase, but other behavioral
15 degradation that could possibly emerge. I mean, it's a big thing to foul up a
16 reactor. Again, those are not insignificant assets.

17 So, I guess my question is, you know, knowing that -- I'll pick
18 on Pete -- those are your assets, you've talked about them and, you know,
19 you view them as yours. So, you don't want to put something in there that
20 you're not sure about. How are you balancing those uncertainties as an
21 industry operator?

22 MR. SENA: Well, it comes down to they are a billion-dollar
23 asset. So, that's why we're asking, you know, not just from EPRI and

1 research, but from the regulator, you know, strong reviews.

2 CHAIRMAN SVINICKI: Yes, but we won't know the
3 "unknown unknowns," either.

4 MR. SENA: Yes. Right. So, how much do you need to
5 know? And it's all about the modeling, the capabilities that we have today.
6 Are they sufficient? What's the level of reasonable assurance that we all
7 need together? You need it; I need it. And so, collectively, it is a very good
8 question. I can't give you a generic answer that this is good enough. So,
9 we have to be sure, and that goes back to the industry will not advocate any
10 type of regulatory shortcuts. But, again, what do we know today from the
11 lessons learned from the seventies, from that 20-year process, and what can
12 we apply today? Just because we did it in the past doesn't make it right for
13 the future, either.

14 CHAIRMAN SVINICKI: Well, and as your presentation and
15 others acknowledged, though, I call it kind of the continuum of exotic. You
16 know, in accident tolerant fuels there are things that push the boundary of our
17 current knowledge and experience less than other things. And the "other
18 things," as some of your presentations seem to indicate, some of the more
19 exotic things on the higher end of the exotic continuum, in theory, based on
20 the kind of computations and calculations, may actually yield you the
21 increased robustness/kind of safety margin/enhanced coping times, and
22 things like that, but also might help you with your economics.

23 So, that's an "unknown unknown" for our staff. And I guess

1 I just want to put that out there, so it's appreciated, the difficulty. It's not just
2 resistance for the regulators. It is, okay, we used to be able to have access
3 to this amount of data. And I take the argument, first of all, that something
4 shouldn't take 20 years. I mean, I'm not crazy. But, second of all, that
5 doesn't mean we needed all that. It just means that we're accustomed to
6 having all of that and the certainty or enhanced certainty that that can create
7 for us.

8 So, our difficult thing is we've got to navigate how much of
9 that might be extra and might not be needed. So, just appreciate that it isn't
10 just a failure to want to be open to new things. It's complicated for regulators,
11 just like it's complicated for you not wanting to foul up a really, really expensive
12 machine. So, together, we've got to navigate that, and it sounds like we are
13 having the right discussions.

14 I think there's also this philosophical undercurrent. While
15 interesting, I don't know that I should take a lot of our time with it. But this
16 program, as I think every panelist recognized, had its origins in Fukushima,
17 but something can have its catalyst in something like that, but that doesn't
18 mean that, as it moves forward, it becomes still centrally about having fuel that
19 is more robust and safer.

20 And let me be clear. My view is, if the regulator views the
21 current fuel as safe, which we obviously do because it's being used at reactors
22 across the country, if we're not going to mandate something, then a whole set
23 of other inducements have to come into play. It has to be, you know,

1 something that demonstrates its value in the marketplace.

2 I guess a curious philosophical question is, if you could have
3 this fuel of enhanced safety, which is such a hard thing for me to say as an
4 engineer because it's not really defined, but if it were more robust and gave
5 you the increased coping times, and it cost the same as the fuel you have
6 now -- this is completely theoretical -- I assume you would do it because it
7 would be better fuel if it had enhanced coping times and was safer.

8 So, I do think that there is some peril in keeping on talking
9 about this as it has to improve economics. I mean, the truth is, if it were the
10 same cost and it allowed you the increased coping times, I think you would
11 still purchase it. I guess I shouldn't answer for you.

12 MR. SENA: No, well, that goes back to just the operating
13 philosophy of the U.S. nuclear reactor fleet. So, if there's always opportunity
14 to improve safety margins, we do it. And if we have an opportunity to deploy
15 the accident tolerant fuel just to improve safety margin, but at no increased
16 cost, we would do it. As a regulated utility, I have a prudence review with my
17 Public Utility Commission. And so, I would have to present to them the --

18 CHAIRMAN SVINICKI: And again, yes, I mean, if we don't
19 mandate it, then it has to be something that you freely elect to do. I will say,
20 though, that it would seem to me, just on basic kind of thermal and radiological
21 phenomenology for materials -- and I'm not a materials scientist, but this isn't
22 a complicated thing I'm about to say -- we begin to challenge the materials
23 when we go to the higher burnups. And I understand that drives the

1 economics.

2 But I'll go back to my kind of speaking for the NRC staff,
3 which I also shouldn't do -- and they'll have an opportunity shortly to speak for
4 themselves -- but their difficulty is they're being asked to yield a little bit on
5 margin to make it something that you all would want to deploy and have a
6 reason to deploy, because we have not found a basis to require it. So, we're
7 not making the industry have different fuel than it has now.

8 So, that's a part of the balancing of factors and the tug of
9 war, and kind of accepting risk and yielding on safety margins that the NRC
10 staff has to do, to find the sweet spot of a review that doesn't take 20 years of
11 an amount of physical or testing data that is not as much as they used to have.
12 So, this is really, like you said, it's not A plus B equals, you know, C. It is a
13 multivariable equation. We have different coefficients than you do.

14 MR. SENA: Uh-hum.

15 CHAIRMAN SVINICKI: And we will each arrive at these
16 decisions differently, but I do think that fuel is like anything else, and there's
17 opportunity for innovation, based on the U.S. operating this many reactors for
18 this long. I do think that a 20-year approval process has an artificial locking-
19 in in time of the types of fuels we use now, and that there is a possibility to
20 have better fuel and more economic fuel. I think they can coexist. I guess
21 that would be my answer to Dr. Lyman's question.

22 But how and what it looks like, and how much the economics
23 drive the question versus the improved safety are something that NRC is going

1 to have to keep front of mind, and that we don't ultimately yield so much safety
2 margin in a qualification of a new fuel, whatever you want to call it, accident
3 tolerant or not, that we actually end up with kind of less safety rigor around
4 fuel than we had. That would be, in my mind, a very, very odd outcome from
5 Fukushima.

6 So, that's all I'll say about that, and I'll turn it over to
7 Commissioner Baran.

8 COMMISSIONER BARAN: Thanks.

9 Well, thank you all for being here and for what's been a good
10 discussion.

11 I want to start -- and there's been a lot of focus on the
12 timelines of how this all plays out -- and I wanted to get a little bit of clarity
13 about that. My understanding had been that the industry goal was to do batch
14 loading in 2023. There's also been some talk today about mid-2020s, like
15 2025, for batch loading of higher burnup, higher enriched fuel, the ATF.

16 Are those two separate targets? Are these the same
17 target? Are you envisioning that someone is going to batch load, I'll call it
18 regular, you know, non-higher burnup, non-higher enrichment ATF, hopefully,
19 by 2023, that being the goal? Or are folks thinking of skipping directly to the
20 higher burnup, higher enrichment --

21 MR. SENA: No, again, I'm speaking mainly mid-2020s.
22 So, '23, '24, '25, that's all the same window. Just recognizing in the timeline
23 that topical reports will be submitted by year end, and then, it's a 12-to-24-

1 month process for the review and approval by the regulator. And at the same
2 time, you have the industry and the fuel vendors working together. If we have
3 that regulatory certainty that the topicals will be submitted, then we can start
4 making the contracts with the fuel vendors because they have to modify their
5 facilities.

6 COMMISSIONER BARAN: Okay.

7 MR. SENA: So, it's just there is so much interplay.

8 COMMISSIONER BARAN: Right, exactly.

9 MR. SENA: I would like to tell you that January 1, 2023 is
10 a certainty, but just because of the unknowns and the interplay, it's going to
11 be the mid-2020s for the deployment of ATF with higher enrichment and
12 higher burnup.

13 COMMISSIONER BARAN: And you think that's the first
14 deployment?

15 MR. SENA: The first deployment.

16 COMMISSIONER BARAN: There isn't an earlier regular
17 ATF deployment?

18 MR. SENA: No.

19 COMMISSIONER BARAN: That's the first point. Okay.
20 And that kind of goes to the question, I mean, when the NRC staff looked at
21 this, you know, if you look at the project plan, I think they see the critical path
22 as being the irradiated testing necessary to fully understand and characterize
23 how an ATF design acts under different conditions and the modeling of those

1 characteristics.

2 And what I'm trying to get a sense of is, do we think -- and
3 2025, that's an extra couple of years compared to 2023 -- but do we think
4 there is going to be enough time for that. When AI was talking, he was
5 mentioning, well, you know, we have lead test assemblies in there and you
6 can get unexpected results from that and that could create additional work or
7 efforts. I mean, if the target is 2023, 2024, 2025, does this require like
8 everything going perfect on the experimental testing side? Is this the kind of
9 best-case scenario for all that work that needs to be done? Or we think it's
10 more straightforward than that?

11 Here comes AI.

12 MR. WILMSHURST: I'm going to ask AI to take that one.

13 I think, to tee up, I believe in research you don't know what's
14 going to happen. There are always going to be uncertainties. There is a
15 high level of understanding of some of these variables, which gives a level of
16 confidence that those timeframes are achievable. But, AI, add some color to
17 that.

18 MR. CSONTOS: So, there are what we call single effects
19 testing and, then, integral tests. Okay? And LTA is integral to a reactor, to
20 a certain burnup rate or burnup, you know. And in that way, the vendors have
21 done a lot of testing, and they've done it in their labs and they've done
22 irradiations at MITR and other facilities around the world. Okay? So, there
23 is some data that they have.

1 And we have a good belief in certain things, and before it
2 goes into a commercial reactor, there's a strong behavioral analysis that is
3 being developed through DOE's work, through the vendors' work, through our
4 work. And it goes to a place where there's a belief in a safety, you know, that
5 this is safe to put into a reactor.

6 The questions are, are there other unknowns, "unknown
7 unknowns," or "known unknowns," that occur after so much of a burnup or
8 after so much irradiations? And that is where we have to build that
9 knowledge level up. And so, that's where the road may divert and we have
10 to do additional research. Maybe it's making the coatings larger or thicker,
11 things along these lines that can be done/fixed through either additional
12 research or additional manufacturing changes. So, there's a lot of
13 opportunities here to optimize as we go forward.

14 It took us a long time, it took us 40 to 50 years to optimize
15 Zirc UO₂. Okay? That came through operational data development and,
16 also, research. So, the combination of both as a function of time and
17 irradiations will get us there. It's just it's going to take us -- and so, there's an
18 iterative approach to this.

19 COMMISSIONER BARAN: You might as well just stay
20 there, Al.

21 When we last had a Commission meeting just focused
22 completely on accident tolerant fuel, I think that was April of 2018. And at
23 that time, there really wasn't this focus, I don't think, on the higher burnup, high

1 enrichment. That seems like it's been kind of a fairly late-breaking
2 development in the last year or two. How much does that complicate the kind
3 of experimental side of this, to get the data you would need to make a schedule
4 feasible for the mid-2020s?

