UNITED STATES

NUCLEAR REGULATORY COMMISSION

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MEETING

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THURSDAY,

FEBRUARY 11, 2021

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The Commission met via Video Conference, at 9:00 a.m. EST, Christopher T. Hanson, Chairman, presiding.

COMMISSION MEMBERS:

CHRISTOPHER T. HANSON, Chairman

JEFF BARAN, Commissioner

ANNIE CAPUTO, Commissioner

DAVID A. WRIGHT, Commissioner

ANNETTE VIETTI-COOK, Secretary of the Commission

MARIAN ZOBLER, General Counsel

EXTERNAL STAKEHOLDER PANEL:

WAYNE NORTON, President and CEO, Yankee Atomic Electric Company

RANDY STARK, Director of the Fuels, High Level Waste and Chemistry,
Electric Power Research Institute

ROGER MAGGI, Chief Commercial Officer, Orano TN

DR. KRIS SINGH, President and Chief Executive Officer, Holtec International

DONNA GILMORE, Founder, SanOnofreSafety.org

DR. DAVID VICTOR, Chairman, Community Engagement Panel

NRC STAFF:

ANTHONY DIMITRIADIS, Chief, Decommissioning,
Independent Spent Fuel Storage Installation,
and Reactor Health Physics Branch, Region I

MARGARET DOANE, Executive Director for Operations

ROB LEWIS, Deputy Director, Office of Nuclear
Materials Safety and Safeguards

JOHN MCKIRGAN, Chief, Spent Fuel Storage and
Transportation Licensing Branch, NMSS

CHRISTOPHER REGAN, Deputy Director, Division of Fuel
Management, Office of Nuclear Material Safety
and Safeguards

RICARDO TORRES, Materials Engineer, Office of
Nuclear Regulatory Research

P R O C E E D I N G S

(9:00 a.m.)

CHAIRMAN HANSON: I convene the Commission's public meeting for the purpose of discussing the NRC's regulatory framework for dry cask storage and transportation of spent fuel and related research activities.

This is my first public commission meeting as chairman. It's an honor to be given the opportunity to serve the country in this role and a huge privilege to work with my colleagues on the Commission and the NRC staff.

I want to thank Commissioner Baran for proposing this meeting topic and I look forward to hearing the valuable insights from our panelists during the discussion today.

I'd also like to note that we are all virtual this morning, I think the first public Commission meeting to be conducted this way, in this case thanks to a little winter weather here in the Washington area, and I'd like to recognize and thank Secretary of the Commission Annette Vietti-Cook and her staff for their hard work in making all of the technology work this morning.

We'll hear from two panels. First to present are participants in our external panel. Following that, we'll have a short break, and then we'll hear from the NRC staff.

With each panel, we will hold questions until the end, and then we'll hear questions from the Commissioners for the panel, but before we get started, I'll ask first if my colleagues have any remarks they'd like to make.

COMMISSIONER BARAN: Mr. Chairman, I just want to take a moment to congratulate you on chairing your first Commission meeting, and as

you mentioned, the first even all virtual --

(Audio interference.)

CHAIRMAN HANSON: Thank you, Commissioner Baran. I appreciate that. It's a team effort and it's a real privilege and pleasure to work with such great colleagues.

COMMISSIONER CAPUTO: Chairman Hanson, I'd also like to add my comments and congratulations to your new capacity --

(Audio interference.)

CHAIRMAN HANSON: Thank you very much for that.

COMMISSIONER WRIGHT: And not to be left out, so Mr. Chairman, it's been -- you know, I knew you before you came to the Commission. I've really enjoyed getting to know --

(Audio interference.)

CHAIRMAN HANSON: Thank you, Commissioner Wright. I appreciate that. You and I are long overdue for a breakfast at the Waffle House when things open up back again. It's been too long.

COMMISSIONER WRIGHT: Amen.

CHAIRMAN HANSON: So, with that, we will begin our external panel. Each panelist will have seven minutes to present. This meeting is being transcribed, and therefore we need to be mindful not to talk over each other during the presentations or during the Q&A session.

I intend to proceed in the order in which you all are listed on the public notice for this meeting, and we'll begin with Mr. Norton, who is President and CEO of the Yankee --

(Audio interference.)

MR. NORTON: Thank you, Chairman Hanson and Commissioners Wright, Caputo and Baran for the opportunity to appear before you today. I am the President & CEO of Yankee Atomic Electric Company with responsibility for the Yankee Rowe, Connecticut Yankee and Maine Yankee sites - three New England single asset nuclear power companies that permanently shut down their power plants in the 1990's and were decommissioned over the next decade.

I also Chair the Decommissioning Plant Coalition (DPC) Steering Committee. My background includes managing all three companies in the decommissioning of their plants; site restoration; transition to ISFSI only; and ongoing ISFSI dry storage operation and maintenance.

(Audio interference.)

-- and the site restoration photo should look familiar to Commissioner Wright. He graciously accepted an invitation to tour our facility and was there with staff following our 2018 inspection campaign for our TSCs at Maine Yankee, but I just want to thank him for visiting and his staff for attending the site to get a firsthand experience of what an ISFSI operations is and looks like. Next slide, please?

Matters of interest related to dry storage sites, I've identified a couple here, decommissioning, risk-informed regulation, dry cask storage and aging management, NRC inspections, and the present COVID response challenges that we deal with. Next slide, please?

On the matter of decommissioning, you know, throughout the

decommissioning, the Yankee experience demonstrated a successful risk-informed process that resulted in exemptions based on safety significance going through the transitional phase of shutdown into decommissioning.

These exemptions are generally recognized today as the exemptions that the industry goes through to try to affect that phase of transition and risk reduction from shutdown through moving fuel to dry storage and the resulting impact on the regulatory requirements associated there with.

Based on industry performance, the NRC's decommissioning rule as such should focus on regulatory requirements involved in the transition from shutdown through decommissioning and reflect the significant reduction level of risk involved.

The Commission should also ensure that the sites undergoing decommissioning and reaching standalone ISFSI like mine have the regulatory basis that aligns with those that have preceded it in that process.

One other note is following completion of decommissioning, the continued application of Part 50 regulations is inefficient and should be addressed to better align with the appropriate provisions of Part 72 and Part 73 as it relates to ISFSIs.

I will note that the existing decommissioning rulemaking that is, you know, in front of the Commission was intended to do just that, and to a large extent, has accomplished that if it moves forward as contemplated. Next slide, please?

On risk-informed regulations, this little motherhood and apple pie appreciate that, but efficiency in dry cask storage and transportation

processes is assured by consistent, predictable, and risk-informed regulation.

Decades of experience and research that have been undertaken to date confirm the safety and low risk of spent fuel in storage and during transportation.

I did note, or should note, that there's several other panelists on this panel here with me and later with the staff that certainly can expand on all of that with much more detail that I can.

Accordingly, the Commission should assure that any new rulemaking or guidance reflect the low risk to the health and safety of the public associated with spent fuel storage and transportation. Next slide, please?

Dry cask storage and aging management. New inspection tools and aging management programs have been successfully integrated into the CofC and site-specific relicensing activities.

As I mentioned earlier, we've incorporated those aging management programs and tools at the three Yankees and have commenced TSC inspection at our sites, the most recent of which was a fuel canister at Maine Yankee in 2018, with one to come at Yankee Rowe and then subsequently Connecticut Yankee.

I'll also note that the recent alignment and guidance between the NRC and the industry as you can see here with the Reg Guide and the NEI-14-03 is a noteworthy positive and a continued move in the direction of alignment across the board in that area.

We look forward to the issuance of the NRC inspection process for aging management programs at ISFSIs. As I mentioned, we're already in the

process of implementing an aging management program, so ensuring alignment with our program sooner rather than later is appropriate. So, we look forward to the NRC's issuance of those inspection processes. Next slide, please?

On the matter of NRC inspections at ISFSIs, the NRC ISFSI inspection program enhancement working group effort recognized the lower risk to ISFSI sites.

As such, the NRC should ensure that traditional inspections and enforcement at ISFSIs continue to align with the risk-informed regulatory approach.

I apologize. The first drafting of this as you can see here said it should be better risk informed. I think that's a carryover from an earlier draft. I was not trying to identify an issue there. That's probably an artifact from a CY inspection issue that we have that Tony Dimitriadis is very familiar with, but I'd like to correct myself there and acknowledge that error.

The NRC should ensure the traditional inspection and enforcement of the ISFSIs continue to be risk informed and updated based on appropriate OE experience.

The practices and experience of the remote inspection that the NRC undertook during the pandemic at operating reactors could lead to more efficient and cost-effective inspection practices for our sites. I think that's an initiative that should be pursued going forward. Next slide, please?

Are we on the COVID response? On the COVID response, I just want to take the opportunity to thank in person the NRC staff for their efforts during this pandemic.

The process was timely, efficient, and effective without compromise to safety and security at our facilities. It was largely focused, at least at the ISFSI sites, on ensuring minimum staffing requirements for security and other personnel.

The effort to develop regulatory compliance strategies and processes was extremely important in ensuring our sites could meet the numerous challenges presented by the pandemic, and I believe that several NRC public meetings associated with those efforts helped reassure our stakeholders that those challenges were being met, so thanks again for that. Next slide, please?

In conclusion, the recent steps taken in risk informing the NRC's regulatory programs for dry cask storage and transportation have enhanced efficiency without diminishing safety margins.

We urge the Commission to continue to reflect on the low safety significance involving those programs in its future rulemaking and guidance documents, particularly with regard to aging management programs, and the ISFSI inspection process for aging management programs, and the CofC renewals.

Industry has demonstrated that the existing regulations, coupled with compliant execution and routine NRC inspections, results in safe and secure decommissioning and spent fuel storage. As such, regulatory changes should be thoughtful, risk informed, and geared towards efficiency. Next slide, please?

And with that, I thank you for your attention. I'm willing to

answer any questions that I can.

CHAIRMAN HANSON: Thank you, Mr. Norton, for that presentation, and next we'll hear from Mr. Randy Stark, Director of Fuels, High Level Waste, and Chemistry at the Electric Power Research Institute. Mr. Stark?

MR. STARK: Thank you, Mr. Chairman. Good morning and thank you for inviting me to this panel discussion. My name is Randy Stark and I'm the Director of Fuels, High Level Waste, and Chemistry Department at EPRI.

For those of you not familiar with EPRI, we are an independent nonprofit research organization with a mission of advancing safe, reliable, affordable, and environmentally responsible electricity for society through global collaboration.

I'm going to focus today's talk on the research that EPRI has done to support extended dry storage of spent fuel. Slide two, please?

Okay, one way to look at the research that we've done is from the standpoint of defense in depth, and what I'm going to do is focus on three areas and sort of work from the inside out where EPRI is doing research pertaining to extended storage.

I'll start with the fuel cladding, the cladding that houses the fuel. EPRI has done R&D to look at fuel cladding integrity during extended storage and transportation, most recently looking at high burnup fuel.

The next part of my presentation will focus on dry storage canisters. EPRI's research here has focused on informing the aging management programs for these canisters.

And finally, I'll talk about some of the ongoing work that we're doing now looking at emerging technologies to gain more information on the condition of dry storage systems. Slide three, please?

Okay, starting with the fuel. First of all, I'd like to define a couple of terms. The first is burnup. Burnup is the amount of energy that's produced during operation by the fuel. It's measured in gigawatt days per metric ton of uranium.

The second term I'd like to define is high burnup. So, you hear about high burnup, which is defined as burnups greater than 45 gigawatt days per metric ton uranium.

And over the last several decades, there's been changes in the industry such as power up rates, longer fuel cycles, higher capacity factors, and more efficient use of fuel that have resulted in higher burnups. Most of today's fuel is now considered high burnup fuel.

Why that's important is we have a lot of data and operating experience from low burnup fuel, and the question that was raised was were there any extended storage issues that we need to consider for high burnup fuel?

So, in 2013, EPRI started an R&D project collaborating with the Department of Energy to study high burnup fuel during extended storage. The objective of the project was to take high burnup fuel, place it in an NRC licensed dry storage cask for a period of approximately ten years, and instrument it and measure, get data, real time data on the high burnup fuel.

So, this high burnup fuel was initially loaded in November 2017 at North Anna Nuclear Generating Station. It's instrumented so we can take

periodic measurements of the fuel, and so far what we've learned from this project is, number one, there's more margin than we originally thought.

The temperature of the fuel as measured going into the dry storage is much lower than the licensing calculations. This was a significant finding because temperature is a primary driver to many potential degradation mechanisms on the fuel. Lower temperatures result in more margin.

In addition to these lower temperatures, we've also seen no issues with the high burnup fuel from the periodic measurements that we've done over the last roughly four years. It's behaving in a similar fashion as the low burnup fuel.