5 MR. CSONTOS: It is a challenge, especially with the
6 Halden shutdown, but there are activities and we're working, my colleagues
7 and I are working on plans of how do we pull this in. We did discuss higher
8 enrichment on that slide that has what we call "the Christmas tree" chart, that
9 red, green, yellow. We identified higher enrichment as a possibility because,
10 then, you get more economic driver to the ATF deployments back in 2018.
11 And we talked about it in our reports as well.

12 But the focus has been that we now believe we can -- you
13 know, some of the data coming out of the testing and the results that have
14 come out of the LTAs and other things, we're seeing a lot more benefits of the
15 ATF to, then, further support the higher burnup, the high enrichment. And so
16 now that we've seen that, it seems like it's much more doable. And so now,
17 it's become much more of an opportunity to get us safety benefits, but also
18 allowing the vendors and utilities to have the economic drivers to introduce
19 something that's safer.

20 COMMISSIONER BARAN: Okay. Thank you.

21 Pete, you mentioned there are a lot of moving parts here.

22 MR. SENA: Uh-hum.

23 COMMISSIONER BARAN: This is not intended as a pun,

1 but one of those is transportation packages. And if we talk not about lead
2 test assemblies for a minute, but if we're thinking more about batch loading
3 full core, you know, the new fuels are likely going to need new transportation
4 packages, both for the fresh fuel before it goes into a reactor and, then,
5 afterwards for spent fuel, after it's been irradiated. I guess it's particularly true
6 for the higher burnup fuels, for higher enrichment levels beyond 5 percent.
7 What's the status of efforts to develop and, then, seek NRC approval for those
8 transportation packages?

9 MR. WILLIAMS: So, that's a big focus for the Licensing
10 and Safety Benefits Task Force for 2020. There really is one package that
11 we believe will be the most critical, and that is the UF-6 package to transport
12 the enriched material from the enrichment plant to the fabrication plant. So,
13 the package we use today is a 30(b). And so, work needs to be done on that
14 package to license it to carry greater than 5 weight percent enrichment. So,
15 we believe that's the critical one.

16 And I don't want to speak too much for the vendors, but I
17 would say that the initial efforts that they've shared with that Task Force is that
18 they do not see significant hurdles with respect to their fabricated fuel new
19 packages.

20 COMMISSIONER BARAN: Okay. Is that true on the back
21 end, too? I mean, I know now we're talking several years in the future. But,
22 after you had a full core that had been irradiated, do we have -- my sense is
23 we don't have transportation packages now that are certified for that,

1 especially if it's higher burnup, high enrichment.

2 MR. WILLIAMS: That's right. So, the big focus on the
3 back end is around dry storage.

4 COMMISSIONER BARAN: Okay.

5 MR. WHITMAN: And so, EPRI hosted a meeting --

6 COMMISSIONER BARAN: That would be dry casks that
7 certify --

8 MR. WILLIAMS: That's right.

9 COMMISSIONER BARAN: Okay.

10 MR. WILLIAMS: It's to begin the development of the
11 storage packages for these fuels.

12 COMMISSIONER BARAN: Okay. All right. So, that's
13 underway, but that's down the road a bit, it sounds like?

14 MR. WILLIAMS: That's correct.

15 COMMISSIONER BARAN: Okay. Thank you.

16 In terms of the question about improved plant economics
17 that I think both Pete and Neil had slides talking about that, do you see the
18 main economic driver for ATF -- the economic driver, the main economic
19 driver -- being the ability to move PWRs to a 24-month refueling cycle? Is
20 that what you see as kind of the thing that delivers the biggest --

21 MR. SENA: Yes, that's correct. So, just about every U.S.
22 boiling water reactor, I think, except one, is on a 24-month cycle. This would,
23 then, afford the opportunity for the large four-loop PWRs to move to that 24-

1 month cycle as well.

2 COMMISSIONER BARAN: And you think that's where you
3 get the real bang for your buck with that?

4 MR. SENA: Yes.

5 COMMISSIONER BARAN: And then, I just had one other
6 question, which really isn't a 51-second kind of question, but I'll just ask it
7 anyway and get any thoughts you have. The NRC staff I think is leaning
8 pretty heavily on expert elicitation for phenomena identification. It's the PIRT
9 process. We didn't talk about it too much on the first panel, but I think the
10 staff will talk about it a little more on the second panel. For new concepts and
11 technologies that may differ significantly from fuels currently used, how do we
12 make sure that the PIRT process is capturing all of the relevant safety-
13 significant issues?

14 I guess this goes a little bit to the point the Chairman was
15 making about the "unknown unknowns". I think you could have really brilliant
16 people sitting around and looking at the literature and trying to think through
17 what are the phenomena we should be thinking about. But how do we make
18 sure we're not going to miss something vital in that process? Any thoughts
19 on that? In seven seconds?

20 (Laughter.)

21 MR. WILMSHURST: Answering it cold a little bit, I think
22 what I see is this fairly unique and open collaboration between all the
23 stakeholders coming together. You have DOE, the utilities, EPRI, the NRC

1 staff, all coming together and having these open dialogs around what their
2 concerns are. And from what I've observed from the outside looking in, this
3 is actually doing a great job of bubbling up just those issues, just those
4 concerns, and getting people aligned around what needs to be done.

5 MR. SENA: Yes, I would agree. I think it's that upfront
6 alignment and communication as opposed to the industry, DOE, the research
7 being done in a vacuum, and then, forwarding all the information to the
8 regulator for their review. And then, you all go, okay, what about X, Y, or Z?
9 But if we can do it in parallel and all the questions be answered upfront, I think
10 that's where the efficiencies are gained.

11 COMMISSIONER BARAN: Thanks.

12 MR. GRIFFITH: And I'd just add, that's kind of what we
13 were founded on, this kind of open challenging ourselves, as well as
14 welcoming the NRC staff to challenge us as we go. The universities and
15 international participants have also challenged us. So, I think it's been
16 healthy.

17 MR. SENA: Yes, I think fundamentally we want to get it
18 right and we want to make sure you get it right, too.

19 COMMISSIONER BARAN: Okay. Thanks.

20 Any final reflections?

21 MR. LYMAN: Yes, if you don't mind. So, yes, humans are
22 fallible. Obviously, that PIRT process has to be informed by confirmatory
23 data. And so, I would again stress that there are unknowns. Historically,

1 you can see that things crop up in fuel behavior that are surprises, and that's
2 why I would again urge you not to take too many shortcuts. Maybe 20 years
3 is excessive, but not to shorten this timeline too significantly and potentially
4 miss safety-significant factors that could imperil the batch or full core loading.

5 For instance, in the example you just discussed, it
6 seems -- maybe I'm wrong -- but the LTA data that's been collected so far is
7 not on high enriched, you know, high enrichment fuel. And so, it seems like
8 there is a gap that's developed between the current data they've collected and
9 the batch loading they're saying could be as early as 2023. So, it seems, if
10 that's the case, there needs to be a gap analysis to see if there aren't any
11 phenomena that are being missed in at least the early stages of irradiation of
12 these high enrichment fuels.

13 COMMISSIONER BARAN: Thank you.

14 CHAIRMAN SVINICKI: Well, thank you again to my
15 colleagues and to all the panelists.

16 We will take a break now, a seven-minute break, but we will
17 reconvene sharply at 10:30.

18 Thank you.

19 (Whereupon, the above-entitled matter went off the record
20 at 10:23 a.m. and went back on the record at 10:32 a.m.)

21 CHAIRMAN SVINICKI: Thank you, everyone, the meeting
22 will recommence now with the NRC staff panel, and we will be led off today
23 by Dan Dorman, the Deputy Executive Director for Reactor and Preparedness

1 Programs, who is substituting for our Executive Director today.

2 Dan, thank you very much and please proceed.

3 MR. DORMAN: Thank you, Chairman. Good morning,
4 Chairman and Commissioners. The staff appreciates the opportunity this
5 morning to provide you with an update on our efforts to, and our progress in
6 the licensing of accident tolerate fuel, or ATF.

7 This panel will give you an overview of the work that's being
8 done across the Agency to support the implementation of ATF for the
9 operating reactor fleet while maintaining a strong focus on the Agency's
10 mission to protect public health and safety and the environment.

11 Because ATF has the potential to provide benefits to the
12 public and to the operating reactor licensees through increased reactor safety
13 and reduced operating costs, the implementation of ATF has national strategic
14 importance. The Congress had continued to maintain attention on and
15 funding for ATF technologies over the last decade.

16 In Section 107 of the Nuclear Energy Innovation and
17 Modernization Act, otherwise known as NEIMA, required the submission of a
18 report from the NRC on the licensing status of ATF, and that report was
19 submitted in January, on January 9 of this year.

20 As we just heard from the external stakeholder panel, a
21 number of our licensees similarly view ATF as a high priority for their fleets,
22 especially considering the introduction of high burnup and increased
23 enrichment into the ATF domain over the past two years.

1 Finally, we also understand that success with the ATF is
2 important to the Commission, and the risks associated with ATF are being
3 tracked in our quarterly performance review to ensure that we continue to have
4 a high level of leadership engagement on this important topic.

5 The next slide, please.

6 In the last Commission meeting on ATF, which was held on
7 April 12, 2018, the NRC staff described the ATF project plan and how the
8 NRC's approach to licensing ATF will be different than the approach that we
9 took to licensing fuels in the past. Since that last meeting, we have effectively
10 implemented the strategies laid out in the project plan to enable the safe use
11 of emerging fuel technologies, and as a result, we are preparing now to license
12 the near-term ATF concepts.

13 We are committed to efficient and effective reviews for ATF
14 applications, focusing on the areas of greatest safety significance and setting
15 aggressive milestones for completing our reviews.

16 We're continually learning from our interactions with
17 stakeholders to sharpen our focus on the issues and building off of our own
18 successes, such as the successful completion of the chromium-coated PIRT,
19 the Phenomenon Identification and Ranking Table, which was mentioned
20 during the earlier panel, and the associated interim staff guidance that will be
21 discussed by others here at the table.

22 We continue to work towards being a more modern, agile,
23 and risk-informed regulator. The current framework is sufficient for us to

1 successfully license accident tolerate fuels. However, to meet the proposed
2 aggressive ATF development and deployment schedules, this framework may
3 need to be modified to improve our review and licensing efficiency while
4 maintaining the Agency's safety goals.

5 We will be innovative in our review approach for the topical
6 reports and other licensing applications using available data, risk-informed
7 thinking, engineering judgment, and well-crafted limitations and conditions on
8 licenses as needed to make our finding of reasonable assurance of adequate
9 protection.

10 One example of becoming a more risk-informed regulator is
11 the current use of the PIRTs. Historically, PIRTs were completed after the
12 regulatory infrastructure was fully developed, if at all. For accident tolerate
13 fuel, we are using PIRTs in the development of the regulatory infrastructure,
14 thereby helping us to focus our approach on these new technologies.

15 Looking into the future, we plan to implement a timely and
16 efficient review process for ATF technologies, and together with external
17 stakeholders, we will continue to focus on the development and regulation of
18 these technologies to enable their safe use.