The plan is to continue to monitor this fuel for about ten years and then we're going to transport it to a hot cell to open and collect data on the fuel after storage.

The bottom line from the data to date on this project is that it continues to show that high burnup fuel is more robust than originally understood and that margin exists. Next slide, please, slide four?

Okay, now I'm going to turn my attention to the stainless steel canisters and, you know, EPRI and the industry has a proven track record in many areas within a nuclear reactor that having a robust aging management program is a great way to manage potential aging mechanisms and components. We've seen it on the reactor side in primary and secondary components in both boiling water reactors and pressurized water reactors.

When I talk about a robust aging management program, it includes the following components, inspection. You need to have reliable

demonstrated techniques to find the most significant indications in the most susceptible locations, and EPRI has worked with inspection vendors to demonstrate these inspection techniques and there have now been several successful campaigns completed.

So far, stress corrosion cracks have not been found, but we expect to see much more data in the next few years as many plants will be doing their initial exams.

Once you've developed an inspection program, the next part of aging management is assessment. If you were to find an indication, what is driving that indication, how flaw tolerant is the component, what are the crack growth rates and things like that, things that you need to do to assess the condition of the component, and we are in the process of developing those crack growth rates and flaw tolerance results.

The next part of aging management is mitigation. Are there things that you can do to reduce the susceptibility of the degradation mechanism? What you see on the slide here on the bottom is laser peening.

Laser peening is a technique that's been used in light water reactors to mitigate stress corrosion cracking. It puts a compressive stress on the surface of the component.

One of the things that you need for stress corrosion cracking is a tensile stress, something to drive the crack, and if you can put a compressive layer on there, it removes the susceptibility to stress corrosion cracking.

The final thing you need in an effective aging management program is repair techniques and, you know, can you repair a flaw before it

becomes critical? And we are looking at various techniques. You can see there a cold spray repair is one of the techniques that we're looking at.

The bottom line here is that EPRI believes that having a robust aging management program is a good way to manage components and the industry has a proven track record developing and implementing aging management programs, and we believe that the industry will be successful implementing these for extended storage. Next slide, please?

Okay, the last slide, I'm not going to spend a lot of time on, but we are in the process of developing technologies such as remote wireless sensors. The idea here is to be able to get real time data may give some greater operational flexibilities and there is some potential for less regulatory burden with direct measurements.

So, we are looking at this and trying to see if we can reliably measure data such as temperatures and whether these sensors will be reliable over an extended period of time. Next slide, please?

And just to summarize my talk, I've walked through the idea of extended storage from a defense in depth standpoint. Really from the inside out, we are seeing no discernible differences in high burnup fuel from low burnup fuel, and in fact, there is more margin that exists due to the lower temperatures.

We believe that a robust aging management program is a good way to manage the potential aging mechanisms of the stainless steel canisters and the components for these, this aging management program are either already demonstrated or are close to being demonstrated.

And finally, we think there are more technologies that may be

available in the future to provide more data. The bottom line here is that our research shows there is margin to ensure safe extended storage to use in the nuclear fuel. Thank you.

CHAIRMAN HANSON: Thank you, Mr. Stark. Next, we'll hear from Roger Maggi, Chief Commercial Officer at Orano TN. Mr. Maggi?

MR. MAGGI: Thank you, Chairman Hanson and the Commissioners for this opportunity to address the Commission and share my thoughts on dry storage and transportation of spent nuclear fuel. Next slide, please?

So, Orano transforms nuclear materials so they can be used to support the development of society, first and foremost in the field of energy.

The Orano group offers products and services throughout the entire nuclear fuel cycle from raw materials to waste treatment, and our activities from mining to dismantling, as well as in conversion, enrichment, recycling, logistics, and engineering contribute to the production of low carbon electricity. Next slide, please?

So, in 2015, the NRC requested that the ASME Section 11 standards committee establish rules for the in-situ in-service inspection of dry storage systems for spent nuclear fuel.

ASME Section 11 rules for in-service inspection of nuclear plant components had been the basis for operating reactor inspections, and those proven methodologies would now be the basis for consensus guidelines for the inspection of used nuclear fuel storage systems.

In parallel to this effort, NUREG-1927, Rev. 1 was established

to provide guidance for the renewal specific licenses and certificates of conformance for dry fuel storage systems, including the requirement for aging management programs.

NEI-14-03 further defined learning aging management programs that directed the licensees to look outward and understand what is happening with other storage systems, industry operating experience, and research to aggregate the growing knowledge base into a living program that can adjust to new information. Next slide, please?

So, leading into or immediately following the 20-year anniversary of the loading of a dry fuel storage system, the in-service inspection regime commences with qualified visual examination of the structures, systems, and components identified by the license AMPs.

Canister surfaces, support structures, overpacks, transfer casks, and ISFSI pads are inspected based on the applicable codes looking for evidence of the identified potential degradation mechanisms. For this discussion, we'll focus on the canister itself. Next slide, please?

So, initial inspections performed several years ago relied on robotic crawlers that entered the overpack from the bottom in the case of our horizontal system and they scanned up to view the support structures, concrete walls, and as much of the canister as could be seen from below. This did provide evidence of whether there was a concern for degradation, but direct visual of the full canister was somewhat limited.

Due that the canisters are stainless steel, there would need to be new crawler types developed which is also small enough to work in the tight

confines of the overpack.

So, recently a suction-based crawler has been developed through cooperation with EPRI, Robotic Technologies of Tennessee, and Orano to be able to allow for the full VT3 and VT1 qualifying visuals of a loaded canister.

So, if you look at the slide on the left, that is an image of that crawler that is deployed onto a canister, and it's a stainless steel canister and that crawler is a suction-based crawler, and it has access to the full circumference of the canister.

So, in 2020, there were three inspections performed with the system at three different TN NUHOMS sites, at Davis-Besse, Oconee, and Susquehanna.

After inspecting over 95 percent of the canister surface, there were no indications of any degradation, no indications of corrosion, which is the key that we were looking for to catch any early signs of potential chloride-induced stress corrosion cracking.

Chloride samples were taken at two of the sites that screened for the need to take samples. The Oconee site did not screen for the need to take samples, and those samples were analyzed by the Sandia Labs with the results of those samples, and all of those inspections uploaded to AMID, which is the industry database for aggregating all of this information. Next slide, please?

So, what if you do find something? In the very highly unlikely event that we do find something that has advanced enough that it requires further characterization beyond what a visual test can tell us, what do we do?

So, in preparation for the late 2021 exam at San Onofre, we'll be inspecting a sample, the horizontal TN NUHOMS systems that are coming up on their 20-year license renewal period.

San Onofre proactively reached out to TN to finalize the development of a robotic inspection tool capable of full volumetric examination of areas of interest that had been identified by the visual examination of the canister. This tool would only be used in the event of a failed visual exam.

So, we would go in with the same robotics shown previously, perform the visuals, and if there is an area of significant corrosion that needs to be examined for the possibility of any pitting or cracking, this system would be deployed with the full capability for additional visual testing, ultrasonic testing, and eddy current testing, and also contains a cleaning capability which would be required in order to, you know, further examine an area of interest.

In the center, that is a modeling of a tool that is now being developed that will also be deployable. It will be tested this year and it will be available to be deployed if necessary for the SONGS inspection. That is a cold spray module for mitigation of corrosion.

A little bit about the images, in the upper left, you actually have the lower half of the shielding, which is a heavy steel shield, and it's also filled with water for neutron shielding.

As the canister is extracted, on the right-hand side you'll see the canister would be extracted into the transfer cask as it is normally loaded and unloaded from an overpack.

It will pass through, you know, the shielded area, and then we'll

be able to deploy the inspection tools to the area of interest to perform the inspection. Next slide, please?

So, at the site's corrective action program, if you do have a flaw that is identified, it will enter the site's corrective action program, and if, through that process, there is a mitigation that is recommended, then again we'll deploy the inspection ring, you know, to perform that mitigation.

So, the case study for mitigation, this test component you see in this slide is referred to as the bookend coupon, and this was actually from the demonstration test that was performed in 2020 on the vertical systems that are currently at SONGS, so this sample was also witnessed by the NRC during that test.

So, the substrate is 3/16 stainless steel and the coating is nickel, which represents the canister material and the coating that's qualified at SONGS.

So, this test of the BRC metal systems process delivered by an RTT magnetic crawler on the heated vertical system. SONGS contracted Orano TN to perform the commercial grade dedication to ensure that all critical parameters were adhered to.

As you can see, the objectives were met reflected by the porosity analysis and adhesion and tensile strength results. The same testing will be performed prior to the 2021 exams of the TN NUHOMS systems at SONGS utilizing the TN inspection ring to deliver a cold spray mitigation module. Next slide, please?

So, moving onto, you know, interim storage, it's not ideal.

Obviously, we'd like, along with the rest of the industry, to see a permanent repository, but for the next several decades while that's being worked on, interim storage is a better option than the disparate storage facilities that we have across the country.

With the approval of the license for the CISF, it's possible to reduce the footprint of several standalone ISFSIs in the next few years. With defueling and accelerated decommissioning going on at several sites, it's possible to consolidate the spent fuel inventory for more than 15 sites this decade.

Removing the fuel from decommissioned sites and returning those sites to greenfield status is a responsible step to take for the overall environment.

Having all such fuel in one or two isolated interim storage sites will allow focused control and management, and is a safer scenario than having the fuel geographically dispersed. Next slide, please?

So, in transportation, I wanted to note to the Commission that in 2020 at the Vermont Yankee decommissioning project, there have been two of eight shipments that have been completed using a Class B package, including many of the same physical protection requirements that would apply to shipping of used nuclear fuel such as route planning with advanced notification, establishing an emergency response plan, and 24/7 monitoring through our movement control center.

The differences between this configuration and the actual shipment of used nuclear fuel would be the routes that would need to be NRC

approved, the requirement for an armed escort, and then the additional safeguards processes around these shipments.

The challenges are not operational. There are 5,000 shipments of radioactive material worldwide every year performed by Orano. Two hundred of those shipments are used nuclear fuel that is transported by rail within Europe. Hundreds of shipments also occur in the U.S. every year, including used nuclear fuel from research reactors and laboratories.

So, the request for support from the Commission is to help streamline and align requirements between the Part 72 storage at site, Part 71 for shipping offsite to an interim storage facility, back to Part 72 storage at the interim storage facility, and then eventual Part 71 back to ship to a current repository. You need a risk-informed approach to support a safe and cost-effective solution. Last slide, please?

So, I've come full circle. Orano has been chosen to participate in multiple advanced reactor demonstration projects, developing fresh and spent fuel handling systems for new fuel types that will produce a new fleet of reactors that are safer, more efficient, and provide an increasingly carbon free energy mix.

We look forward to many more decades of cooperation with the Commission, and that concludes my remarks. Thank you.

CHAIRMAN HANSON: Thank you, Mr. Maggi. We're going to just take a short pause here. I understand we've got some technical difficulties with the outside broadcast. It sounds like some people are able to see the video feed and others aren't, so we're going to just take a short break here while we've got our technical people working on that.

And when we come back, I just want to remind everyone, you know, we want to make sure that everybody has an opportunity to speak and that the Commissioners have an opportunity to ask their questions, so just kind of be mindful of the time.

SECRETARY VIETTI-COOK: Chairman? This is Annette.

CHAIRMAN HANSON: Yes, Madam Secretary?

SECRETARY VIETTI-COOK: We are recording this meeting, so --

CHAIRMAN HANSON: Okay.

SECRETARY VIETTI-COOK: -- and this has happened once before where we had trouble with media streaming when we were holding it within the, in the Commission meeting room, and what we did is because we're recording the meetings, we're able to put them up on the website pretty quickly after the meeting is held. So, the public may not be able to view it live, but they can go in and look at the archive of the meeting.

CHAIRMAN HANSON: Okay.

SECRETARY VIETTI-COOK: Okay?

CHAIRMAN HANSON: All right, that's fine. With that then -- thank you for that reminder, Madam Secretary. I think with that then, next we've got Dr. Kris Singh, President and Chief Executive Officer of Holtec International. Dr. Singh?

DR. SINGH: Hello, Mr. Chairman. Thank you for inviting me to this presentation. Can you all hear me? Okay, good.

CHAIRMAN HANSON: We can.

DR. SINGH: I'm going to speak on the regulatory status, the framework of regulatory status and innovation in the dry storage industry, dry storage fuel management industry. Next slide, please?

I heard you, Mr. Chairman, speak last week at the NEI board of directors meeting, and I must tell you that I was most encouraged to hear your words about NRC's regulatory posture and mission to continuously improve the organization. It was actually quite inspirational for me, so thank you for -- and I guess industry, the board members, they felt the same way.