19 Next slide, please.

20 Our first speaker will be Andrea Veil, who will provide an
21 overview of our ATF activities. She will be followed by Mike Orenak, to her
22 right, who will discuss the readiness for licensing near-term concepts. After
23 Mike, Marilyn Diaz, to my far right, will discuss fuel cycle and transportation

1 readiness for accident tolerant fuel licensing.

2 After Marilyn it will come back to my left to Josh Whitman,
3 who will discuss the technical basis for the review of the chromium-coated
4 cladding and reactor burnup extension. And finally James Corson, on my far
5 left, will provide an update on the preparation of the confirmatory analysis tools
6 for ATF concepts.

7 Next slide, please.

8 And with that introduction, I will turn the presentation over to
9 Andrea Veil, our recently appointed Deputy Director for Engineering in the
10 Office of Nuclear Reactor Regulation.

11 MS. VEIL: Thanks, Dan, and good morning, Chairman and
12 Commissioners. I'd first like to start with thanking the many staff members
13 that have worked on ATF and have since moved on to different parts of the
14 Agency, and also some represented here, but there's a lot of staff working on
15 this project.

16 It's very complex, not just because of the technology that
17 you've heard about, but also, as you heard from the first panel, we're not
18 following the 20-year model. So there's somewhat of a compressed
19 timeframe.

20 I was in the Office of Nuclear Regulatory Research before
21 coming to this project, so I'm also bringing those observations and insights.

22 Next slide, please.

23 In order to set ourselves up for success while of course

1 maintaining public health and safety, we're engaging in three very important
2 activities. The first one is early and frequent engagement with stakeholders.
3 The second is examining the regulatory framework in the processes, as you
4 heard some earlier, and also following emergent technical issues.

5 Next slide, please.

6 With regard to current status, we fully understand how
7 important it is to engage early with our stakeholders, and when we do engage,
8 we stress getting timely information about potential topical report submittals,
9 applications, and amendments. This allows us to really plan effectively to
10 avoid any licensing bottlenecks or any resource implications.

11 But at the same time, we set very clear expectations every
12 time we engage. As Dan mentioned, we'll be flexible in our review, but that
13 is absolutely contingent on complete applications and justifications for us to
14 make our determination of reasonable assurance. And that is something that
15 is stressed every meeting that we go to.

16 We visit often with our colleagues in the Department of
17 Energy. We go to test facilities, manufacturing facilities, and that
18 engagement also encourages good communications with the actual national
19 laboratories where the testing is occurring.

20 We also engage very frequently with the international
21 community, in particular the Office of Nuclear Regulatory Research fosters
22 those international relationships, both by going to international labs and going
23 to research reactors in the international community.

1 One aspect of the international, as you heard earlier, is the
2 closing of Halden, and so you can hear more about that from James Corson,
3 but we have considered that in our deliberations.

4 Research is also engaging in a very important activity, which
5 is refining the confirmatory analysis codes, which James will also detail in his
6 presentation. Within the NRC, the ATF steering committee and the ATF
7 working group meets at least monthly, but sometimes we're often as needed
8 to address emergent issues and to assess those issues as they come up.

9 And in my opinion, I'm early to the project, but this project is
10 an excellent example of successfully working in a matrix organization and
11 keeping focus on a project.

12 Next slide, please.

13 You've heard a lot in the first panel about the regulatory
14 framework, and we are assessing that regulatory framework and processes.
15 As you also heard, 10 CFR 50.68 has an explicit limit of 5 percent enrichment
16 for fuel assemblies. There are currently two materials licensees, Part 70
17 materials licensees, that are in house with amendments.

18 This gets convoluted very quickly, but the Part 70 licensees
19 have amendments in house. The reactor operators, an exemption would be
20 required to receive fuel enriched above 5 percent.

21 Another known challenge of course is NRC resources. We
22 currently have the skill sets and the resources need to license these
23 technologies, but of course in our engagements, we stress the importance of

1 having up-to-date information so that we can continue to plan for the
2 foreseeable future. But I do want to stress that we do have the skill sets and
3 resources for what we know is forthcoming for ATF licensing.

4 Next slide, please.

5 The staff is following emerging technical issues, and as you
6 know, reactor designs mean uranium dioxide pellets with the zirconium alloy
7 cladding has virtually remained unchanged for the past 50 years in the US
8 fleet. So we're following these emerging technical issues because it's
9 evolving, and it takes our focus and we really have to react quickly to figure
10 out, you mentioned "unknown unknowns," to kind of stack the deck and figure
11 out as much as we can with the information that we have.

12 By following these emerging issues, we can react quicker.
13 Now, of course we're not making any presupposed promises, but this could
14 result in faster issuance of regulatory guidance or safety evaluations if we
15 have more information up front.

16 And although it's not a new phenomenon, the Commission
17 and the TAs have heard about fuel fragmentation, relocation, and dispersal
18 and different CA briefs and in other meetings. Or otherwise on this FFRD.
19 And you'll hear more about that in Josh Whitman's presentation.

20 So in summary, overall we spent a significant amount of
21 time understanding both licensing challenges and technical challenges
22 surrounding ATF licenses.

23 And we have confidence that we can license in the

1 requested timeframes, but of course I can't stress that's contingent on
2 complete applications, and those applications have to reflect the lessons
3 learned that we've both discussed in collaboration and put very clear
4 messages out in every interaction that we have with both DOE, vendors,
5 licensees and whoever else will listen to us about ATF.

6 Next slide, please.

7 The next speaker will be Mike Orenak, who's the project
8 manager for the ATF project. Thank you.

9 MR. ORENAK: Thank you, Andrea. Good morning,
10 Chairman and Commissioners. I'm here to discuss the readiness for
11 licensing near-term ATF concepts.

12 Next slide, please.

13 We consider ATF technologies near-term when we can rely
14 on the existing data, models, and methods in a review of industry submittals.
15 There are three technologies that we consider near term. First is chromium-
16 coated cladding. One vendor stated they'll be coming in with a topic report in
17 2020. No power reactor licensees have stated they're going to adopt
18 chromium-coated cladding yet.

19 The second technology is doped pellets. We've approved
20 doped pellets for BWR applications. When it comes to PWR applications, a
21 couple vendors are exploring that too.

22 The third technology is iron-chromium-aluminum alloy
23 cladding, which is also known as FeCrAl cladding. Two licensees have lead

1 test assemblies inside the reactors. However, no topical report submittal
2 dates have been told to us yet.

3 Next slide, please.

4 The ATF project plan is being followed. In the April 2018
5 Commission meeting, new paradigm was introduced. In this new paradigm,
6 the development of technical bases by the licensee will happen in parallel with
7 the refinement of the regulatory infrastructure.

8 The benefit of this arrangement is that it allows licensing to
9 start earlier, where previously the licensing had happened after the
10 development of technical bases.

11 Next slide, please.

12 Two examples of how we're following the project plan. As
13 Dan had discussed earlier, we completed a chromium-coated PIRT in January
14 of 2019. The use of the PIRT is a part of the licensing approach that allows
15 more efficient refinement of the regulatory infrastructure.

16 We use the PIRT in the development of the interim staff
17 guidance. PIRTs for other subjects are currently scheduled, and that will be
18 discussed by James later.

19 The second example is our issuance of the interim staff
20 guidance. The interim staff guidance's are normally issued after applications
21 are received because the staff will finally have an idea on what the licensees
22 are going to present to us. Because of our interactions with the vendors and
23 stakeholders, our interactions have allowed the early issuance well before we

1 received any topic reports or license amendment requests.

2 Both documents support staff efficiency, they avoid multiple
3 RAI rounds, and provide regulatory certainty for licensees.

4 Next slide, please.

5 The staff is being flexible in response to the stakeholder
6 needs. The industry uses lead test assemblies to obtain data to make the
7 safety case for new fuel designs. Since the last Commission meeting, NEI
8 had requested clarification on licensing requirements, given the interest in
9 accident tolerant fuel lead test assemblies. We issued a response of June of
10 last year.

11 The LTA letter provides guidance on terms limited number
12 and non-limiting core regions; the use of approved codes and methods; the
13 use of 10 CFR 50.59, which is changes, tests, and experiments; the use of
14 exemptions to 10 CFR 50.46, which is acceptance criteria for emerging core
15 cooling.

16 The LTA letter ensured regulatory consistency and reduced
17 misunderstandings regarding the insertions of LTAs. A second example of
18 us being responsive is the issuance of Appendix A to the project plan, which
19 is entitled Fuel Burnup and Enrichment Extension Preparation Strategy.

20 Due to industry and Department of Energy activities
21 regarding high burnup and increased enrichment, we decided to revise a
22 project plan, and it was issued in October of 2019.

23 Next slide, please.

1 Early and frequent communication is key to the success of
2 a project plan, and the NRC staff is following through. If you look on the top
3 row of the slide, I've already discussed the project plan and the LTA letter.
4 On the top right is RIS 2019-03, which is pre-application communication
5 scheduling for ATF submittals.

6 This RIS request is schedule information for Part 70, 71, and
7 72 vendors, and this assists the NRC staff in workload planning. Today we
8 received two responses, and we hope to receive a third response in the middle
9 of next month.

10 We continue to engage vendors and licensees. These
11 interactions allow us to stay up to date on technical developments, changes
12 to licensing strategies and schedules.

13 We encourage pre-application meetings with the vendors
14 and licensees to take care of any issues before they arise whenever we have
15 applications. One example of our interaction with vendors was the
16 development of the ISGs accelerated to the end of 2019.

17 Originally, we had planned to issue the ISG at a later date,
18 but when one vendor came and said they would submit a topical report by the
19 end of 2019, we saw it on our schedule and managed to issue it -- so on
20 January 3 of this year, well before we received any topical reports.

21 We meet with industry representatives and working groups
22 and provide -- and during these meetings, industry provides a high-level
23 overview of direction and schedules.

1 And finally, we put forth a significant effort to interact with
2 stakeholders, especially the public. At some of the public meetings, as you
3 can see on the slide, there was not an open subject, or sorry, open portion of
4 the meeting, these are totally proprietary. The staff decided to, or requested
5 an open portion at the beginning of those meetings to interact with the public.

6 Next slide, please.

7 We are ready for known forthcoming applications. The
8 current regulatory framework is suitable for review and licensing of ATF. For
9 high burnup and increased enrichment, the framework still continues to be
10 acceptable. However, as discussed earlier by Andrea regarding 10 CFR
11 50.68, should widespread adoption occur of increased enrichment,
12 rulemaking would commence to facilitate a more predictable licensing
13 process.

14 For chromium-coated, we've issued -- we've completed the
15 PIRT and issued this Interim Staff Guidance, and we're waiting for the topical
16 report applications. The staff will review the need for other guidance
17 documents on a routine basis.

18 To ensure we're ready for a power reactor license
19 amendment request, we are developing a licensing roadmap. This licensing
20 roadmap accounts for variations with an amendment request for coated
21 cladding, cladding changes, increased enrichment, and high burnup.

22 For this roadmap, we'll identify resources, timelines, or use
23 steps in special circumstances, such as review with the ACRS.

1 Once we complete the draft licensing roadmap, we'll
2 perform validation and verification using nonstandard previous fuel reviews to
3 confirm that all parts of the licensing process are taken account for. After
4 we're completed with the licensing roadmap, we'll execute a few, a couple
5 table top exercise. They'll process simulated amendment requests to identify
6 bottlenecks and other resource needs.

7 And finally, when the amendment requests do come in, we
8 will have the analysis tools ready to make our safety case. And those will be
9 discussed by James in his presentation.

10 Overall, we are following the project plan. We are
11 completing licensing actions in parallel with industry progress on the technical
12 bases, and our communication with stakeholders allow us to be ready for the
13 forthcoming ATF technologies.

14 I'd like to turn the presentation over to Marilyn Diaz, a
15 Chemical Engineer in the Office of Nuclear Materials, Safety, and Safeguards.

16 MS. DIAZ: Thank you, Mike. Good morning, Chairman
17 and Commissioners. I will be providing an overview of the status of accident
18 tolerant fuel as it relates to the front and back end of the fuel cycle, including
19 the accomplishments we've achieved so far. During my presentation I will
20 address how NMSS is focused on preparing for these new technologies.

21 Next slide, please.

22 We are effectively implementing strategies to support the
23 industry's 2023 goal of deploying ATF. We have taken a bigger role at the

1 table, with industry increased interest on deploying ATF with higher
2 enrichment levels and burnup. We are making progress, and here are some
3 of our recent accomplishments.

4 We issued two special authorizations for the achievement of
5 the lead test assemblies, or LTAs. This action allows fuel vendors to
6 transport a limited number of LTAs to the reactor sites.

7 We also issued a revision to a certificate of compliance for
8 one transportation package vendor authorizing the transfer of ATF assemblies
9 for chromium-coated cladding and up to 5 percent enrichment. This action
10 allows the fuel vendor to transport an unlimited amount of ATF assemblies to
11 the reactor site.

12 Since the last Commission meeting, NMSS staff worked
13 with NRR to issue Appendix A of the project plan addressing the strategy to
14 prepare the Agency for the review of future licensing actions, including license
15 amendments to go beyond the current 5 percent enrichments limits.

16 And lastly, staff developed a critical path identifying the
17 schedule and timeframe for licensing actions needed to support the industry
18 plan to deploy ATF with higher enrichments in 2023. This critical path was
19 sent to the Nuclear Energy Institute in August 2019.

20 To support 2023 deployment of ATF with high-assay, low
21 enriched uranium, NRC must receive an application to increase fuel
22 enrichment by August 2021.

23 Next slide, please.

1 We are effectively implementing strategies identified in the
2 project plan. As we continue to license these new technologies and prepare
3 for the future actions, we are building on our processes in a smarter way. We
4 continue to enhance and revise our own licensing practices. We continue to
5 make progress in becoming a modern risk-informed regulatory.

6 For example, in preparation for the ATF and HALEU
7 amendment request, we gathered a team representing each technical area to
8 evaluate the risk associated with the future applications. The risk insights
9 gained from the approach better inform the scope of the reviews.

10 In October, we received our first license amendment request
11 to fabricate fuel with enrichments up to 8 percent from Global Nuclear Fuel-
12 Americas. And in November, we received a license amendment request from
13 Louisiana Energy Services to allow them to enrich up to 5.5 percent
14 enrichment. Additionally, we received an application from GE-Hitachi for
15 transport of irradiated ATF in the GE 2000 package.

16 Increased communication with licensees and asking
17 questions early, like issuing requests for supplemental information during the
18 acceptance review, has improved the efficiency of these reviews. To prepare
19 for these technologies, we have also been conducting an assessment of the
20 current regulatory framework and processes to identify and resolve any
21 licensing issues.

22 We evaluate 10 CFR Part 70 and 71 for the review of the
23 enriching fuel above 5 percent. For the transportation of UF₆, uranium

1 hexafluoride, for fuel fabrication and fresh fuel transportation of the ATF near-
2 term concepts with HALEU. To date, we have not identified any significant
3 regulatory or technical challenges for the near-term ATF concept with HALEU
4 for the front end of the fuel cycle.

5 We continue to evaluate our regulations to determine if
6 review of these technologies will require rulemaking. To date, no changes to
7 10 CFR Part 70 or 71 is needed to accommodate these new technologies.
8 We will engage the Commission if rulemaking is needed.

9 An example of our analysis is that staff has identified that for
10 transporting UF₆, HALEU, licensee will be required to provide an evaluation
11 of optimum moderation per 10 CFR 71.55. One viable option is that licensees
12 may request an exemption from this requirement.

13 In addition, we're working with Office of Research to assess
14 the availability of criticality benchmarking data for higher enrichments and
15 cladding performance for spent fuel.

16 Next slide, please.

17 Another strategy we're successfully implementing is early
18 and frequent engagement. We have amplified our engagement with internal
19 and external stakeholders. This facilitates a common understanding of the
20 new technologies we will need to be prepared to license and the timelines for
21 the proposed deployment of these technologies.

22 For example, as mentioned before, staff sent a letter to NEI
23 identifying when we need to receive applications for the use of ATF with

1 HALEU to support the 2023 goal. During the 2020 Regulatory Information
2 Conference, we have a fuel management track, which includes a session on
3 licensing, storage, and transportation of ATF.

4 Through different forums like this conference, other public
5 meetings, and communications with industry, we're working to identify and
6 address challenges early. We're also actively participating in the industry's
7 ATF working group that was formed to discuss regulatory and technical
8 initiatives that are needed to support ATF with HALEU.

9 Additionally, we're actively engaging and encouraging pre-
10 application interactions and utilizing our various forums for engaging external
11 stakeholders. For example, staff has engaged in pre-application interactions
12 with licensees regarding their upcoming amendment to transfer ATF fuel with
13 HALEU. Their licensing action is expected to be submitted in early 2020.

14 Next slide, please.

15 Lastly, we're engaging in early training research requests
16 and continued dialog with internal and external stakeholders as new
17 information comes available on these technologies, with the goal of ensuring
18 that our workforce is fully equipped with knowledge and skills needed to
19 support the workload.

20 To ensure we can support the expected amendments and
21 new applications, we factored the skills necessary to support these reviews
22 into the strategic workforce planning process so we have the staff needed to
23 meet the workload demand.

1 For example, we're ensuring staff completes cross-
2 qualifications in key technical areas to enhance their agility and enable the
3 review of future license applications. In addition, we're conducting training
4 for NRC staff. We successfully coordinated a seminar given by Oak Ridge
5 National Labs last July on ATF. This seminar was recorded for future use by
6 the NRC staff.

7 We will continue to assess the need to train staff on specific
8 topics related to ATF and HALEU.

9 This reaches the end of my presentation. I will now turn it
10 to Josh Whitman. Josh is a Nuclear Engineer in the Office of Nuclear Reactor
11 Regulation and will be talking about the technical basis for chromium-coated
12 cladding and higher burnup.

13 MR. WHITMAN: Thank you, Marilyn, and good morning,
14 Chairman and Commissioners.

15 Next slide, please.

16 So I'll start by talking about one of our biggest
17 accomplishments since the last Commission meeting, the issuance of the
18 Interim Staff Guidance, or the ISG on chromium-coated cladding, which was
19 issued in January of this year.

20 The ISG describes what should be addressed and licensing
21 submittals for coated claddings. So first I'll step through this pyramid from
22 the bottom up, describing the process and inputs that we use to get to the final
23 ISG.

1 We began with a literature search performed by Pacific
2 Northwest National Labs, or PNNL. This used the EPRI gap analysis, other
3 documents in the public literature, as well as PNNL's expertise from providing
4 contract support for fuel reviews to create a document that was -- described
5 the state of knowledge of chromium coatings on and their use in reactors.

6 This document was then provided as background to experts
7 who had formed the Phenomena Identification and Ranking Table panel, also
8 known as a PIRT panel. This panel then met in April of last year and added
9 their -- the experts reviews this document and provided their professional
10 recommendations and insights based on their expertise.

11 These experts were from the nuclear and coding fields and
12 both industry and academia, and they worked through and created a rank list
13 of material properties, specified acceptable fuel design limits, also known as
14 SAFDLs, and new degradation mechanisms, and ranked them by knowledge
15 and importance level.

16 So these rankings, as well as the discussion at the PIRT
17 panel, were then incorporated into the final PIRT report, which was released
18 in June of last year. From there, we created the ISG by adapting the PIRT
19 report, adding more focus guidance for reviewers. And we completed this all
20 on an accelerated schedule, going from the final PIRT report to issued
21 guidance in just about seven months.

22 We did that in order to ensure that the ISG was issued
23 before the first coated cladding topical reports were submitted to the NRC for

1 review.

2 Although we had an accelerated process, we also
3 incorporated stakeholders throughout the process and throughout the
4 development of the ISG by holding the PIRT publicly; releasing the PIRT
5 report publicly; holding multiple public meetings throughout the ISG
6 development process, including a ACRS subcommittee meeting; and by
7 noticing the ISG for public comment and incorporating the stakeholder
8 feedback.

9 Next slide, please.

10 So what is in this ISG? The ISG is intended to supplement
11 the Standard Review Plan, or SRP, and the plan is to eventually incorporate
12 it into the SRP after we have had the ability to exercise it through the first
13 topical report submittals and work out any kinks that we might find.

14 ISG contains guidance for reviewers to supplement the
15 guidance in Chapter 4, Reactor, in Chapter 15, Transient Accident Analysis,
16 of the Standard Review Plan. It also includes that list of material properties,
17 SAFDLs, and new degradation mechanisms I just -- I talked about on the PIRT
18 slide.

19 By issuing the ISG, we hope to ensure -- we will ensure
20 regulatory reliability and consistency between reviews and different reviewers
21 for the coated claddings as they are submitted to us.

22 Next slide, please.

23 So with the issuance of the ISG the NRC is now ready to

1 review coated cladding topical reports. But there's one key challenge, which
2 is the limited data at high burnup that's going to be available for these
3 technologies while they are submitted.

4 Now, as the previous panel discussed a little bit, historically,
5 fuel vendors have waited until they've collected data at the full range of
6 requested burnup before submitting a topical report to the NRC for review.

7 While this simplifies the review process, it has the down side
8 of requiring many years just to achieve the burnup and then additional time to
9 perform the post-radiation examinations and collect the data from -- in order
10 to submit that with the topical report.

11 Additionally, if there's any benefits for the new fuel design,
12 many plants may need to wait until they've achieved a full core of that design
13 through three reloads before they can fully achieve those benefits in licensing
14 space.

15 So to help alleviate some of that lag, we are willing to look
16 at a phased approach to licensing of the coated cladding designs, which is
17 what's described in the diagram on the slide.

18 In a phased approach, vendors would first submit topical
19 reports with data collected to an intermediate burnup level and staff would put
20 appropriate conditions and limitations on burnup based on this data.

21 Then in the future as they collect more data, vendors could
22 submit this data to the NRC as a supplement to the topical report to either
23 remove or raise the limitation on burnup.

1 Additionally, fuel vendors would likely need to submit a
2 separate topical report or supplement the topical report to claim the benefits
3 for the new cladding materials or the new coatings as they collect that data.
4 So that can be done in parallel with the first plants starting to load -- starting
5 to batch load these coated cladding.

6 Next slide, please.

7 So another major accomplishment that we have had since
8 the last Commission meeting is the high burnup and increased enrichment
9 appendix to the ATF project plan, which was issued in October of last year.