I'm going to expound on the regulatory, your side of the aisles a little bit just so to clear some misunderstandings that are in some circles in the country.

I have been with the NRC as an outsider, a supplier, always the status of a lowly supplier designer since 1975, since NRC really opened its operations, so I have seen the agency grow from an infant to maturity and I can tell you that it has grown extremely well.

It has, today, the NRC has a vast body of regulatory literature, some of it inherited from AEC, but most of it, it has developed since it came into being.

10 CFR 71, 72, NUREGs, Reg. Guides, ISGs, SERs, there is a huge body of literature that NRC is on the record, and what's remarkable is that very, very seldom has any one of them had to be revised or changed.

So, your process for internal review, rigorous review has ensured that the documentation that is available to the public and to people like us who develop designs are truly dependable, truly science based, and are truly

robust for us to work from, so we thank you for that and I hope that that continues.

I do not believe there is need for new regulations. There is need for continuing research. There is need for continuing innovation. No question, there is --

I tell people the story that in 1895 or thereabouts, a senior official in the U.S. government said that we should now close the U.S. Patent Office because everything that could be developed has been developed, and that was in 1895.

After that, the airplane, by the way, was developed and plenty more, so there is always room for innovation and I am so glad to hear that NRC continues to be innovation focused. That is fantastic for the industry. That is fantastic for the public.

We have -- we all know there has not been a release of failure activity from any dry storage facility in the United States or actually overseas where U.S. technology is used, and that speaks to the robustness of the regulatory process that we have.

Two items I will comment, one is, of course, risk-informed regulation. Let's continue on that path because, you know, Holtec is also developing a reactor, a small modular reactor, and unless our regulation is aligned with risk, the reactors won't be cost competitive, so that is very, very important.

And another aspect of U.S. NRC regulation is the rules of engagement. Your rules of engagement basically mandate that the process is science based and it is disciplined. The review process is disciplined and that

is not so common. Most of the world, the regulator has a free hand and can run amok, you know, with asking questions in an incoherent way. That doesn't happen with the NRC and I can tell you that is a key reason that we are able to go through the review process and license systems. Lest anybody think that the process is easy, I should tell you that it is the most rigorous process in the world.

Right now, for the past four months, we have been debating with the NRC on what is the most accurate way to predict the structural response under high impact load conditions.

The prior technology, we cited, NRC said not good enough. You have to run tests. You have to run experiments, and have been doing and simulating on computers for the past several months, so don't think NRC is easy, not in the least, not in the least.

Now, we have, speaking of innovations, we have patented, Holtec has patented over 100 innovations in the past 25 years that the NRC has either certified or reviewed and approved that are being used currently in our dry storage programs in the U.S. and around the world, so innovation is alive and well. It is, of course, as I said, there is never -- you should never, never slow down. We should always be looking to make things better.

In dry storage, our innovation is focused on protecting the fuel, protecting the workers who actually load the fuel and perform the operations, protecting the environment, and strengthening the system against beyond the design basis events such as an airplane crash for example.

These are our four objectives, and just about every innovation that we license, that we come up with is focused in one of or more of these four

areas. I'll give you an example, a couple of examples of innovations quickly. I'm running out of time here. In 2005, we licensed a centralized storage system we call the consolidated interim storage system, the only one licensed in the country at this time, using above ground casks, and please flip a couple of slides here. I think we are behind.

And today, you're seeing the system on the -- could you please go to the next slide? Yes, today you see here the storage system below, below the ground. It's actually deployed at SONGS and it's used at several other sites now.

This system basically makes an airplane crash inapplicable and has enormous resistance against any kinds of loads and meets all of the other objectives that I mentioned. That's innovation. Let's go to the next slide, please?

We have, through innovation, reduced the time loading and offloading fuel from pools to dry storage from seven years to three years. That's saving four years that fuel is not in the pool. Of course, we know from Fukushima pool is more vulnerable than dry storage. We have saved four years. That's a direct innovation.

We have reduced the temperature of fuel in the pool if the pool were to go dry, and that also is a direct benefit to safety of the plant, a decommissioned plant, and the local community.

You see in the bottom of this slide a robotic welder that we developed that basically removes the welding people from near the canister while it is being welded, and that, of course, directly reduces human dose. Next slide,

please, and that will be the last one?

Aging management, we have -- you see this canister with blue lines. That is where the gentleman before mentioned laser peening was done. We introduced it to the industry and that directly protects the welds which are most vulnerable to stress corrosion and cracking. That was developed in the past five years.

Manufacturing processes have been developed to develop, to ensure compressive stresses on our side of the surface of the canister even without peening, and that protects the canister, of course, from stress corrosion cracking.

We are continuously developing technologies to improve the canister's service life, to protect it from the loadings that it may see, the design basis and beyond design basis, and I can tell you that we are proud to report that the state of the technology today is light years ahead of what it was only two decades ago. Thank you.

CHAIRMAN HANSON: Thank you, Dr. Singh, for that presentation. Next, we have Ms. Donna Gilmore, the founder of SanOrofreSafety.org. Ms. Gilmore?

MS. GILMORE: Okay, can you hear me?

CHAIRMAN HANSON: I can hear you. We're just waiting for your slides to come up on the screen here, I think.

MS. GILMORE: Okay, well, I can start before they come up.

CHAIRMAN HANSON: Okay.

MS. GILMORE: So, my background is in designing and

deploying mission complex, mission critical systems for the State of California.

And I attended a meeting at the NRC in 2014 where the NRC, Mark Lombard, Al Santos, Darrell Dunn, you know those folks, they said that the canisters, these thin-wall canisters could not be inspected for cracks, could not be repaired, and they knew they were vulnerable to cracks.

I could not believe what I was hearing. Why would anybody put highly radioactive fuel in containers that can't be inspected, repaired, and maintained? I was in disbelief.

So, I ended up spending, over the last decade, researching everything about dry storage and transport in order to look at what the options are and what we should be doing. Go to the next slide, please.

Now, there's a plan proposed for the transport of these uninspected thin-wall canisters across the country. That will no more solve our nuclear waste problems than rearranging the deck chairs on the Titanic would have stopped it from sinking. Next slide, please? Next slide?

I never come to executive management with a problem without a solution, so I've looked through the world and this is what we need to do. Step one, we need to require thick-wall, maintainable, transportable storage casks before these thin-wall canisters reach the age where they will fail.

The Swiss are an example. They have these thick-wall casks. The thin canisters are a little over a half-inch to 5/8 inch thick. The thick ones are ten to over 19 inches thick.

They don't have the inspection issues. They can be inspected. They can be maintained. They can be repaired. They can be

opened up to see what's going on inside just like they are at Fukushima.

ASME N3 was created, American standards were created for these pressure vessels, and the thin-wall canisters that the NRC has been approving do not meet those minimum safety standards. The NRC should be requiring ASME N3 instead of giving exemptions to it.

We're going to need hot cell dry fuel handling systems in order to repackage the fuel. The NRC should stop approving exemptions or they're allowing disbursement of funds to procure these thin-wall canisters.

In reality, the thick-wall casks are less expensive considering their maintainability, life span, and reduced risk of nuclear disasters that can cause evacuations, radioactive contamination, and can affect the economic and security stability of our country.

Step two, once you get them in thick-wall casks, store them in air cooled buildings for additional environmental and security protection away from coastal and flood risk, but you must do step one before you do step two. Next slide, please?

Okay, they are vulnerable to criticalities, and major radioactive releases, and hydrogen gas explosions. I'm not going to be able to go through all of the slides, but I have slides that address those issues.

So, the current canisters -- we've got a little blur going on there -- are vulnerable to short term cracking. The Sandia 2019 report on DOE technology gaps -- please try and focus that slide, please -- technology gaps states this is a short-term problem of through wall cracking, and after decades of having these canisters, they've got no solutions to that.

When they use the term inspection, they don't mean inspection for cracks. They mean inspection for some precursors for cracks, and they're not even doing that on all the canisters, so let's just go to the next slide. Next slide, please?

Now, you can look at this chart and see the difference between the thin canisters used in the United States and what the rest of the world is using. Next slide?

At Fukushima, they use thick-wall casks. Those survived the earthquake and the tsunami. Thin canisters can have partial, undetected partial cracks. There's no seismic or earthquake rating for those. Next slide? Next slide? I'm going to skip this slide.

All right, there is a picture of a microscopic crack. Now, the cold spray they're talking about to repair cracks, I've read the instructions for that. You can to scrape out the crack. It's going to be subsurface. You have to scrape it out so you get good adhesion, and they can't do anything like that.

Let's just go on. You can read these later. I don't want to run out of time. Go to the next slide, please?

All right, and regarding transport, the NRC engineers -- I participate in a lot of NRC meetings. The NRC engineers really try and do the right thing. They required Holtec for their transport casks, they said you have to show there's no defects, surface defects greater than two millimeters.

You need to ensure that the high burnup fuel inside, since it's been in dry storage which they know can degrade, has been maintained so that it can be transportable. What did the NRC approve? If the radiation levels are

low enough, you're good to go.

So, I urge the Commission to make sure that the actual engineers that are trying to do the right thing are able to do that. The problem seems to be somewhere above there.

Now, the interim storage sites, if the canister arrives leaking, their plan is to send it back, which there's no plan for that. The plan to put a leaking canister inside another canister, it would likely overheat. There's been no thermal analysis of that. Next slide? Let's just go to the next slide.

Okay, this is a now problem, and the NRC said in 2014 that once a crack starts, it can go through the wall in 16 years. We have canisters already 32 years old. I submitted comments to the NRC to the NUREG-2224 on high burnup storage and transport and I have not really received an adequate response to that. Next slide? Next slide?

And the NRC and EPRI are saying we don't have enough humidity at San Onofre for corrosion. They're ignoring the fog, surf, and onshore winds. Next slide?

This is a picture of a Holtec lid. If you have an airplane fall on that, you tell me what's going to happen. Next slide?

Now, EPRI, the report they're using to say we won't have problems for over 80 years, the EPRI report ignored coastal conditions. They ignored a two-year-old Diablo Canyon that already had conditions for moisture to stay on the surface and dissolve salts.

They ignored the South African Koeberg tank that the NRC said was comparable to the canisters. It had leaks in only 17 years with cracks that

were up to 0.6 inches long and most canisters are only a half-inch thick. That same report used assumptive words over 254 times. Next slide? Next slide?

And Holtec admits that even it's not practical to repair a canister, that it's not a path forward. Next slide? I agree with him on that. I agree with Kris Singh on that.

The Holtec -- I don't have time for these slides, but please review the slides on the problems that we have with the Holtec canisters for above and below systems. Next slide?

I don't think I have time to go through the rest, but this is another example of an NRC inspector saying it's impossible to inspect and repair these canisters according to the code. Next slide? Next slide?

I think I'm just going to skip the rest of these slides because I'm out of time, but I've written them so you can look at them without narration, and I put in here the critical pieces of information that are needed to denote. There's not enough time to cover the high burnup issues.

We could really use more meetings on this so we could go in depth in these particular issues because this is critically important. Thank you for the opportunity to present.

CHAIRMAN HANSON: Thank you, Ms. Gilmore, for your presentation. Next, we'll hear from Dr. David Victor, Chairman of the Community Engagement Panel at San Onofre. Dr. Victor?

DR. VICTOR: Excellent, well, thank you very much, Mr. Chairman. Congratulations on your new role. Thank you to the Commissioners for joining us, for the invitation, and to my fellow panelists.

I chair the Community Engagement Panel at San Onofre. It's a group of 18 volunteers, mainly elected officials. In my day job, I'm a professor of industrial organization at UC San Diego and I'm also in the Scripps Institute of Oceanography in the mechanical and aerospace engineering department at UC San Diego.

I'm going to do something unusual which is talk without slides, so maybe we could just pull down the slides so I am David Victor and I can just talk. I feel in industry meetings that sometimes talking without slides is a little bit like being naked because there's so many slides out there.

So, I just want to make five points in my remarks and these are all summarized in the document that I submitted in advance along with some appendices, and then I think there was confusion about the accession numbers, so now that's been clarified. It's a very short document that has my five main points that I'd like to make today.

The first one is that despite the shutdown of the plant and controversy about the plant as you've just heard, controversy has not gone away and that's been central to almost every meeting that we've had at the Community Engagement Panel.

In the appendices to my document, to my talking points, I have agendas from the last year and summaries of a number of topics that we've gone over, so the controversy continues.

And I think one thing that's very important is there's a kind of disconnect between how one thinks about risks of a shutdown plant as an engineer where the motive forces are small, approaching zero, and so a lot of the

concerns from an engineering point of view disappear.

And then in some plants, including San Onofre, a lot of people are concerned, and that disconnect in some sense is getting bigger, and I think all of us need to recognize each other's perspective here.