10 The appendix follows the same general format as the ATF
11 project plan with four major focus areas: inner reactor regulatory framework,
12 regulatory framework for fuel cycle transportation and storage, probabilistic
13 risk assessment activities, and independent confirmatory calculation activities.

14 The purpose of the project plan appendix is to prepare the
15 agency for efficient and effective licensing of high burnup and increased
16 enrichment when submittals come in.

17 We included input from the public in this process through a
18 public meeting and submitted comments and we are now working to
19 implement the plan, much like we are working to implement the ATF portion
20 of the project plan.

21 Next slide, please.

22 So as part of this process we need to develop the technical
23 basis for high burnup fuel. As we described in SECY 15-148, one

1 phenomena sensitive to high burnup is fuel fragmentation, relocation, and
2 dispersal, also known as FFRD.

3 FFRD is the observation that under certain accident
4 conditions high burnup fuel may break into small pieces which could then
5 relocate within the fuel rod and potentially disperse with the primary coolant if
6 the fuel cladding were to rupture.

7 We have a growing understanding that shows that fuel is not
8 susceptible to FFRD until it achieves greater than the current burnup limits.
9 But it may be susceptible below the burnup limits being proposed by industry.

10 As you can see from the slide, below the current burnup
11 limits the fuel particles are large whereas above the current burnup limits the
12 fuel fragments into much smaller pieces that would have a greater propensity
13 to relocate or disperse.

14 So industry is aware of FFRD and recognizes its importance
15 to demonstrating the safety of high burnup fuel. Both industry and NRC
16 participate in international research programs that are working to gain further
17 understanding of the phenomena, and as part of the early engagement
18 described in the project plan appendix, NRC attended a EPRI workshop on
19 high burnup fuel just last month where FFRD was a primary topic of
20 discussion.

21 But FFRD is not currently addressed in any licensees'
22 analyses of record and moving to high burnup fuel it may need to be
23 dispositioned.

1 Next slide, please.

2 So as laid out in the project plan and the project plan
3 appendix, the staff have had considerable early engagement with all of our
4 stakeholders -- industry, DOE, the National Labs, EPRI, and the public.

5 In the last year we have visited both Oak Ridge National
6 Lab, where the picture on the left was taken, and Idaho National Labs to view
7 experimental setups and experiments being run on ATF.

8 This can provide invaluable context to data that's submitted
9 with topical reports that are collected from these experimental setups for
10 the -- context for the reviewers and help to reduce the questions and improve
11 the review process.

12 We have also observed coating processes at two different
13 vendor sites, and as industry has stepped up their focus on high burnup, we
14 have stepped up our engagement there as well, attending two EPRI high
15 burnup workshops and we are also holding a RIC session in a couple weeks
16 on the same topic.

17 We have also attended DOE's advanced fuel campaign
18 meetings and EPRI, DOE, INL, ATF workshop, where I was at last week,
19 where industry presents some of the new developments in research, some of
20 the new data they've collected and DOE goes over some of their plans for the
21 program.

22 We have also attended the Top Fuel Conference where ATF
23 has been a hot topic in recent years.

1 And, finally, we have regular interactions with vendors to
2 understand changes in their licensing strategies as they evolve. We hold
3 these as noticed meetings with open portions to improve transparency with
4 the public and our other stakeholders.

5 So next up, I am going to hand it over to James Corson, who
6 will be discussion the preparation of confirmatory analysis tools for ATF
7 concepts.

8 Thank you.

9 MR. CORSON: Thanks, Josh.

10 Good morning, Chairman and Commissioners.

11 So I am going to be talking about the various activities that
12 we have ongoing in the Office of Nuclear Regulatory Research to support
13 licensing of accident tolerant fuel.

14 Next slide, please.

15 So our efforts in the Office of Research fall into three broad
16 categories. The first is preparation of our confirmatory analysis tools for fuel
17 performance, neutronics, thermal hydraulics, and severe accidents and
18 source term, and these light -- these confirmatory analysis tools help our
19 licensing process by verifying the type of information that the vendors are
20 submitting.

21 The second major area of activity is participation in
22 international research programs to obtain data for our code development and
23 for validation and to increase our understanding of safety-significant

1 phenomena.

2 And then the third major area, the Office of Research is
3 leading the literature reviews and PIRT activities for accident tolerant fuel and
4 for burnup and enrichment extension.

5 And as previous speakers have mentioned, PIRT is a really
6 key part of our ATF project plan. They help us to become a more modern
7 risk-informed regulator because they help us identify the areas that are of
8 greatest safety significance so that we can focus our review on those things.

9 So I'll be discussing our efforts in these three areas on the
10 following slides.

11 Next slide, please.

12 So, first, we have done a lot of work to update our computer
13 codes to be more modular and flexible so that they can support different fuel
14 types.

15 On the left of the slide you see a representation of the old
16 way of doing things where the material properties and the physics models and
17 solution methods are all sort of jumbled together and this makes it a lot more
18 difficult to change out new material properties.

19 As a result of that, we have made a number of efforts to
20 remove those material properties and put them in separate libraries. So for
21 our Fast Fuel Performance Code, we have actually created a separate
22 material properties library.

23 So this makes it more resource efficient to modify existing

1 fuel properties as well as to add properties for new concepts like
2 chromium--coated cladding.

3 So, of course, this reduces a lot of redundancy and a lot of
4 effort, which is a good thing, and this has benefits not just for ATF, which
5 motivated this activity, but for existing fuels as well.

6 So the material properties that we use in our codes come
7 from a variety of sources. They come from the open literature. They come
8 from international research programs and from material properties handbooks
9 that are published by the Department of Energy and the National Labs.

10 Likewise, we work closely with our counterparts at the labs
11 and with our international counterparts to develop new models for our codes
12 and also to obtain the data we need to validate the codes.

13 And as Josh mentioned, getting this data is, of course, a
14 challenge. But we interact quite frequently with the Department of Energy
15 and the vendors to remain up-to-date on their test plans so that we are as
16 prepared as we can be.

17 Next slide, please.

18 So I already mentioned how we separated out the material
19 properties from our Fast Fuel Performance Code into a dedicated library.

20 We can also use this same material properties library in
21 some of our other tools like the TRACE thermal-hydraulics code and, again,
22 this just reduces some of the redundancy for code development, which is very
23 useful when we are adding new properties.

1 But then it also has benefits for existing UO2 Zirc when we
2 have to do long-term maintenance on the codes. So just another area where
3 we have significantly improved our codes as a result of ATF activities.

4 Next slide, please.

5 The second area where the Office of Research is leading
6 activities related to ATF and burnup and enrichment extensions is
7 international research.

8 So we rely heavily on international research to obtain the
9 data we need for code development for material properties and for validation
10 data, and these international research programs greatly increase our
11 understanding of safety-significant phenomena.

12 So I have just a few of the programs we participated in listed
13 here. First up is the Studsvik Cladding Integrity Project, which has provided
14 valuable data on fuel fragmentation, relocation, and dispersal phenomena that
15 Josh had mentioned previously.

16 The SCIP program also provides information on the back
17 end of the fuel cycle. So that's relevant to work ongoing in NMSS. I also
18 have listed reactivity insertion accident tests that we follow.

19 There have been some tests done at the Nuclear Safety
20 Research Reactor in Japan on doped fuel. So we follow those tests. And
21 we also participate in the Cabri International Project at the Cabri reactor in
22 France to obtain data on high burnup and doped fuel RIA tests.

23 And then the last thing I have listed up here is we have

1 obtained valuable information on iron-chromium-aluminum cladding behavior
2 during a LOCA and subsequent QUENCH from the QUENCH facility in
3 Germany.

4 So all of these programs provide valuable data for our codes
5 as well as enhance our understanding of safety-significant phenomena.

6 Next slide, please.

7 So the last area I want to talk about is PIRTs and the
8 previous speakers have mentioned quite a bit the chrome-coated PIRT so I
9 am not going to dwell on that any further.

10 I'll also mention that more recently we have completed a
11 literature review on fuel performance considerations and data needs for fuel
12 above current burnup limits.

13 So that literature review was completed by our contractors
14 at Pacific Northwest National Lab and it's publicly available so to identify what
15 data is already out there for our codes as well as some of the data that needs
16 to be collected to support licensing of high burnup fuel.

17 We also have literature reviews ongoing with PNNL related
18 to chrome-coated cladding and iron-chromium-aluminum cladding fresh fuel
19 transport and spent fuel transport and storage. So those are -- those
20 literature reviews will be published in the next couple years.

21 And then the last major PIRT activity I want to talk about is
22 the severe accident and source term PIRT, which will be coming later this
23 year.

1 Next slide, please.

2 So the severe accident and source term PIRT for ATF and
3 burnup and enrichment extensions will increase our knowledge of severe
4 accident and source term behavior, and this will feed into a number of different
5 activities at NRC.

6 So this knowledge improves our ability for emergency
7 planning and incident response. It also helps with our code development
8 activities for the MELCOR severe accident and source term code, and
9 MELCOR is used to help support regulatory source term development and it's
10 also used to help support development of surrogate criteria for probabilistic
11 risk assessment.

12 And these surrogate criteria, in turn, are used in regulatory
13 cost-benefit analysis anytime we need to evaluate new requirements or back
14 fits.

15 So these are just some of the areas that the severe accident
16 PIRT will help feed into. It'll help identify areas where ATF or high burnup
17 fuel may behave differently than the existing UO2 Zirc system and it'll help us
18 identify where we need to adjust our guidance.

19 So those are the activities that we have ongoing in the Office
20 of Research. I'd like to now turn it back to Dan for some closing remarks.

21 MR. DORMAN: Thank you, James.

22 If I could have the next slide. The next one.

23 So I want to conclude with the people. You see here a

1 number of the NRC staff working on the -- implementing the ATF project plan
2 including several of the folks here at the table.

3 This is not, obviously, an exclusive list. We have, as you
4 see before you, several offices of the agency actively engaged in the full life
5 cycle of accident tolerant fuel and making sure that we are thinking through all
6 of the implications of accident tolerant fuel.

7 But I would be remiss to stop there and not acknowledge
8 the significant collaboration that you've heard about from both panels. I think
9 the collaboration and particularly the pre-application discussions are critical to
10 our success in meeting the objectives for a timely implementation of accident
11 tolerant fuels.

12 The preparation that goes into that enables the staff to be
13 better prepared for the applications that will come before us that you see
14 translated into Interim Staff Guidance, which is review guidance for the staff
15 but also helps guide people preparing applications to know what are
16 the -- what are the important issues that the staff will be focused on in
17 reviewing their application and enables us to have more confidence that we
18 will be able to deliver a timely safety decision at the appropriate time.

19 So with that, that concludes the staff's remarks and we look
20 forward to your questions.

21 COMMISSIONER SVINICKI: Well, thank you very much,
22 Dan.

23 In addition to that photo of that happy bunch, I want to note

1 that something very rare. I've sat around this table at a lot of Commission
2 meetings for over 12 years now and we have achieved gender parity around
3 this table.

4 I have to tell you that's very, very rare.

5 [Laughter.]

6 COMMISSIONER SVINICKI: I don't know how many times
7 this has ever occurred for us. But with that, we will -- I will turn to my
8 colleague. Thank you for helping with gender parity on this side of the table.