Also, we also need to calm down a little bit. Some of the previous remarks I thought were frankly untethered from any of the engineering reality, untethered from what real, the real statements and context that were made by your staff and by people from the different vendor communities, and including from EPRI, but that's the first point I want to make is the controversy around a plant like this continues.

Second is that because of that and because of the failure, frankly, for a repository, the defense in depth programs that Randy Stark spoke about and others have been working on, those have become very, very important, and because many local stakeholders frankly were surprised to learn that when the plant was shut down that the fuel was going to be there for the foreseeable future.

And people in the industry weren't surprised by that. That's reality, but I think a lot of the local community views that as a violation of the original contract and we need to have a solution to that problem, and we've been spending a lot of time on that.

The third point I want to make is about the role of NRC regulations in this space. A lot of appropriate things have been said about the rigor of the NRC regulations.

I think it's really important to recognize that those must be

viewed as a floor and not a ceiling, and the NRC should expect and the industry should expect that in some communities around the country, people are going to want more, and that is true of San Onofre and that's been documented extensively, and I'll talk a little more about that.

I've heard some noises at various times inside the NRC and certainly inside the industry, kind of concern that if one plant goes further than the baseline, that that will create new standards for the industry.

I think we just have to recognize that plants are in different circumstances, not only geophysically different circumstances, but also politically different circumstances, and there has to be flexibility for that and we have to just recognize that.

This is one of the -- we participated in the NRC's effort to learn about local engagement panels and submitted testimony to that, and oral testimony as well. I think this is -- the diversity in local engagement processes is emblematic of these different kinds of political situations.

We happen to have a panel of volunteers. It's not a decision-making panel. I think that works very well in the San Onofre context. In other contexts, there will be different approaches and we need to have some flexibility about how this is done in different kinds of settings.

The fourth of the five things I want to say concerns a strategic approach to the management of onsite spent nuclear fuel. That is going to include aging management beyond the NRC floor as I just discussed.

In the case of San Onofre, that includes already for the Holtec system a pretty extensive inspection and maintenance program. The claims that

have been made that inspection is not possible, those claims are simply false, have been repeated multiple times and are false each time, and they are simply wrong and they need to stop.

We're a little backwards because the licensing attention to the new Holtec system happened more recently, and so that plan is in place earlier than it would be at many other sites for a new ISFSI, the Holtec part of the ISFSI, but an approach for the Orano system that Mr. Maggi talked about, that is well advanced and is coming along, and there's also extensive engagement with the EPRI program that Randy Stark talked about.

So, I'm not going to say more about those except to say that because of the ongoing attention to the ISFSI and the security of the ISFSI, one of the things we've done on the Community Engagement Panel is we had, at community request last year, a meeting about extreme outlier events. Think terrorism, think other kinds of risks, think airplane crashes.

We invited some of the nation's and the world's leading experts on that topic and had a non-classified, non-safeguards meeting on that subject talking about it extensively.

It's all on songscommunity.com. The video is there, all of the background materials. There's a library of information. To my knowledge, that's never happened in the industry before and I think it's really important as part of this ongoing engagement with the community.

There's a lot of other elements of what a strategic approach might really look like, and I just want to draw out one implication of this for you, the Nuclear Regulatory Commission, which is you have an impact on parts of the

strategic approach and you don't have an impact on other parts of the approach, and take for example Yucca.

I mean, as someone who looks at the politics of this industry, Yucca is effectively dead. Now, people don't want to recognize this, there's a certain degree of sleepwalking about those realities.

Maybe Yucca comes back in the context of other kinds of options being considered. We need to find some solution to that problem and we need to begin a blue ribbon-like process that's similar to what's happening in Canada or happened in Finland or other places to site the facility or to have a long-term strategy.

That's outside your purview, but it would be very helpful to have more pressure from the NRC back to Congress and the other relevant places to work on this problem.

And the fifth and last thing I'll just talk about very briefly is what does defense-in-depth mean in practice? Well, at the San Onofre site, it has meant that in every single dimension more has been done, in part because of public concern about this and part because the seismic risks at San Onofre and the potential stress corrosion cracking risks. Those risks are different at that site than they are at many other sites, and that includes the design of the systems there with slightly thicker walls, different kinds of stainless steel, fabrication including the laser peening that Randy Stark talked about and Dr. Singh talked about.

And I think we just have to recognize -- and I'll close by making this comment: to me what is extraordinary is the technology in this area is

changing very rapidly and the industry and its regulators and its communities have to get more comfortable articulating how that technological evolution is good for us and we want to encourage it. So it's to look beyond what's going on with the cold spray, look beyond what's going on with the new inspection rings and so on, to be able to articulate a system where the technology is changing in ways that are beneficial to us. And we shouldn't just be thinking about the technologies here in a static fashion, that the technological change is enormously powerful, and it is part of a serious long-term aging management program, one that is responsive in different ways at each different site, responsive to the local circumstances.

Thank you very much for your attention and your invitation today.

CHAIRMAN HANSON: Thank you, Dr. Victor, for that presentation.

We will now proceed to Commission questions. We're going to start with Commissioner Wright this morning.

Commissioner Wright?

COMMISSIONER WRIGHT: Hi. Good morning. So first I'd like to say thank you to everyone for your presentations. I mean, it's good to hear about the different activities that -- the significant activities, too, that are related to spent fuel storage and transportation. And it's nice to see a couple of you in person who I know well.

David Victor, I haven't seen you in a while, but it's good to see you.

Dr. Singh and Wayne Norton, too.

And, Donna, welcome to this panel.

We also have regular business line meetings on this topic, but this is a really good focused meeting, which I think is important for us. It allows us to delve deeper into a lot of the issues that are out there and that are of interest to people in addition to just the Commission. And it also may not get as much attention as some of the other stuff, so this is a good conversation to have.

It's good to have a broad-based -- a cross-section of external stakeholders, too, because as a Commissioner it's really great to hear the varied opinions and the diverse discussion. It adds to the flavor of everything and diversity of thought leads to good discussions, too. So that's good.

So I'm going to start I think, Randy, probably with you. So one of the issues that many of you touched upon was the ability to inspect and repair the dry cask storage systems. And as Wayne noted, one of my first visits was to Maine Yankee in 2018. And it was right after they had just completed a demonstration of the robotic inspections to support the aging management plan. So I'm really pleased to hear about the progress that's been made in some of that.

So, Dr. Singh, and also Roger, if you want to jump in, you can. So my question is, are the inspection and mitigation techniques discussed so they'd be considered only in the context of aging management? And is it possible that they may be needed in other contexts, such as during the initial license period? And in addition, I'd like to also know if you agree with the characterizations of the limitations on the repair mitigation techniques mentioned

by Ms. Gilmore, too. So thank you. I'm going to turn it back over to you all.

MR. STARK: Okay. I'll start and then my fellow panelists can join in.

But, yes, the first thing you want to know about when you're developing an inspection program is what is it that you're looking for. In this case we're looking for stress corrosion cracks. And then you want to be able to reliably find those cracks with techniques. In this case we're looking at either visual techniques or volumetric techniques. And I think that these have been demonstrated. I believe my colleague from Orano talked about the fact that they have developed visual UT and eddy current techniques to find these cracks. So I think that the components for finding the flaws or the potential flaws in the most susceptible locations are there.

In terms of the technologies that we spoke about to mitigate and to repair, I think that they are also -- I'll let Dr. Singh and others talk about their specific techniques, but we have demonstrated that we can get compressive stress on the surface and that we can do a cold spray and repair these flaws.

COMMISSIONER WRIGHT: Who else?

MR. MAGGI: So, Commissioner Wright, this is Roger Maggi. So I think the question asked was, could these techniques be applied in the initial license period, which is 20 years for older systems; 40 years potentially for the newer systems.

These systems are designed, actually, and analyzed, before licensing for 100 years plus. The initial license period of 20 years is a fraction of that period, and the analysis shows that there's no credible degradation

mechanism that could cause a flaw to initiate through a corrosion process, which of course you'll need the chlorides and the water or humidity to make the brine to initiate the corrosion, which could initiate a crack, only if you're in an area of stress on the canister. A lot of things have to come together.

But in that 20 years through the analysis that EPRI has done and even our own analysis, which shows that it would be decades before the crack would propagate through the canister itself. But the aging management programs are set up to find those issues.

We've inspected well over a dozen canisters. We've had zero indications of any corrosion that has been initiated on any canister. Any corrosion products that have been found have been attributed to maybe the rolling process for the shells, where a little bit of carbon steel got imbedded into the canister surface, but actual corrosion of canisters has not been found yet.

The inspection techniques continue to develop. The visual inspection techniques, which are used in the operating plants as well, we're detecting much higher risk of potential leaks on reactor vessel heads and steam generators. Those VT3/VT1, which is qualified for finding cracks, your systems are qualified for that capability, and you have to prove that capability by a code in order to perform that exam.

There are also cleaning requirements. I heard a statement that you can't clean out a crack before you seal it. That's not true. The cold spray process actually is set up to perform the cleaning prior to the sealing. So yes, these techniques could be applied in the initial licensing period, but we don't see a case where that would ever be necessary as long as the fuel was loaded

within the initial license requirements.

DR. SINGH: Can I make a comment?

COMMISSIONER WRIGHT: Yes, sir.

DR. SINGH: Yes, thank you. I think that there is a misconception, primarily in the activist community, on how fragile these canisters are. The canisters -- it's made out of stainless steel, 304 -- 316 stainless steel, which is about the most ductile fracture-resistant material there is known to man, man and woman.

The canister, thin-wall canister, as you call it, Donna, is -- will by our projections, based on literature, in New Mexico, where we are building the consolidated storage -- we are hoping to license the consolidated interim storage facility, will last not 20 years, not 40 years, not 30 years; 300 years without developing a crack. And that is based on science, not allegations. Okay?

That is -- and by the way the canister is so robust there has never been a leak anywhere. The metal casks that you propose have leaked. Virginia Power, Dominion, spent $7 million chasing the leak in storage. In the United States, the canister technology competed directly with metal cask technology early on. We could have provided either. And it was like the battle between the spoon and the fork 400 years ago. Finally, the fork won because it was a more universal dining tool compared to the spoon. The same thing is true here. The canister won because it has superior and inherent properties, and among them is its ability to keep radioactive materials confined. Okay?

So let's not -- you can -- by the way contrary to what you stated, Donna, you can put the canister if it's at the thread. First of all the cracks don't

happen overnight. It will take years before a crack manifest and then finally actually cause a release. I mean, decades. And in that -- if you postulate that, you can use a sequestration canister. We have the technology. And you can put the canister in there, even at reasonably high heat loads, and you provide a second barrier. We have double-wall canister technology. We have all sorts of solutions.

So please recognize the fact that a large number of scientists and engineers within the NRC and in the industry and national laboratories have together come to the consensus that the canister is the right -- a right technology. And I appreciate your passion, but -- your technical position is well-intention, but wrong-headed. Thank you.

COMMISSIONER WRIGHT: Okay. Thank you.

I'm going to move real quick. I've only got a couple of minutes left. And if it's okay, I'd like to move onto Mr. Norton.

Wayne, so welcome and thank you for providing the licensee's perspective on spent fuel storage and transportation.

You mentioned that you'd like to see the NRC ISFSI inspection program be more risk-informed. Do you think that the recent changes to the program that were to put into place last month have achieved that goal?

You there?

MR. NORTON: Sorry. Sorry, I had myself muted.

Yes, I do. In fact, I think the movements towards extending the time frame between inspections and looking at alternatives for inspections do just that very thing in fact. So that was not intending to imply otherwise. My

point is simply as we move now into inspections on the aging management programs, new programs that we're rolling out in the industry we need to continue to make sure that we risk-inform those activities going forward.

COMMISSIONER WRIGHT: Do you have any suggestions on how the program could be further risk-informed?

MR. NORTON: Not on the top of my head other than, as I said, I wasn't necessarily --

COMMISSIONER WRIGHT: Sure.

MR. NORTON: -- identifying weaknesses in that regard. I was recognizing progress in that regard. And I do believe that there are opportunities to look at that process as aging management programs unfold, looking at inspection criteria for those new system inspections to make sure that there's alignment.

So at this point it's hard to say, Commissioner, because I don't think we've fully unveiled the inspection process for the aging management program yet.

COMMISSIONER WRIGHT: All right. Thank you very much.

And, Mr. Chairman, I think my time is up.

CHAIRMAN HANSON: Thank you, Commissioner Wright.

Thank you all, for the panelists for being here. I think this kind of open and vigorous debate is really important, both for the NRC and those of us on the Commission, but also for the public to hear.

As many of you know, I'm particularly interested in issues of public confidence, how the NRC builds and maintains public confidence. And

so I guess my first couple of questions are going to be for Dr. Victor.

Dr. Victor, based on your experience on the Community Engagement Panel at San Onofre what can you tell us about effective communication between NRC and the public or between licensees and the public? Kind of what worked well, what miscommunications or missteps did you see, and what can the NRC do better in that regard?

DR. VICTOR: Great. Well, thank you very much, Chairman Hanson.

From our perspective; let me make a few remarks, my sense it's been enormously important that we are not a decision-making panel. So that means that the panel can focus on facts and analysis and diverging points of view and doesn't need to get itself wrapped around the procedures and making formal decisions and formal oversight. And so I see that as an enormous strength of the panel.

In other communities, in other reactors, things have been done in different ways. They're more procedural. My sense is the procedures kind of get in the way of these fluid and complex topics. So that's the first thing I'd say.

Second thing I'd say is I have been pleasantly -- I won't say surprised. I didn't have any prior experience, but I have been thrilled by the engagement of NRC staff in the regions and also at central headquarters with us as we grapple with the technical questions. I've also been alarmed at the extent to which a number of people have taken NRC comments out of context, kind of lambasted staff members in public, made wild accusations. And I think that's

not helpful to us in the community and it's not helpful to you and it gets everybody's backs up. And so I think we've got to find a way to continue to talk with each other about these complex technical issues. So that's I think a very important lesson.

The last thing I guess I would say is I think confidence in the public is going to be -- continue to be shaken so long as we don't have a -- at least -- I won't say a solution, but a strategy that is viable for long-term management of spent fuel that includes interim storage, but includes a repository. And so I would hope that there's a way for us in the individual communities to talk more with Congress and more with the NRC, where that's relevant, today's meeting is part of that, to articulate what we could actually do that would help build some public confidence.

And people along the way have raised a lot of interesting questions, including questions that are typically safeguards and classification questions. And I think one of these we've shown over the last couple years is it's possible to deal with a lot of those technical issues in plain English and in a non-classified, non-safeguards way. And that's helpful. There's always going to be -- some people are just going to disagree with you no matter what you say. You can say it's up and other person says it's down. I get that. But for folks who are open to ideas and debate, it's possible to talk about a lot more openly than I think the industry has assumed.

CHAIRMAN HANSON: Okay. Thank you for that.

You said something interesting in your presentation. You said the NRC regulatory framework should be a floor and not a ceiling. And I'm

interested -- I'd be interested to hear you talk more about that. And in particular some of those additional agreements, or kind of above -- things above the floor, or so forth, might be between a community or another jurisdiction and the licensee. But do you have any specific recommendations for NRC to kind of address this point? Obviously, rulemaking is something that we do, but there are other maybe potential mechanisms at NRC as well.

DR. VICTOR: Yes, so I don't know a full answer to that question. It's a good question. I think at minimum it would be very important for the NRC to signal that these additional arrangements that are made between plants and the local communities, or plants and local regulators. In the case of the San Onofre plant a lot has happened through the Coastal Commission because the Coastal Commission is the kind of supreme California licensing body for all things coastal. And so a lot of it gets refracted through provisions that the Coastal Commission requires.

I think at minimum some confidence that the NRC views what it's doing, quite appropriately as a regulator, as a floor and then within limits letting plants go and address local community needs. This has come up for us in a lot of places. One example is now a real-time radiation -- a fence line radiation monitoring system that streams to a California public agency. I believe there's only one other plant in the U.S. that does that. I think a lot of engineers look at that and scratch their heads and go why would you need that? But that's been a part of the local community discussion and it's building confidence around that.

And then also obviously there's been a lot of questions raised about security of the ISFSI and whether there might be additional rules. I've

written a letter to the NRC about whether the NRC might be developing additional rules in that area, but meanwhile the plant has already gone on and implemented things above and beyond with regard to physical security of the ISFSI. And we've had a chance to talk about that in a fairly open way with the public. So I think at minimum if plants could have confidence that they could do these things and not face blowback from the NRC, that would be helpful.

CHAIRMAN HANSON: Okay. Thank you very much for that.

I think my last question will be, Mr. Maggi and Mr. Stark, you both mentioned this cold spray, chloride-induced stress corrosion cracking mitigation. I'm interested in that. I've been interested in that technology for a while, right, sort of this spray-on metals, and I'd be interested to hear you talk a little bit more about how that technology works in practice. But I guess I'm also curious about that to -- whether or not there's been any thought to giving -- to that technology being used prophylactically on spent fuel canisters.

MR. MAGGI: So, Randy, maybe I can start and you can jump in.

So the premise of the system -- and it's been around for quite a long time, so this is additive manufacturing. The system that -- the one we're working with in particular, VRC Metal Systems, they have been applying cold spray in repair -- field repairs of military equipment for a very long time. So they work directly with the DoD. And they can apply various materials, whether it's steels or titanium or other alloys, as applicable, to whatever they're attempting to repair.

And again it's additive machining, or additive manufacturing,

using very high-velocities driven by high-temperature gases. It's called cold spray. It's actually kind of hot, but not at the elevated temperatures that you get from welding, and those kind of temperatures lead to the stresses in the canisters or other -- anything else you're welding -- a lot of that goes on in the primary system of the reactor as well.

But the metal powders are basically sprayed onto the surface from a fairly short distance at a very high velocity with enough kinetic energy then to -- when the collision happens with the substrate; in this case the canister surface, there's enough energy there to form that bond and essentially in a sense weld itself to the substrate. And then each layer on top of that is adhered to the layer beneath it.

And if you look at the porosity testing, the adhesion and tensile strength testing, it is close to what you would get from an actual weld overlay, which again has its own issues because it would impart new stresses into the canister surface. So that's basically how it works.

There are other methods out there for repair, but in light of the restrictions on how to get to these canisters and other considerations and the maturity of this particular additive manufacturing process this really is right now the best option for repairs of canisters in-situ in service.

CHAIRMAN HANSON: Okay. Thank you.

MR. STARK: Mr. Chairman, if I could just state one thing?

I think your last point had to do with merely mitigation of cracking as opposed to repair. I think the cold spray technology is an option for repair. I think there are technologies that are options for mitigating cracks before

they become an issue. So I showed the peening as one of those options. That's a potential to sort of prevent or mitigate cracking before there is a crack.

CHAIRMAN HANSON: Okay. Great. Thank you. I think my time is just about up, so thanks again.

DR. SINGH: Mr. Chairman, can I make a quick comment?

CHAIRMAN HANSON: Dr. Singh?

DR. SINGH: Yes. Yes, thank you. Prevention of course is better than cure, and one of the major efforts we have made is to ensure that the canister, the upper half of the canister thickness is in compression, does not have tensile stressors by the suitable selection of rolling process and welding details. And if you have compressive stresses on the outside, you cannot initiate stress corrosion cracking. It's in the nature of providing laser peening. You basically root out the root cause. But you wouldn't have stress corrosion cracking. And by the way, we are practicing it at Holtec. Thank you, Mr. Chairman.

CHAIRMAN HANSON: Thank you, Dr. Singh.

All right. Thank you again, everyone.

Commissioner Baran?

COMMISSIONER BARAN: Thanks. Thank you all for participating today. Dry cask issues often don't get a lot of Commission-level attention, so I think this is very valuable discussion. We do sometimes cover it in our business line meetings, but there we only hear from the staff. We don't really have an opportunity to hear from external stakeholders. So I think it's a great opportunity to have a good discussion about the issues.

Donna noted that some of our European counterparts have

required dry casks with thicker metal walls than those typically used in the U.S. I'm interested in whether others on the panel see the thicker-walled casks as safer or more robust than the thinner-walled casks. And if so, how much safer they are.

I got the sense from Kris Singh's comments he didn't think there was really a difference in safety. I'm interested in other's -- what are your thoughts on that? Maybe Randy or Roger, how do they compare?

MR. MAGGI: Well, so we -- actually at Orano we offered both systems. The real difference between the thick-wall and so-called thin-wall canister is in the protection for external events. So for the heavy metal cask -- it's not really a canister; it's a cask -- that thick wall provides the protection for both environmental -- missile protection, radiation protection. That's all in the package.

The canister itself is protected by the overpack. The canister never sees the light of day once it's loaded with fuel. So it's in the -- it's put in the spent fuel pool inside of a transfer cask, which is a heavy-walled cask. It's loaded with fuel and then it's processed, which means drying and sealing the inner and outer top covers with full-penetration welds. And then that cask, heavy-walled cask is taken out of the spent fuel pool and then transported out to the ISFSI, where that canister is then inserted into its overpack. And this is the same for vertical or horizontal systems.

So now the overpack becomes the protection. And in many cases, whether it's the multiple-feet thick, reinforced high-strength concrete or in the underground system that Holtec has, the protection is provided by that

subterranean level. You're better protected in these new overpacks than you are in that just thick-walled canister. That thick-walled canister by the way is carbon steel, not stainless. The canisters are stainless steel. So I think that's the big difference.

And there are utilities here in the U.S. that still buy thick-walled casks from us, but they're actually looking at transitioning to the canisters because they are -- they're easier to deal with and then they're -- once they're in their overpacks they are better protected and in the future more easily retrieved and transported, and they are more economical.

COMMISSIONER BARAN: So I want to make sure I'm understanding what you're saying. From your point of view, as someone who designs and manufactures and sells these different kinds of casks, the ones that are predominantly used in the U.S. are not, to kind of put it simply, any less safe than the ones in Europe? You think actually --

MR. MAGGI: Right.

COMMISSIONER BARAN: -- they may be safer?

MR. MAGGI; I do believe that in the evolution of the overpacks, whether it's an underground system or our MATRIX system that is a double horizontal system heavily protected by its multiple feet thick concrete walls -- you can't walk up and pick one of these things up and take it away. Theoretically you could do with a large cask, but these overpacks are better protection for the canisters than just a large cask sitting by itself.

COMMISSIONER BARAN: Okay. I don't know, Randy, if you wanted to chime in on anything on this either. Do you have a thought to

share on this?

MR. STARK: Yes, what I would state is I'm not aware of any recent research that EPRI has done where we've compared the two. I think they're probably both safe and it would be up to the utility that's purchasing -- deciding to make a purchase between the cask and the canister to figure out the pros and cons of both types. But I'm not aware of any research that EPRI has done recently to look at the comparisons between the two.

COMMISSIONER BARAN: Okay. And I want to give Donna a chance to kind of respond.

Donna, did you have anything you wanted to add on this topic before I move onto something else?

MS. GILMORE: Okay. Can you hear me?

COMMISSIONER BARAN: Yes.

MS. GILMORE: Yes, so you know the thin canisters have air vents. So that's how the corrosive particles get in and sit on the canisters, which they never clean. And in the case of the Holtec system, the loading, since I didn't get to that on my slide, but the actual downloading of the canister in the storage vault or above-ground cask is actually gouging or scraping along the entire -- along the length of the canister. So you're already introducing carbon particles, which are highly corrosive. There's a whole list of things that are corrosive to these thin canisters.

And the fact that once a cracks starts they continue to grow -- and they're really talking about precursors to cracking. That's what they can identify is some precursors, but they really don't know what's going on under the

surface.

The thick casks -- and there's a German model which is a ductile cast iron. They're almost over 19 inches thick. And they're maintainable. The steel ones that Orano -- I'm pronouncing it wrong -- makes, I mean that's what they use in France. And they have a coating on them to protect it from the environment. They keep them in buildings for additional protection.

Now regarding the Dominion issue, I'm not familiar with that issue, but I am familiar that Orano designed an inferior thick cask system for them. They put a lid -- a cap over the lid and it resulted in moisture collecting under it and prematurely damaging the seal. So just look at the comparison chart because that's a real chart. And David Victor isn't a technical person, but he does have opinions about things. But the science -- everything I'm saying I have the scientific documents from the NRC, from the national labs, from all the reputable sources, and David Victor does not in that regard. Thank you.

COMMISSIONER BARAN: Let me ask a question. It's a little bit different, but I think it's come up in remarks --

(Simultaneous speaking.)

DR. VICTOR: Just -- having been just disparaged, can I comment briefly on that?

COMMISSIONER BARAN: Sure. I mean, I don't think we want this to really be a personal discussion.

Let me just ask this: so Congressman Mike Levin put together a San Onofre Task Force, which I'm sure those of you who have been involved there know all about it. And one of the task force's recommendations was that

NRC should require 100-year design life for dry casks. And I think they're concern is that long-term dry cask storage at sites is a possibility.

What do folks think about that proposal? I mean, I've heard -- I think maybe both Roger and Kris kind of had weighed in that actually the data shows these -- the casks are really going to last without meaningful degradation for much longer periods of time than the current licensing framework is talking about.

Should we be thinking about requirements of a longer design life and then potentially licensing for longer periods of time? Do you folks have thoughts about that?