9 Commissioner Caputo?

10 COMMISSIONER CAPUTO: Thank you.

11 And I'd like to just start by making an observation just about
12 the wealth of expertise sitting at this table, and I know that for each one of you
13 that are here there is a cadre of staff who also contribute their expertise in the
14 nature of what's being done here.

15 But I do think it's really remarkable just the level of
16 intellectual heft that's being applied here. And so thank you for all
17 contributing your best work to this effort.

18 Mr. Dorman, let me start with you with a question. I think
19 this should be fairly easy and straightforward. But do you believe the staff is
20 proceeding with an appropriate safety focus on accident tolerant fuel or is
21 there a risk of compromising safety in order to meet the industry's preferred
22 schedule, as Dr. Lyman contends?

23 MR. DORMAN: I do believe we are maintaining an

1 appropriate safety focus on this. If I could briefly leverage the question.

2 The chairman mentioned “unknown unknowns.” This
3 process that is much shorter than our traditional 20-year process is a step
4 wise process. As I mentioned in my opening remarks and I think Josh
5 touched on it as well, there may be license restrictions and conditions as we
6 go through the steps of the process and the approvals that we will have will
7 be for the next step of the process until we get to the point of a full approval
8 of, ultimately, full load, of course. And those will be based on the data that
9 we have at the time we make those decisions that give us enough confidence
10 in the safety determination to go the next step. Definitely a strong safety
11 focus.

12 COMMISSIONER CAPUTO: Okay. Thank you.

13 Dan, I am going to come back to you with another one. So
14 the Nuclear Energy Innovation and Modernization Act required us to submit a
15 report to Congress on our progress on this issue and we reported that “the
16 existing regulatory framework is generally acceptable for licensing near-term
17 ATF fuel designs using amendments and exemptions.”

18 Now, Andrea has indicated that we still - we are still
19 assessing the need for rulemaking and new updated guidance documents,
20 and I know this was also mentioned by Mr. Orenak.

21 So can you just give me a little clarity here?

22 MR. DORMAN: Sure. So and Andrea touched on a
23 couple of areas and I think Dr. Lyman touched on 50.46. So there's a number

1 of things in play that could adjust the framework if you made a decision on
2 50.46.

3 50.68, obviously, at some point if there is broad
4 implementation of higher enrichments than 5 percent in the reactor fleet it
5 would be prudent for the Commission to update its framework to reflect the
6 higher enrichment than what is currently allowed in 50.68.

7 But that is not an impediment to us approving on a case
8 basis the use of accident tolerant fuels, going forward. So we can do an
9 exemption to 50.68 as an example to allow more than a 5 percent enrichment
10 in the reactor.

11 So we can do it in the existing framework. If this ends up
12 being a broadly deployed material in the fleet, at some point it will be prudent
13 for us to update the regulatory framework.

14 I think between now and some point in the future we are
15 going to continue to learn more that will be valuable informing the regulatory
16 basis of what such an update to the regulatory framework would look like.

17 COMMISSIONER CAPUTO: Okay. So if I can shift to
18 Mike and maybe have him contribute a little bit here, because on slide 13 he
19 has a bar that says refinement of regulatory infrastructure, which both
20 precedes and overlaps licensing activities. So that suggests that there is
21 regulatory work that needs to be done.

22 MR. ORENAK: Regulatory work meaning Interim Staff
23 Guidance. I mean, at least that's for chromium-coated cladding.

1 COMMISSIONER CAPUTO: Okay. So the Interim Staff
2 Guidance was issued?

3 MR. ORENAK: Mm-hmm.

4 COMMISSIONER CAPUTO: But only for the chromium
5 cladding?

6 MR. ORENAK: Correct.

7 COMMISSIONER CAPUTO: So this implies that there is
8 refinement of other regulatory infrastructure for other ATF technologies?

9 MR. ORENAK: This is -- the ATF project plan is a general
10 framework for all of the technologies. And so for the other ones I don't think
11 we have it defined on what we are going to do for the regulatory infrastructure
12 yet because that's the only one we see, you know, forthcoming right now is
13 chromium-coated cladding.

14 COMMISSIONER CAPUTO: Okay. Well, this takes me
15 to my other question. So I've heard several times this morning that we are
16 prepared to license near-term ATF concepts. But I am hearing there may be
17 regulatory infrastructure work that needs to be done. There is also the
18 potential for assessing criticality research and where there's
19 available -- enough data available and there's also the discussion of preparing
20 confirmatory analysis tools. So I guess my question is, you know, we are
21 prepared to license but does that actually mean we are ready now or will be
22 ready by the time applications come in or we will finish getting ready after
23 applications come in.

1 Because if we need to wait and see what applications look
2 like in order to provide guidance then applicants don't have the benefit of the
3 guidance in preparing their applications, which makes it more difficult for
4 applicants to submit complete high-quality applications.

5 So I am sort of struggling to figure out our degree of
6 preparedness because it doesn't sound like we are prepared as quite the clear
7 definitive statement that it would suggest.

8 MR. DORMAN: So I'll go back to Pete Sena's comment
9 about A plus B plus C and then its calculus. I think we are in the transition to
10 calculus.

11 So up to this point, we have been, from the regulator side,
12 doing the PIRT, doing the ISG. We have been doing the A plus B plus C.
13 What we need is the data. What we need is the topical. So that's the next
14 step and we are ready to get that data and get those topicals. There's a
15 potential for the unknown unknown in the topical. We will see. But that will
16 be the next step that will prepare the applicants for the LARs -- the license
17 amendment requests -- that they will need to batch load the fuel. So there
18 is -- there is an element of -- yeah, there's a lot of -- there's a lot of moving
19 parts here and as we get closer to each moving part we are -- I think what we
20 are seeing in the collaboration and in the implementation of the project plan is
21 the engagement that we need to have confidence that at the next step we are
22 going to be ready. We are ready for the next step. We are ready to receive
23 the topical report on chromium-cladded fuels. But and we are also -- and I'll

1 take this opportunity to jump into Tiger Teams and acceptance reviews and
2 some of the more general things that are broader than just ATF that are going
3 on throughout the agency to improve the process of accepting the application
4 for review and laying out a review plan that will be very focused on the
5 important safety issues.

6 So I think -- so I am confident that we are ready for the next
7 step. I am confident that we have a project plan that will have us ready for
8 the further steps as they come.

9 MS. VEIL: And I'd like to just add that this is partly what
10 happened when the initial ATF plan was sent out. There wasn't an
11 expectation that they increased enrichment and high burnup would be coming
12 at the same time as ATF and that's why we have such early and frequent
13 engagement. When the staff became aware that that was going to be
14 something that the industry was going forward with, that's when we got
15 together, got the appendix out last October. So we are iterating, I think, as
16 Mr. Csontos said from EPRI, on the information that we get and then executing
17 based on that information. But we are ready to license chromium-coated.

18 COMMISSIONER CAPUTO: Okay.

19 Now, I am just going to make a caution here that I think if
20 we are going to make statements that we are prepared to license near-term
21 ATF concepts, there's a difference between we are prepared and we are
22 getting prepared. And given the level of scrutiny and public attention to this,
23 I think we need to be incredibly frank and precise in our use of language.

1 Because if we say that we are prepared that's very easily
2 interpreted by external stakeholders as oh, okay. They are ready.

3 But we are not, because there's still a fair amount of work
4 being done. So I think we just need to be a little bit more precise in our
5 language and a little more clear about the nature of that.

6 So, Ms. Diaz, one last quick question for you. You stated
7 that you're working with the Office of Research to assess the availability of
8 criticality benchmarking data.

9 If the necessary data isn't available, how long do you think
10 it takes to develop that data?

11 MS. DIAZ: So what we are saying is that currently for the
12 near-term concepts we are ready to review license applications with higher
13 enrichments for above 5 percent. The work that's being done with the Office
14 of Research and the literature review that will be done is to further inform our
15 reviews and to more efficiently conduct our reviews.

16 So we have -- there's a plan that will address for higher
17 enrichments going from 5 percent to 8 percent and that will be conducted in
18 the near term to inform that.

19 But for right now, I think we have enough to review the
20 applications with all the alternatives like the applications will need to provide
21 a bigger margin of safety when it comes to criticality and we will have to
22 provide additional information on the uncertainty and sensitivity analysis for
23 the criticality safety evaluations.

1 COMMISSIONER CAPUTO: Okay. Safety evaluations.
2 So does that mean you need that data in order to make licensing decisions on
3 near-term?

4 MS. DIAZ: So we believe we don't need the data to be able
5 to review if something comes in tomorrow.

6 COMMISSIONER CAPUTO: So what safety evaluations is
7 it that you need to have this data by and what's the time frame for that?

8 MS. DIAZ: I think --

9 COMMISSIONER CAPUTO: How far out are we looking?

10 MS. DIAZ: So --

11 COMMISSIONER CAPUTO: More or less, do you have
12 the time you need to develop the data you need if it's not available?

13 MS. DIAZ: I have here Drew Barto from the Office of --

14 MR. BARTO: Drew Barto, NMSS.

15 So critical experiments have been done in the past. This is
16 the kind of data that we are looking for, for criticality code validation.

17 There likely aren't going to be any more done. So as far as
18 that type of data coming down the pike, it doesn't look like we are going to get
19 anymore.

20 So we are in a situation you have more than a thousand
21 critical experiments below 5 weight percent available to you. We are looking
22 at now what's available above 5 weight percent, and that's not to say if there's
23 not as many, which we already know there's not as many, that you can't

1 validate. You can validate. We already have in our NRC guidance methods
2 for extrapolating code bias and bias uncertainty beyond your range of
3 applicability. Necessarily, your margins -- your margins get larger because
4 the uncertainty is larger so there's an option there for how to do that. We also
5 have better computational tools for looking at existing critical experiments and
6 those are the sensitivity uncertainty analysis techniques that have been
7 developed primarily by Oak Ridge National Lab for looking at critical
8 experiments.

9 So there's lots of critical -- some critical experiments in that
10 range that might not look like they are applicable to what we want to license
11 that may in fact be applicable. So we just have to do that work to look at that.
12 But we can -- we can license this now with existing methods for extrapolating
13 beyond the range of applicability for code bias and bias uncertainty.

14 COMMISSIONER CAPUTO: Okay. Thank you.

15 COMMISSIONER SVINICKI: Thank you.

16 Next we will hear from Commissioner Wright.

17 COMMISSIONER WRIGHT: Thank you. Thank you for
18 the discussion today and the preparation. I do agree with your comments
19 earlier, Andrea, that there are a lot of people backing you up and, you know,
20 they are appreciated for what they do.

21 We kind of -- I am probably going to go back into some of
22 this again that's already been discussed to some level and I am going to start
23 with you again, Andrea, and please, Marilyn, if you feel like you need to jump

1 in, jump in.

2 My understanding is that many of the issues we are
3 discussing today, and I think I referred to it in the first panel, for accident
4 tolerant fuel with higher enrichments and burnup will be applicable to
5 advanced reactor fuels that may use the high assay LEU.

6 Can you give me a little bit more detail? Maybe an
7 overview of how you're integrating these efforts and will the resolution of
8 technical and policy issues for accident tolerant fuel with higher enrichments
9 and burnup also apply to and make it easier to license advanced reactor fuels?
10 Can you maybe talk a little bit about that?