MR. MAGGI: Yes, Commissioner Baran, thank you. So the designs are analyzed for a 100-year life, much the same way that the reactors are designed with the thoughts of 60, 80, 100 years of operation, but they're not licensed to that because we do need to be able to revisit license conditions on a periodic basis to ensure that they are still accurate, the original analyses and assumptions are still accurate, take into consideration any operating experience. That really is where the regulator has a chance to come in, review a license renewal application to ensure that all of the potential issues are dealt with on a time-limited aging analysis so that we can determine if yes, it's operating as we intended, as we designed, and you can go for another 40 years.

So initial licensing period 20 years, extended period is 40 years; they are designed for a 100-plus years. So that's already baked into the actual design, but appropriately a license does not give you 100 years of operation without a review to ensure that everything is as it was.

COMMISSIONER BARAN: And I see my time is just about up but I wanted to give David Victor a chance to respond. I see his hand's up.

DR. SINGH: Yes, I would like to comment also on the thick-wall canister -- cask.

DR. VICTOR: Thank you. So let me just say two things: first on the 100-year life, I think NRC has to do what NRC knows how to do, which is what are the time horizons over which it is very confident it can license? And so I think we shouldn't replicate what happened with the -- for example, the operational licenses with some of the early Swedish reactors, where basically licenses into perpetuity were given.

You should operate over the time horizon for which you have confidence and do aging management and encourage new technologies and relicense. I think that's what you do well. That's what gives the public confidence. Don't venture -- my advice is don't venture into territories where you can't be truly confident.

And I think this whole discussion about the thick-wall canisters is an example of that. I mean, we have to remember the European experience has a different history in part because of reprocessing. They need to reopen canisters, reprocess the fuel. We don't do that. We have once through in the United States for good reasons.

What we need is a passive safe system that can operate in the real world, not in some kind of magical alterative reality, that could be licensed, that could be transported, that can be accepted at interim source facilities. And if we continue down this kind of crazy rabbit hole about the thick-wall canisters,

we're going to distract ourselves from what really matters, which is systems that work in a long-term strategy here. And I really would urge us to focus on that kind of practical reality, and not these other kind of shiny objects.

COMMISSIONER BARAN: Well, I know I see that Kris and Donna both have thoughts and they want to weigh in, but I want to be respectful of Commissioner Caputo's time. She's up next. So I'm just going to turn it back over to the Chairman and hopefully you all will be able to kind of get your comments in as we go forward. Thank you.

CHAIRMAN HANSON: Thank you, Commissioner Baran.

Yes, let's -- in the interest of making sure that Commissioner Caputo has her allotted time to ask and get answers to her questions; and also we've got to move onto the staff panel as well, let's keep moving here.

So, Commissioner Caputo?

COMMISSIONER CAPUTO: I just want to start by saying thank you to the staff. This virtual Commission meeting, first in the Agency's history, is a bit of a technological adventure, and I just really want to take a moment to just recognize Denise, Sergio, Wesley, Leon, everybody else who behind the scenes has worked so hard to make this come together.

CHAIRMAN HANSON: Amen.

COMMISSIONER CAPUTO: And I also want to thank the panelists for contributing your time, your perspectives and also embracing the virtual nature of this Commission meeting. So thank you all for making this meeting a success.

I would like to start with Mr. Maggi. So one of the concerns

that's raised, obviously, is just about I think the integrity of canisters to begin with. And I just wanted to clarify, when canisters are loaded, those canisters -- the environment within those canisters, the air, the moisture, et cetera, it's all fully evacuated, the canister itself is leak-tested and the environment is replaced with helium to create an inert environment. And this eliminates moisture, the potential for hydrogen production or the production of zirconium hydrides.

So this step is therefore going to prevent degradation of the fuel, correct? And it adds a layer of defense-in-depth?

MR. MAGGI: You explained it exactly. There's nothing I could add to your explanation. That is exactly what occurs. The vacuum drawing process removes all the moisture, the helium backfill gives you the inert environment, and then it's obviously welded shut. So, yes. That was very accurate.

COMMISSIONER CAPUTO: Okay. And I know we've heard a lot about inspectability, serviceability, et cetera, and whether or not the canisters are in fact inspectable, but I just want to note that in your slides you listed significant technologies. You listed the aspect of inspections that are required as part of aging management, use of robotics to fully inspect canisters and overpacks, a fully-shielded inspection, and if necessary repairs to the system in the unlikely event that you find flaws or potential degradation, in-situ corrosion mitigation, and the development of in-situ monitoring technology.

So let me just ask you: these are all services that you offer clients in the industry, right, to our licensees to help them meet our regulatory requirements?

MR. MAGGI: Yes, that is correct.

COMMISSIONER CAPUTO: Okay. Thank you.

Randy, Mr. Stark, so it's been mentioned a couple times that the industry hasn't encountered cracks yet and concern that we're only looking for precursors to cracks rather than cracks, but by definition we would see precursors prior to the formation of cracks, correct?

MR. STARK: We would, but I want to state that what we are demonstrating -- the techniques that are being demonstrated are for SCC cracks, so it is -- the techniques will find stress corrosion cracks as well, as well as precursors.

COMMISSIONER CAPUTO: Okay. And so there are contentions that canisters are at risk for early cracking, that EPRI cherry-picked data to falsely claim that it would be 80 years before cracks can go through canister walls.

Now considering that the industry began using dry cask technology in '86, and at this point we have in the neighborhood of 3,300 dry casks in use, given those decades of research and operating experience has EPRI has seen any evidence that raises doubts about that 80-year conclusion?

MR. STARK: Well, let me just start by saying that the report that was referenced, the 2014 report, was a flaw-growth and flaw-tolerance report. It was a generic study to really inform the aging management process, so we were parametrically looking at different conditions, different flaw orientations, different temperatures, different environmental conditions to understand how flaw-tolerant these components are.

And if you look at the cases that were on there, there were various numbers of years in which a flaw that had been initiated could grow through the wall. So there's not a conclusion in the report that says 80 years is the number.

What the major conclusion is from that report is that these systems are flaw-tolerant and that the -- having an effective aging management program to find flaws, to inspect for the flaws and find them before they become an issue is still something that we stand by. If you look at the aging management program guidance that we've developed, it's consistent with that statement.

COMMISSIONER CAPUTO: And so when Dr. Singh mentioned that it would take years for these cracks to actually propagate all the way through, do you agree with that and does that give time for any maintenance, repairs, or repackaging that might be necessary should we, in the unlikely event, come across those situations?

MR. STARK: Yes, I mean I think we're very early in the aging management process. We've just started inspecting. I know Mr. Maggi stated it's a learning aging management program, so the more operating experience we get, the more informed we will be. But based on the information we have right now, yes, I believe that these systems are robust and we'll be able to find flaws and mitigate and repair before they become an issue.

COMMISSIONER CAPUTO: Okay. And I just have one last question for you, Mr. Stark. You mentioned that there's been a technology leap in performance margins, and I think David Victor mentioned earlier about the need to communicate better how technology leaps actually benefit the public or

improve safety. Can you just talk about how these improvements and performance margins actually translate into improved safety?

MR. STARK: Yes, so what I was referring to was the fuel itself. And what we learned from the high burnup demonstration, from actual data that we got from that demonstration was that the temperatures of the fuel were a lot lower than what were originally calculated. So that's where the margin -- when I talk about performance margin, that's what I'm talking about.

COMMISSIONER CAPUTO: So just let me ask a clarifying question, and then I'd like you to continue.

So what you're essentially saying is that high burnup fuel, rather than being a concern, is actually beneficial in terms of the performance of the cask?

MR. STARK: Well, so I'm specifically talking about the fuel. So there's really -- there were two things that I talked about: one was the fuel and then the second was the canister. So when I'm talking about the temperatures of the fuel, I'm talking about the potential degradation mechanisms. Hydride reorientation, for one, was a potential degradation mechanism on high burnup fuel that we wanted to look at. It's very much -- the higher the temperature, the more susceptible you would be to that kind of degradation mechanism.

And all I'm stating here is that with the lower temperatures, we have less concern with those degradation mechanisms on the fuel. That's not to say what those low temperatures of fuel mean for the canisters. That's a different point.

COMMISSIONER CAPUTO: Okay. All right. So are there

any other improvements in safety margins and performance that help improve safety?

MR. STARK: Yes, I mean, I think -- so we talked about -- in terms of fuel we talked about the lower temperatures. In terms of the canisters, all the things that we're talking about here in terms of an aging management program, the ability -- Dr. Singh talked about putting compressive stress on the walls in the susceptible areas adds margin. Being able to inspect, repair. There's a lot of things with regards to an aging management program that impact safety, that make it such that we believe that we have a safe extended storage program.

COMMISSIONER CAPUTO: Okay. Thank you very much.

MR. STARK: Yes.

CHAIRMAN HANSON: Thank you, Commissioner Caputo.

And I just want to thank all of our guests, our panelists this morning. I think this was a very robust and helpful discussion for the Commission. I'd like to thank my fellow Commissioners.

We're going to take a five-minute break and we'll reconvene with the NRC staff panel for additional presentations and Commissioner questions. Thank you all very much.

(Whereupon, the above-entitled matter went off the record at 10:52 a.m. and resumed at 10:59 a.m.)

CHAIRMAN HANSON: Okay, everyone. Welcome back for the second panel of the Nuclear Regulatory Commission's discussion of the NRC's regulatory framework for dry cask storage and transportation of spent

nuclear fuel and related research activities.

We're pleased to have the second panel here made up of the NRC staff and led off today by Executive Director for Operations Margie Doane, followed by staff panelists Rob Lewis, Christopher Regan, John McKirgan, Anthony Dimitriadis, and Ricardo Torres.

And I'll introduce each of them as we go along, but for now EDO Doane, you have the floor.

MS. DOANE: Okay. Thank you, Chairman Hanson.

So I'm going to cut down some on my introductory remarks so that maybe we can continue with this really good conversation, but I do want to emphasize a couple points.

So first, we're very pleased to be here today, Chairman Hanson and Commissioners, to talk about this important issue and we'll be available for questions after, of course.

So I would like to emphasize a few points: There's been significant activity in this area over the last several years, and this is an important area of NRC oversight. And what you will hear today from the NRC staff is that our robust regulatory framework has continued to ensure safety during these changes to the spent fuel environment.

Our success in implementing the framework is due to collaboration across the Agency as evidenced by the multiple offices represented on the staff panel today, and there are other offices as well. Through the dedication of our staff, continuous coordination and collaboration with our domestic and international partners and through consideration of diverse

feedback and our stakeholders we've been successful in adapting to the changes in the spent nuclear fuel arena while becoming a more modern risk-informed safety regulator.

I want to say a few things about -- we heard David Victor's remarks on the first panel regarding the need for the NRC to not suggest that there would be blowback from additional agreements made between community boards and others and the licensee. And while the NRC must be disciplined to establish the regulatory basis for which the licensee is required to comply with, the licensee is not precluded from going beyond these requirements as they address community concerns.

The NRC issued a report on community engagement to Congress in July 2020, which included insights about how to effectively engage as community action boards. Further, we routinely provide expert presentations at community meetings when requested, including the Coastal Commission that was mentioned by Mr. Victor earlier. So we very much appreciate his remarks and also the compliments of our engagement.

Now let me introduce our staff panel. With me today is Rob Lewis, Deputy Director for the Office of Nuclear Material Safety and Safeguards; Christopher Regan, Deputy Director for the Division of Fuel Management in NMSS; John McKirgan, Chief for the Spent Fuel Storage and Transportation Licensing Branch in NMSS; Anthony Dimitriadis, Chief for Decommissioning Independent Spent Fuel Storage Installation and Reactor Health Physics Branch in Region I; and Ricardo Torres, Materials Engineer for the Office of Nuclear Regulatory Research.

Finally, it goes without saying that the staff and I are committed to providing you, Chairman Hanson, the necessary support and information you need as you assume the responsibilities of the NRC Chairmanship and we also want to offer our congratulations on your appointment.

I'll now turn the presentation over to Rob.

MR. LEWIS: Good morning, everyone. Thank you, Ms. Doane.

Chairman Hanson, let me add my congratulations. I, along with John Lubinski and all of the NMSS team, are looking forward to working with you in your new role and we appreciate your long-standing interest and expertise in materials and waste issues.

CHAIRMAN HANSON: Thank you.

MR. LEWIS: Chairman and Commissioners, we welcome this opportunity to brief the Commission on our regulatory program for spent nuclear fuel storage and transportation.

In my time, I will cover quickly our basic responsibilities, work scope, and some program background.

And next slide, please. Our primary responsibilities include the review and certification of packages for the transportation of radioactive materials under the requirements of 10 C.F.R. Part 71 and the review and licensing of spent fuel storage facilities and certification of storage cask designs under 10 C.F.R. Part 72.

As the program office, NMSS also sets expectations across our business line for spent fuel storage and transportation, and we work closely with

our partner offices, including Region I and the Office of Nuclear Regulatory Regulation, who as Margie mentioned, are represented at the table today.

You'll hear today that we conduct an extensive outreach program for spent fuel storage and transport commensurate with the high level of interest for these program areas.

With respect to spent fuel storage, NRC rules allow two approaches: specific and general licensing. A specific license requires an application to the NRC for a facility. The applicant must describe in detail all aspects of the planned facility, site, cask system, and programs to assure safe operation. This process includes safety and environmental reviews and opportunities for hearings. We currently have two specific license applications under review for spent fuel storage.

Alternatively, our regulations in Part 72 specify that all holders of Part 50 power reactor licenses have a general license to use a currently certified cask listed in Part 72 without further application to the NRC. A reactor licensee must assure that their site and programs are bounded by the cask design parameters. The staff reviews the safety of each cask design and certifies through regulation changes if it meets our requirements.

It was in the late 1990s that the NRC created a dedicated Spent Fuel Project Office with NMSS in response to then-anticipated growth of spent fuel dry storage facilities and transportation. This office and its successor divisions have enabled NRC to maintain a strong focus on safety and security as this program has evolved and grown significantly over the last 25 years.

I myself served in this program for nine years starting in 1995,

first as a staff nuclear engineer and as a branch chief. Chris Regan served in SFPO for 11 years starting in 1999. Now reflecting on my NRC career, I'm quite grateful to have had the opportunity to work in this area. Our work gave us strong expertise in all manner of licensing, inspection, outreach, and regulatory development fundamentals that I've used throughout my career. I believe, with respect to spent fuel storage and transportation of all radioactive materials, we made lasting impactful changes to public safety as we stood up that program.

In the early days of the Spent Fuel Project Office some of the key focus areas involved a trend towards larger casks with higher heat loads and accumulating operating experience with fuel loading, cask movements by crane, and new fabrication facilities and techniques.

Today our technical focus is also upon issues such as applying technologies to aging management programs, as you have heard in Panel 1, readiness for accident-tolerant fuels, and spent fuel storage for operating reactors that are transitioning to decommissioning. As the program has grown and evolved, we have adjusted our focus areas, skills mix, and regulatory guidance to keep our dedication to protecting people and the environment.

Next slide, please. When I started in the Spent Fuel Project Office in 1995 there were eight spent fuel storage licensees. All but one were specifically licensed and all casks were approved for storage only. Within 10 years there were 41 independent spent fuel storage installations. The majority were generally licensed and many casks were certified for both storage and transportation. Today there are over 80 licenses at almost every nuclear power reactor site.

Regarding transportation, while the growth of spent fuel transport that was anticipated when the Spent Fuel Project Office was formed did not occur, we now see renewed interest in preparedness for spent fuel transportation campaigns.

Several points were raised in the first panel, so I'll end with a quick -- I'll end by quickly sharing a bit of staff perspective on those.

We appreciate receiving insights on regulatory matters. We believe that such input strengthens our products and decisions. We collect those insights through many ways: informal interactions, the public meetings, through publishing draft regulations and guidance, and through more formal means such as petitions under 10 C.F.R. Part 2 or adjudicatory proceedings.

The staff has heard the insights offered by the first panel before through those forums. We're always listening and open to seeing new perspectives and we're always looking to see if there are areas where we can enhance our approaches, but as of now we did not hear any new information that provides a basis to change our conclusion that the casks meet the regulation, or that causes us to question the safety provided by the underlying regulations.

So thank you again for this opportunity and for your attention, and I'll now hand off the staff's presentation to Christopher Regan.

MR. REGAN: Thank you, Rob. Good morning, Chairman and Commissioners. As Rob mentioned, I have spent a good portion of my career, beginning in 1999, when I joined the Spent Fuel Project Office. After 11 years, I moved on, but in January 2019, when the opportunity arose, I returned because I find the work so interesting and rewarding.

I will be building upon the discussion of the framework Rob just mentioned for you -- described, by sharing with you information in four key principle areas: an overview of our current regulatory program, the strengths of our staff, coordination and relationships with our partners, and finally, I'll touch on our preparedness for the future for dry cask storage and transportation of spent nuclear fuel. Next slide please.

The first commercial casks were loaded in 1986. And since then, the NRC has worked to ensure the safe and secure storage and transportation of spent fuel, currently in more than 3,300 dry cask storage systems across the country.

The cornerstones of our framework continue to be our comprehensive, performance-based, and risk-informed regulations, as well as established oversight program for spent fuel storage and transportation licensees and the vendors that fabricate the packagings and systems.

Dry storage systems and transportation packagings must be designed to protect the public and workers and be able to withstand a myriad of credible natural disasters and accidents. With this in mind, the NRC has well-established safety requirements that must be met.

These requirements, along with a thorough and independent safety review by NRC staff, ensure that the systems can maintain confinement of the radioactive material, provide radiation protection, prevent nuclear criticality, and maintain the ability for the spent fuel to be safely moved to a repository or interim storage facility.

Part of the NRC's licensing review also includes review of

licensee security measures to minimize the likelihood of a successful terrorist attack. This review ensures that licensee programs meet all the security requirements and regulations and in orders for the physical protection of the spent fuel while in storage and during transportation to provide a high assurance of security.

It should be noted, and I think it's been mentioned, that over the past 20 years, no known or suspected attempts have taken place to either directly attack, sabotage, or steal radioactive material from storage casks at a spent fuel storage installation.

Our oversight program ensures that we observe and inspect critical activities, respond to events, and take enforcement action where necessary. We complete periodic inspections, from cask design and fabrication through storage facility operation and renewal. And we inspect corrective action programs so we have confidence that licensees can independently identify and address deficiencies.

In the vein of continuous improvement, we recently accomplished a significant milestone in completing enhancements to the spent fuel storage inspection program that focuses in on those areas most important to safety and which were informed by the decades of operational experience, our subject matter expertise, and careful consideration of stakeholder-provided feedback.

To sum this up, the NRC's comprehensive regulations that form the basis of our licensing and strong independent inspection program, coupled with the fact that spent fuel dry cask storage and transportation systems are

designed as passive long-lived systems that are inherently robust and resistant to damage, have contributed to an excellent safety record for more than 30 years. Next slide please.

The strength of our program is also largely due to our people. We have been successful because we have technically competent, incredible staff with extensive expertise in all relevant technical disciplines, spanning structural and materials engineering, radiation protection, thermal analysis, criticality control, shielding, and aging management.

And I recall when I was Chief of the Structural Materials Branch in the old Spent Fuel Project Office, I did a quick calculation and noted that in my branch alone, of about a dozen people, there was over 300 years of engineering and spent fuel experience. And several of those staff are still working in my division today.

So our strategies to maintain this high level of expertise and prepare for an agile and diverse workforce in the future includes instituting cross-training for future bench strength and leveraging experience between our licensing and inspection staff. We're also using the Agency's strategic workforce planning tool, and we're actively supporting Nuclear Regulator Apprenticeship Network assignments and staff rotations and continuing to implement knowledge management initiatives on several fronts. Next slide please.

I'd like to stress the close ties and many partnerships that we have regarding spent fuel storage and transportation. Now we foster these partnerships with the federal, state, and tribal partners to ensure openness and transparency of our processes and consideration of those diverse perspectives

of those organizations.

In a similar fashion, we also ensure that we keep open and transparent communications with the general public, illustrated by the over 20 public meetings related to spent fuel-related topics we held in Fiscal Year 2020.

As key federal partners, we coordinate extensively with the U.S. Department of Energy on spent fuel research. We co-regulate the transportation of spent nuclear material, including spent fuel, with the U.S. Department of Transportation. Also we engage with numerous forums on spent fuel transport topics, including with the Department of Homeland Security, Transportation Security Working Group, and national conferences and with states and tribal nations.

Only just a few weeks ago, myself with NMSS staff met with the Tribal Radioactive Materials Transportation Committee to specifically discuss the topic of spent fuel transportation. Similarly, we have participated in several spent fuel transportation tabletop exercises, where there was a wide range of players, including state and local governments and tribal communities.

And finally, I should note we coordinate and engage with the international community on many fronts too, through various committees and working groups with the IAEA and the Nuclear Energy Agency and our counterpart regulators to share and learn information on spent fuel and waste management issues. Next slide please.

Finally, I'd like to say a few words about our efforts and current activities to prepare for the future and to hold true to being a more modern, risk-informed regulator. We anticipate longer storage periods, and as a result, we

are enhancing our oversight program for aging management-related activities to ensure licensee programs are effective at addressing any potential degradation issues to support long term storage system functionality.

And I should note that the numerous examinations of stainless steel storage systems for spent fuel conducted to date, no significant degradation effects have been found. I think you heard some of that this morning from our external panel.

Furthermore, we continue to actively monitor industry's use of technological advancements for regulatory implications, like the use of robotics for inspection and for spent fuel storage designs innovative application in-situ repair techniques, already widely and effectively used in other industries.

And closer to home, identifying opportunities to use mobile IT for our inspectors in the field and as an integral part of our inspection program.

In licensing, we are making good progress using our established regulatory framework for review of two applications for consolidated interim storage facilities. And associated with these two proposed facilities, we are proactively preparing for a potential large scale spent fuel transportation campaign by completing a transportation regulatory readiness review.

And finally, we continue to maintain a high level of external awareness to have the most up-to-date insights regarding spent fuel matters, including accident-tolerant fuel and advanced reactor fuels through our agency's research programs and our extensive network of external partnerships.

This concludes my portion of our presentation. At this time, I'd like to turn it over to John McKirgan. Thank you.

MR. MCKIRGAN: Thank you, Chris. Good morning, Chairman, Commissioners. My name is John McKirgan, I'm Chief of the Storage and Transportation Licensing Branch. It's a pleasure to be speaking with you today.

I have two main topics I'd like to share with you. I want to touch on the licensing process enhancements, including accident-tolerant fuel and advanced reactor fuel readiness. And the other topic is the transportation readiness for potential spent fuel shipments. Next slide please.

I'll begin by offering that while our current licensing processes have served us well, the staff is embracing the spirit of becoming a more modern, risk-informed regulator. And we've identified a number of enhancements that demonstrate that.

At the same time, industry has also come forward with their ideas. The Nuclear Energy Institute developed and shared with the staff a white paper entitled “Defining Spent Fuel Performance Margins” that offers a number of enhancements that the industry is undertaking, as well as some topics that they have sought staff's engagement. Staff is engaging on those efforts in monthly public workshops with the industry to discuss the recommendations and develop implementation plans.

But today I want to talk about what the staff's doing in this area. So the staff is taking advantage of the opportunity to innovate and further risk-inform our licensing process for the review of new and amended dry cask storage designs. We continue to work proactively to risk-inform our approach on various technical topics.

I want to highlight three examples that are particularly important, given that these are the key drivers for change and major contributors to our success in further risk-informing our program. These include the graded approach to the format and content of applications, the risk tool, and the method of evaluation, or MOE, topical report.

In prior meetings, we've discussed the graded approach pilot. This was a pilot effort, and Orano volunteered to pilot with us. The effort was to develop a set of criteria including risk-informed criteria for determining the format and content of certificates of compliance and their technical specifications and to apply those criteria to a current certificate.

Orano offered the standardized NUHOMS horizontal storage module for this pilot. This was a certificate that had been used extensively over the years and had been amended a number of times, and over that time the certificate had grown to over 300 pages of technical specifications.

So the graded approach defines a format and content for storage certificates to focus the content on the most important aspects of a certificate. This will result in more flexibility for certificate holders and licensees using cask systems so that they can make changes without requiring an amendment, while continuing to ensure safety.

The graded approach is also anticipated to reduce the number of amendments and the rulemakings for approving those amendments to only those that are needed in terms of safety. The rulemaking for the pilot amendment was completed in September, and staff is engaging with industry on the next steps to facilitate further use of the graded approach.

The second example I want to share with you today is a new risk tool developed by the staff. This is an example of where the staff's openness to innovation and is consistent with the Be riskSMART principle of providing the framework for risk-informed decisionmaking. The risk tool was developed by the staff and enhances the staff's review of dry cask licensing actions by including risk information early in the review process.

The risk tool is based on existing risk studies, past safety evaluation reports, and staff expert knowledge. The risk tool will be used during the initial acceptance of an application to assess the scope, level of effort, and complexity of a review by providing a preliminary risk rating of the proposed licensing action.

The tool consists of a detailed report that captures the process a reviewer can use to assess the proposed changes against specific safety functions of the design and to help determine the relative impact of the changes on the cask performance. The staff also developed an accompanying simple job aid with visuals that is a further focused reference for the reviewer.