11 MS. VEIL: I can start at a high level and then Marilyn may
12 be able to add more for HALEU. But some of the lessons learned that we are
13 getting both in the confirmed reanalysis tools and some of the other knowledge
14 we are getting with assessing some of the accident tolerant fuel technologies
15 are helping us to, number one, gain efficiencies because we don't have the 20
16 years and the benefit of the data that the chairman talked about. So we do
17 have to use innovative techniques to figure out how we are going to license
18 this.

19 In no way are we minimizing safety or trying to take
20 shortcuts in any way. So it's really stretching the staff's capabilities and that's
21 why the PIRTs are so important, and by nature of a PIRT you're getting the
22 experts in the field. So you're going out, getting the people no matter where
23 they are that are experts in the field to do this.

1 So we are working together in a broad -- you know, across
2 agency as a broad project to try to get that information and to help both
3 advanced reactor fuels, code development and it's touching many other
4 aspects of what we do at the agency and I think it's a great example of one of
5 the innovative projects that we are doing to try to move ahead.

6 And as you can see, even the slides don't have the dense
7 words and all the things that you normally see. So we are trying to
8 demonstrate that across the entire project.

9 COMMISSIONER WRIGHT: Right.

10 MS. DIAZ: I would just add that in NMSS we have been
11 following both the ATF and advanced reactor program closely. Some of the
12 same people that are involved in the ATF licensing actions are also involved
13 in the -- preparing the agency for the advanced reactor.

14 So I think I agree with Andrea's statements that we are
15 closely working together towards what we learn in one program can be learned
16 in the other one and we are in close communication with both programs.

17 COMMISSIONER WRIGHT: Okay. Thank you.

18 Mike, you -- and I guess, Marilyn, if you jump in here if you
19 want to, but the Regulatory Issue Summary 2019-03 on preapplication
20 communication scheduling was issued in November 2019. It's my
21 understanding that the RIS contained a list of questions that the addressees
22 could voluntarily respond to within, like, 60 days or something.

23 I am interested in maybe knowing a little bit more about the

1 types of responses you got and has the response been what the staff
2 expected, and how will these responses, I guess, better prepare staff?

3 MR. ORENAK: Some of the questions were such as "what
4 technologies do they intend to submit or intend to apply for," what -- you know,
5 "what topical reports are coming in the future." The responses we have
6 received have been very helpful to us with it comes to scheduling out and
7 when resources will be needed and approximately the times lines going
8 into -- you know, into the license applications.

9 COMMISSIONER WRIGHT: Okay. Thank you.

10 I am going to come over to Mr. Corson here.

11 Very good presentation too, by the way. Thank you. You
12 discussed -- and in the first panel I referred to this when, I think, Mr. Sena from
13 Southern.

14 You discussed a lot of the good work that the staff is doing
15 to improve the codes and models for fuel analysis. In the accident tolerant
16 fuel project plan, it's noted that the staff has no indication that fuel vendors
17 intend to rely on advanced modeling and simulation to support license
18 amendments for near-term concepts.

19 Can you give me a little bit more detail on the benefits, if
20 any, for an applicant to utilize such models for license applications?

21 MR. CORSON: Sure. So I will say the one area where the
22 vendors have talked about potentially using advanced modeling and
23 simulation is in reducing the number of experiments that they need to perform.

1 So what -- I'll say the shortcoming of these advanced
2 modeling and simulation tools, the atomistic scale or mesoscale models, is
3 they are very hard to validate because it's hard to get a lot of the information
4 on, you know, basic properties that you need to validate these codes.

5 So it's hard to rely on them to develop a model that you're
6 actually going to use. But it's very useful in identifying trends in the data. So
7 you could see, you know, maybe at this weight percent of a dopant you might
8 expect this behavior and you might expect it to be better than this other weight
9 percent.

10 So in that respect, I think advanced modeling and simulation
11 could be very useful in sort of narrowing the window of experiments that you
12 need to perform and really targeting those experiments to look at what is really
13 important. You know, what do you really need to measure in order to help
14 you validate your codes.

15 So I would say, you know, none of the vendors are really
16 talking about directly using advanced modeling and simulation in their license
17 applications but they are, I believe, doing some work to help them identify
18 important experiments and important things to measure.

19 COMMISSIONER WRIGHT: Okay. Thank you.

20 Ms. Diaz, I am going to come with you the last -- the last
21 question I've got here, I think.

22 You mentioned that the staff doesn't anticipate needing to
23 make any changes to Part 70, 71, or 72. But they may need to make some

1 changes to guidance. What types of changes to guidance have you identified
2 for the fuel designs that you expect to see in the near term and what is your
3 time line maybe for implementing them?

4 MS. DIAZ: So right now, we believe that Part 70, 71, and
5 72 we won't need any rulemaking or any guidance changes. There has been
6 some recent updates to the guidance for transportation and cladding materials
7 that has recently been issued for high burnup.

8 So that's one we just issued and we believe that the
9 guidance provided in that guidance and other guidance are going to be
10 applicable for what we are expecting in the near-term concepts of ATF.

11 I guess our understanding is as we move forward with the
12 research activities that we are conducting and we are planning to conduct
13 there is going to be and for the criticality literature review and there are some
14 other research activities that will be for the cladding properties.

15 Based on what comes out of those reports and there will be
16 another PIRT on that -- based on what comes out of those reports and PIRT
17 we will know more about what changes to our guidance will be needed for the
18 next step.

19 COMMISSIONER WRIGHT: Okay. Thank you very
20 much.

21 And you're the only one from NMSS up here so, you know,
22 you did a good job. Thanks.

23 COMMISSIONER SVINICKI: Well, I join my colleagues in

1 thanking the staff and all of those who supported their presentations for a lot
2 of great updates and information today.

3 Andrea, you had I think made a comment that the way that
4 the NRC is structuring itself to approach this work is akin to a kind of a matrix
5 organization approach.

6 Historically, NRC has made it somewhat cumbersome
7 sometimes to assign individuals to work and we were a little more stove-piped
8 in the way we were approaching things.

9 I've long been an advocate for kind of cross-functional multi-
10 disciplinary teams, given the complexity of the type of work that we do.

11 Should I draw from your statement, Andrea, that in your
12 observation we are getting a little bit more agile as an organization to have
13 this kind of a -- getting the capacity to the work no matter where people are
14 assigned in the organization?

15 MS. VEIL: Yes, I would make that conclusion because I've
16 seen it in other areas as well. We are not encumbered by bureaucracy or
17 hierarchy.

18 If I need to, you know, reach out to Mike I reach out to Mike.
19 I don't have to reach out to his division director or deputy or branch chief.

20 So I've seen this model work well, particularly in this project.
21 But I am also seeing it in other projects as well. So I think the needle is
22 moving.

23 COMMISSIONER SVINICKI: Thank you very much.

1 That's encouraging. And I know when we saw that post-Fukushima and we
2 had some difficulty in getting staff on all the analysis and review work we had
3 to do, I think we acknowledged the problem at that stage so it's good to hear
4 that we have moved the needle away from some of that, which is classic, you
5 know, where you're kind of doing something to yourself. So it's good that we
6 have worked on that.

7 Can someone on the panel just briefly give an overview of
8 how the Advisory Committee on Reactor Safeguards is involved in this work
9 and at what points? How is the staff structuring its engagement with the
10 ACRS?

11 Josh, please.

12 MR. WHITMAN: Yeah. So it depends on exactly -- okay.
13 So the -- for the ISG we had a subcommittee meeting with the ACRS to go
14 over that. That's part of the ISG process is going through the ACRS.

15 We have also had additional ATF-ACRS meeting -- I think
16 at least one, maybe two -- where we have gone over the project plan. And
17 then for the near-term concepts that we expect submittals in the very near
18 future I think we are all anticipating that the ACRS would like to see those.
19 And so we are kind of scheduling into our review time that.

20 COMMISSIONER SVINICKI: Okay. Thank you.

21 And since you mentioned the project plan, I noted that when
22 you all became aware that the higher burnup and higher enrichment stuff was
23 going to emerge maybe a little sooner than you thought you did the Appendix

1 A update to the project plan.

2 Is that your conceptual approach, going forward, is maybe
3 a series of appendices to the project plan or do you consider the project plan
4 the basic structure of your approach and you wouldn't really need to revise
5 that or update it? Do you have any concept?

6 Yeah, Mike?

7 MR. ORENAK: We look about every six months to update
8 the project plan for current events and so, yeah, if we do have -- if we have a
9 need for a new appendix or update the project plan we will go ahead and do
10 it at the time.

11 COMMISSIONER SVINICKI: Okay. So both the plan
12 itself but you can also supplement it through appendices. Thank you.

13 MR. ORENAK: Yeah, because in the last -- yeah, in the
14 last revision we did a few revisions just for updating the completion of
15 activities, and if we need something larger, yeah, then we will add a new
16 appendix to it.

17 COMMISSIONER SVINICKI: Okay. On the previous
18 panel there was a description of perhaps some industry suggestion that the
19 staff maybe confine its regulatory reach into the fuel manufacturing process
20 parameters and it was indicated by the panelists that the staff had not adopted
21 that suggestion.

22 I wasn't really following that but it raises a kind of an
23 interesting point. Could one of you talk very generally about the engagement

1 in terms of the actual manufacturing process, you know, of this fuel?

2 What kind of considerations, how active are you in terms of
3 any maybe restrictions or limits or qualifications and things you want in that
4 area? Just at a very high level. I realize it could be very detailed.

5 MR. WHITMAN: Yes, I'll try and be pretty brief.

6 The current fuel relies on ASTM standards for a lot of their
7 testing. And so the NRC has the ability to go and inspect those processes
8 and they have something to inspect it against.

9 There was a comment on the ISG that requested that some
10 language be added that the NRC would not, I guess, regulate the
11 manufacturing process. I forget the exact terminology.

12 And it was based on the fact that in the PIRT there's some
13 discussion about certain material properties where it might -- you know, there's
14 some background on all those material properties in the list and it says, you
15 know, this material property may be particularly affected by the coating
16 application process.

17 And so I think there was some sensitivity that they don't
18 want -- they didn't want us to go in and --

19 COMMISSIONER SVINICKI: Kind of like design the actual
20 application of a coating and what kind of nozzle would do it and things.

21 MR. WHITMAN: Exactly.

22 COMMISSIONER SVINICKI: Like, they didn't want the
23 specification to go there.

1 MR. WHITMAN: And I think it would have been premature
2 for us to say hands down we are not going to ever look at that because the
3 vendor needs to define what coating they want to approve and for the current
4 process, you know, it's a zirconium alloy.

5 They talk about the alloying elements and the different
6 impurity levels that are allowed, and that's all stuff that can be inspected and
7 can also be inspected against the ASTM standard.

8 With something like the coatings where there is no standard,
9 you know, it's up to them to define that and if it turns out that they need to use
10 a very specific nozzle to get this performance and without that nozzle they get
11 completely different performance, then they may need to use that in their
12 topical report as a way of defining that coating.

13 I don't think that's going to be the case. But it didn't seem
14 appropriate to remove that possibility at the ISG.

15 COMMISSIONER SVINICKI: Okay. That's very helpful.

16 Dan, did you want to say something?

17 MR. DORMAN: Yeah, just briefly, at a little bit higher level.

18 So the Commission regulates the fabricator of the fuel for
19 the safety of the public around that facility and the workers at that facility.

20 Separately, we regulate their customer, the reactor. And
21 through the reactor's quality assurance plan, they regulate their vendors.
22 And I think what Josh was touching on is the standards for what they are
23 regulating on this safety-related component we have clear standards for the

1 existing fuel. There are not consensus standards for the next generation of
2 fuel, and that's where this discussion is happening.

3 COMMISSIONER SVINICKI: Thank you. That's a very, I
4 think, helpful discussion and clarification about that.

5 James, you talked about -- it was a very interesting
6 discussion about the confirmatory analysis tools and you had a slide where I
7 think you said, you know, the materials properties were kind of jumbled up
8 inside. It was a gear. It was all kind of baked in there. And now we have
9 materials properties libraries and things so you can do a more stylized kind of
10 confirmatory analysis.

11 You also mentioned, though, the importance of, you know,
12 validation when you alter the machinery in that way and you kind of say well,
13 you're going to draw all these properties from a library instead of having them
14 invoked in some other way within the model itself.

15 So we have at NRC -- are we documenting, though, the
16 validation process when we go through that? Because I know often it's very
17 helpful if analysts later -- 10 or 15 years later can have insights into how you
18 validated that what you thought the model was analyzing it was actually
19 analyzing once you made this type of change.

20 Can you talk a little bit about how we document that for the
21 future?

22 MR. CORSON: Sure. So I was talking about this in the
23 context of our FAST code, and FAST is a combination of our older FRAPCON

1 and FRAPTRAN code.

2 So FRAPCON and FRAPTRAN this is where things are sort
3 of jumbled together, and we have validation documents for both FRAPCON
4 and FRAPTRAN. They are available on our website for the
5 FRAPCON/FRAPTRAN codes.

6 So you can see the sorts of experiments that we are using
7 to validate our codes for various models' integral data. We will have that
8 same sort of document when we release FAST to the public -- not to the public,
9 to our user group -- in the next month.

10 So you'll see that same sort of validation and you should see
11 that the results haven't really changed after we have removed these material
12 properties for the existing properties.

13 Now, when we start to add new materials then we would
14 need to do -- we would need to essentially append this assessment document
15 to say it's also valid for these fuel types.

16 So right now, the -- of course, the assessment document
17 focuses primarily on UO2 Zirc up to a certain burnup. But I believe there will
18 also be test cases for metallic fuels that are used in, like, advanced reactors.

19 So you'll see, you know, how some of those things have
20 been added to FAST once we have, you know, updated the codes.

21 I hope that answers your question.

22 COMMISSIONER SVINICKI: Yes. Thank you. That
23 is -- that's very helpful.

1 And with that, I will turn to Commissioner Baran.

2 COMMISSIONER BARAN: Great. Thanks. Well, thank
3 you all for your presentations.

4 It sounds like industry is really heading in the direction what
5 ATF of higher enrichment, higher burnup fuel. So I have some questions
6 about that.

7 I know that the chairman noted that, you know, when you
8 look at the project plan there's actually an appendix just focused on that. I
9 don't know if that means the appendix has taken over the entire plan at this
10 point. But it sounds like maybe it has.

11 Starting kind of at the beginning of the time line, if we think
12 about lead test assemblies, I am going to just ask these questions to the whole
13 panel and whoever wants to answer can jump in.

14 Will lead test assemblies for accident tolerant fuels with
15 higher burnup or enrichment beyond 5 percent require NRC approval through
16 license amendment requests?

17 MR. WHITMAN: So, in general, it's sort of contingent on
18 the licensee to go through their 50.59 process and determine when a license
19 amendment is needed for any change of the reactor, not just LTAs.

20 But, you know, we provided the LTA guidance letter to help
21 make clear the agency's position on the use of 50.59.

22 So I don't want to say that there's -- you know, basically, we
23 wrote a letter that said, you know, here's how you make the decision. So I

1 don't want to make the decision myself.

2 But I would say that, personally, it would be difficult for me
3 to fathom a insertion of a higher enrichment LTA that would meet the guidance
4 and be allowed to be inserted without a license amendment.

5 MR. DORMAN: And it would require an exemption to
6 exceed the 5 percent. So they would need that prior approval.

7 COMMISSIONER BARAN: Okay. And then if we kind of
8 move forward a little bit to batch loading and the regulatory framework for that,
9 the staff's project plan discusses how higher burnup and higher enrichment
10 ATF might not fit into some of the current regulatory requirements including
11 those for emergency core cooling systems, accident source term, criticality
12 accidents and ALARA. There were others, too.

13 With respect to in-reactor performance and approval to
14 batch load ATF with higher burnup enrichment in reactors, it sounds like
15 changes to the regulations are probably going to be needed. But it also -- the
16 project plan also talks about near-term applicants needing to request
17 exemptions and demonstrate compliance with safety requirements.

18 And I guess as a little bit of follow-up to some of the
19 questions that Commissioner Caputo was asking, but I guess I am struggling
20 a little bit with what the right regulatory framework is for this.

21 Do we want to have -- do we want to go the rulemaking route
22 and have an actual regulation in place for ATF with higher burnup, higher
23 enrichment? Or are we satisfied with an exemption approach, at least in the

1 early years? Do folks have additional thoughts on that?

2 MS. VEIL: I'll start at a general level and then Josh may
3 want to add some detail.

4 For rulemaking, I would struggle with saying to what
5 percent. It's the "unknown unknowns." If you go down the path of
6 rulemaking you're assuming there's widespread adoption of ATF. So are you
7 rulemaking to an absolute limit 10, 20 percent? Are you rulemaking to 5.4
8 percent?

9 So we would need to know more about adoption, potentially
10 benefit to margins that applicants or licensees are going to ask for, and we are
11 looking at this time frame.

12 Right now if we were to try to engage in rulemaking
13 for -- let's say, for chromium coating, which is not needed at this point, it would
14 be a bit like taking a hammer to -- you know, to hit a gnat.

15 We have the Interim Staff Guidance and we are prepared to
16 license chromium coated. So the exemption was the more feasible and more
17 durable way to handle chromium coated right now.

18 But that's why we are assessing rulemaking because, as
19 Commissioner Caputo pointed out, some of the more exotic -- and the
20 chairman also said some of the more exotic technologies if we get an idea that
21 there's apparent widespread adoption then that may require rulemaking.

22 MR. WHITMAN: Yeah. So I guess there's two places
23 where exemptions may be needed in the near future. One would be for a

1 different coating. There may be the need for 50.46 exemptions.

2 But for the 50.68 exemptions, I do think we -- the 50.68 rule
3 which limits plants to loading less than 5 percent enrichment into their spent
4 fuel pools.

5 I think we do intend to regulate through an exemption at the
6 beginning before determining whether there's going to be widespread
7 adoption and worth the resources to invest in new rulemaking for that.

8 COMMISSIONER BARAN: I mean, does the -- you know,
9 it sounds like that the time frame involved is kind of slipping, potentially, from
10 2023 to more like 2025 and it sounds like there's a shift really from regular
11 ATF to, you know, maybe exclusively high burnup high enrichment.

12 Does that affect the way you look at whether rulemaking
13 makes sense? I mean, it potentially provides additional time.

14 Even if you didn't get all the way to final the documents that
15 you're creating for that rulemaking process, which actually includes some
16 public involvement, exemptions don't, you know, reg basis proposed rule
17 those documents would be, presumably, quite helpful to your technical
18 reviews of applications that were to come in even if their rule weren't final by
19 then.

20 I mean, does that -- does the kind of changing time frame
21 and the changing nature of what's coming in, you think about this issue?

22 MR. DORMAN: I would offer I think about it the other way.

23 COMMISSIONER BARAN: Okay.

1 MR. DORMAN: The -- so the nearest term appears to be
2 a chromium-coated at some level of enrichment above 5 percent.

3 And through the -- through the lead test assembly data,
4 through criticality benchmark data, through all the data that will be gathered to
5 provide a technical basis to support the exemptions needed to place that fuel
6 in a batch in a reactor to provide some alternative to 50.46 for ECCS
7 performance criteria for that, we are going to learn a lot through the process
8 that would help us informing the regulatory basis for a subsequent rulemaking.

9 If we wait for the -- for all the data and get the regulatory
10 basis and go through the rulemaking process, we are not going to -- we are
11 not going to get there in that time frame, number one.

12 I think, number two, I think that, you know, then we are
13 deferring the licensing until after we get through a rulemaking process and I
14 don't think that's necessary for us to be able to reach safety conclusions about
15 specific applications.

16 COMMISSIONER BARAN: I wanted to ask about an issue
17 that Commissioner Wright actually mentioned with the first panel, which is that
18 the project plan suggested that NRC's existing license renewal generic
19 environmental impact statement might not adequately address the
20 environmental impact of higher burnup higher enrichment ATF.

21 Can someone walk through that issue in a little bit more
22 detail?

23 MR. ORENAK: Right now, whenever we are developing

1 the licensing roadmap when it comes to Generic Environmental Impact
2 Statement, we are going to be reviewing what's going to be needed for high
3 burnup and increased enrichment.

4 I know currently right now that the staff is reviewing at least
5 for license renewal and are aware of ATF issues for the -- for the next revision
6 of the -- to the GEIS.

7 COMMISSIONER BARAN: So is this -- I mean, is this kind
8 of an open question about for the purposes of licensing, you know, ATF in the
9 near term whether -- is there an open question about whether a GEIS
10 adequately covers this or there's going to be additional environmental
11 information that would need to be provided by an applicant?

12 MR. ORENAK: Right now, I think it's an open question.

13 COMMISSIONER BARAN: Okay. And what is it going to
14 take to answer that question? We have to see what people submit or there's
15 analysis going on of the existing environmental impact statement and what it
16 does or does not cover?

17 MR. ORENAK: I think we are going to have to see what
18 the licensees submit.

19 MR. DORMAN: And it will need to look at, okay, the
20 changes in the material properties and the associated impacts on effluence
21 and inputs that would go into the Environmental Impact Statement. Are they
22 bounded by what's already in the GEIS or would there be some other
23 environmental considerations that need to be addressed in that licensing

1 process, whether it's through an EA or a modification of a supplemental --

2 COMMISSIONER BARAN: From kind of a regulatory
3 certainty point of view, I guess our communication then is to a potential
4 applicant you, yourselves, are going to need to analyze whether or not what
5 you have bounded by --

6 MR. DORMAN: And we need to -- and we need to continue
7 in these collaborations and the engagements with stakeholders as they
8 develop the data from LTAs and from other sources to understand that as well,
9 going forward.

10 COMMISSIONER BARAN: Thank you.

11 COMMISSIONER SVINICKI: Anything further? No?

12 Well, again, I want to thank the NRC staff and also the
13 previous panel as well. I think this was a great update.

14 Commissioner Baran and I were saying in the back we didn't
15 realize it had been almost two years, but I think this was a very timely update
16 and there is really an impressive amount of activity and work that's been done
17 in the interim.

18 So I thank you all and, with that, we are adjourned.

19 (Whereupon, the above-entitled matter concluded at 12:00
20 p.m.)