So this gives tools to the reviewer on the front lines of the review to build in the risk information right at the start during the acceptance review of an application. This will help ensure the level of effort and depth of the review are commensurate with the risk to better focus reviews on safety-significant items. The staff plans to pilot the use of the tool later this year.

The last innovation example I want to share with you is what we're calling the MOE topical report for shielding analysis. So in this case, the staff is proposing to industry to explore the development of an approach similar

to the core operating limits report approach used in operating reactors. Here, we're adapting a successful strategy used in the reactor fleet and applying it to dry cask storage.

The vision here is to approve a methodology by which vendors and licensees can perform the shielding evaluations of a particular canister loading. This is a logical continuation of the graded approach pilot program to focus the format and content of the certificates in the area of shielding on more performance-based criteria to streamline the process for review and certification of spent fuel dry storage designs.

The MOE approach would provide flexibility for the vendor and general licensee to make changes without an amendment while ensuring the protection of public health and safety. The NRC has discussed with industry the necessary information for the review and approval of such an approach, and the staff's understanding is the industry intends to submit a topical later this year. Next slide please.

I'll only mention briefly the staff's readiness to continue to support industry plans for transportation of ATF batch loads for mid-2020s, enrichments up to 10 percent in advanced reactor fuels. This is an important topic for the program so we wanted to mention it. You will also hear about this in an upcoming meeting on advanced reactors.

My key message here is that we continue to find our current regulatory framework has everything we need to support the transport of fresh ATF or near-term advanced reactor fuel concepts. The regulatory framework for dry storage and transportation of spent fuel is largely performance-based, which

provides flexibility to account for increased enrichments and higher burnups associated with these new designs and reactor operating conditions. Therefore, we do not anticipate the need for rulemaking in support of transportation of spent ATF or advanced reactor fuels.

We proactively engaged the industry to communicate the necessary regulatory timelines related to ATF and advanced reactor fuel transport and have successfully encouraged pre-application communications.

The staff has performed timely, safety-focused reviews for the fresh fuel and spent fuel transportation packages that have been supporting industry's development of ATF. Packages have been approved from such vendors as Westinghouse, Framatome, and General Electric.

Further, we've held pre-application meetings with other vendors. As you see in the picture here, there are two transportation packages. On the left you have the MAP-12 packages for transportation of fresh ATF assemblies. And on the right is the GE 2000 for transportation of ATF rod segments. Next slide please.

The final item I'd like to share with you today is the staff's efforts to ensure we're ready to carry out the Agency's mission in anticipation of a possible large-scale campaign for commercial transportation of spent nuclear fuel in the United States. The NRC staff is proactively assessing the Agency's readiness to fulfill its regulatory role and identify any potential enhancements to our program.

My first key message here is that the NRC's regulatory framework for transportation remains robust. We have comprehensive

regulations related to the package approvals and an excellent oversight program to ensure the continued, safe, and secure transport of reactor fuel.

The staff also has extensive domestic and international engagement, which continues to keep our framework informed of regulatory and technology advancements and lessons learned worldwide.

It's important to recognize that our program is solid and the track record for spent fuel shipments is exceptional. All transportation packages approved by the NRC must meet regulatory requirements that include strict performance requirements under hypothetical accident conditions. In addition, all transports must meet NRC and Department of Transportation requirements for radiation levels on the outside of the packages.

To protect workers and the public, the transportation package system has multiple barriers. The Agency has studied the safety of transportation, the risk of accidents, and the transportation of high burnup fuel. Results showed that the risks associated with the radiation emitted from the packages and the risks from accidental releases from transportation accidents is very low.

The plain language brochure entitled “Safety of Spent Fuel Transportation” explains the risk studies performed, and the studies show there's less than a one in one billion chance that radioactive material would be released in an accident.

Notwithstanding the exceptional track record of safety as a continually learning organization, the staff proactively took the initiative to re-look and reassess our readiness. Under this initiative, the staff is reviewing the

relevant regulations, guidance, inspection procedures, availability of information, communication strategies, and coordination with other agencies for the safe and secure transport of spent nuclear fuel.

The staff has determined that their current regulatory framework is sufficiently complete and flexible to provide for effective oversight of commercial transportation in conjunction with other federal agencies. As part of the assessment, the staff is developing recommendations for some enhancements to the NRC program for greater efficiency, principally in the area of inspection of the processes by which material from storage is prepared for transportation.

The staff's preparing a report with its recommendations and a roadmap for implementation scheduled to be made public by May of 2021.

The staff has begun outreach to communicate clearly and transparently the NRC's role in spent fuel transportation, in cooperation with other federal partners, principally the Department of Transportation, and to ensure that we fully appreciate the diverse perspectives on spent fuel transportation.

In January the staff presented at a symposium on spent fuel transportation sponsored by NEI. The staff is developing an integrated plan to communicate its readiness and assessment results and conduct additional outreach to stakeholders and the public consistent with the regulatory principle of openness.

So that completes my portion of the presentation, and I'll turn it now over to Tony.

MR. DIMITRIADIS: Thank you, John. Good morning,

Chairman, Commissioners. My portion of the presentation will focus on the implementation of the inspection program and recent innovations. Next slide please.

As mentioned before, the regions play a critical role in ensuring the safety and storage of transportation of spent fuel by implementing the inspection program. The spent fuel inspection program remains robust and continues to assure that risk-informed safety focus areas and inspection focus is designed to effectively monitor licensee performance.

The NRC performs inspection of the design, testing, repair, fabrication, procurement, modification, assembly, maintenance, and certificates of compliance for spent fuel -- nuclear fuel transportation packagings. Next slide please.

The ISFSI inspection program begins with the oversight of spent fuel early in the process, where inspections are conducted during the construction of the ISFSI pad, cask processing and transportation of radioactive materials.

In the slide, you can see various pictures showing, starting at the upper left and moving counterclockwise, our inspectors during the construction of an ISFSI pad, transportation of high activity radioactive material that closely resembles transportation of spent fuel, our inspectors during an ISFSI onsite inspection, and a welding dry run inspection.

I would like to provide two recent examples of how our oversight continues to ensure safety in the field, including a transportation inspection and a construction inspection. An example of inspection of

transportation of high activity radioactive materials similar to spent nuclear fuel includes our Region IV staff when they inspected a shipment made by a licensee to a low-level radioactive disposal site.

And you can see a picture taken during this inspection on the lower left section of the slide. Our inspectors were able to observe the shipment of a reactor pressure vessel where they were able to verify training for the personnel associated with the shipment of -- insured that the reactor pressure vessel arrived at the rail yard was properly transferred and arrived at its ultimate disposal site per the requirements.

The inspectors concluded that the licensing staff was knowledgeable of the regulations and demonstrated adequate skills and accomplish the package preparation requirements for public transport.

So another inspection example involves the construction of an ISFSI pad that was completed in the summer of 2020. The picture on this slide shows our inspectors performing this inspection where they performed walkdowns of the ISFSI pad construction areas and examined the rebar installation and concrete form work installation to verify compliance with licensee-approved specifications and procedures.

The inspectors observed that the actual concrete placement of pour number one and observed tests of several concrete characteristics of the ISFSI slab.

The inspection program continues to ensure the safe design and fabrication of transportation and spent fuel storage systems through vendor inspections. These inspections are conducted by a group of inspectors within

NMSS. During the pandemic, vendors and fabricators were inspected to assess compliance with the requirements outlined in Part 72 and Part 71.

For example, a combination of an onsite and remote inspections were conducted last year to evaluate Holtec Orrvilon and Turtle Creek facilities, as well as the Orano TN first time fabrication of the MATRIX horizontal storage module at Wolf Creek. Next slide please.

As Chris mentioned, the inspection program was recently enhanced to be more risk-informed, be clearer, comprehensive, and have a consistent approach to ISFSI inspections across the four regional offices, focusing areas on most important to safety. The working group took a holistic approach to further risk-inform the program by ranking the relative risk of dry cask storage loading activities based on five safety focus areas that the staff used to prioritize activities by risk.

The results enhanced the inspection program by focusing our inspection efforts on those activities that are most important to safety. For example, we increased our inspection hours on areas such as loading campaigns and canister processing.

We slightly decreased our inspection hours on certain areas where there's program overlap with the operating reactor inspection program, or with the Decommissioning Inspection Program for those aspects that are already included in their associated procedures.

These areas include radiation protection, for example, problem identification and resolution, fuel movement, and fuel movement within the spent fuel pool. It is important to note that we have the ability to modify the inspection

frequency at any time based on licensing events or performance to ensure adequate oversight. Next slide please.

Now I will briefly talk about the innovations, specifically two examples that are our staff embraced in an effort to be a more modern risk-informed regulator. First example that I would like to bring to your attention is the centralized dry run inspections. Dry run onsite inspections are performed to ensure that the process is well-planned and carefully executed.

They are completed in addition to the onsite inspections performed during actual loading of spent nuclear fuel. Typically dry run inspections include fuel loading, closure, and that is welding; unloading, processing, and transportation to the ISFSI pad. Part of the loading evolution is ensuring that the environment inside the cask is inert to help prevent the degradation of spent fuel.

So in 2020, our staff saw an opportunity where we could conduct an inspection during a centralized dry run where multiple sites would be represented. The staff demonstrated commitment to innovation and proposed to industry that we conduct this onsite centralized dry run inspection to evaluate if this approach is effective and if it garners practical inspection results.

This approach was initiated in February 2020 and culminated in an onsite inspection during the week of March 16, 2020. Exelon had representatives from five sites on hand for the welding dry run so that the demonstration and any potential lessons learned could be directly shared with all sites simultaneously. This approach was very effective as our inspectors were able to observe and evaluate the dry run activities, as would be done at each

respective site.

Based on the results of the centralized dry run inspection, the staff expanded this approach and conducted two additional inspections where one inspection involved two sites represented by Beaver Valley and Wolf Creek at TN's facility in South Carolina, and another inspection where our four Exelon -- four Exelon sites gathered at Holtec's Camden, New Jersey facility.

The former inspection was a joint effort between Regions I and IV. Our Inspectors' observations and interviews yielded valuable inspection results to ensure the health and safety of workers and the public.

The second example of innovation related to the use of technology. Due to the restrictions stemming from the COVID-19 public health emergency this past year, our inspectors closely -- worked closely with the industry to find solutions in performing inspections in a safe manner. They used cellular technology and personal tablets to communicate with licensee personnel, directly observe cask preparation activities, and of course review documents.

Our inspectors observed numerous pre-operational activities at multiple sites via use of Skype and/or Microsoft Teams. They participated in numerous conference calls, interviewed site personnel, and reviewed documentation that basically includes procedures, records, and condition reports in support of these inspection activities.

In addition, the regions leveraged talent and collaborated with NMSS, the Division of Fuel Management, to conduct reviews required under 10 CFR 72.212 and 72.48, which provided an important supplemental piece of the inspection to complete proper assessment.

The background picture captured that you could see here is NRC Inspector Joe Schoppy during the first centralized dry run at Holtec's Camden, New Jersey facility in March of 2020, and that's basically right before we began the COVID restrictions within the Agency. Here he is independently observing a mockup of the multipurpose canister. Next slide please.

Last but not least, we continued to focus on our people, our employees, who happen to be very talented in ensuring maximum flexibility, agility, and resiliency for a successful future. This past year has presented, as you know, numerous challenges in the inspection arena. Yet our staff adapted and continued to ensure safety in the field.

So in this slide you can -- on the upper left shows our Inspector, Elizabeth Andrews, observing a dry run evolution of canister processing at Holtec's Camden, New Jersey facility. The picture on the lower right of this slide shows Senior Inspector Katherine Warner performing walkdowns during construction of the ISFSI pad at Three Mile Island.

As you could see, our Inspectors took great care to abide by all of the COVID restrictions. You could see they're wearing their face covering to ensure that they were safe, as well as ensuring their actions also protected site personnel.

We continue to work with NMSS to enhance integration of oversight activities associated with the ISFSI program where we are seeking to identify areas where integration of inspection and licensing can be enhanced to ensure the NRC can be a more modern risk-informed safety regulator. So as part of that, we are identifying areas of cross-training of staff resources and

sharing expertise.

Lastly, to mostly -- to most efficiently share resources in response to COVID-related travel and inspection restrictions, NMSS assisted the regions by providing the ISFSI staff to support inspections at certain sites. That completes my portion of the presentation, and I'll turn it over to Ricardo.

DR. TORRES: Thank you, Tony. Good morning, Chairman and Commissioners. Thank you for the opportunity to discuss how the Office of Nuclear Regulatory Research is currently supporting NMSS and our partner regions on the safe management of spent nuclear fuel. Next slide please.

At the Office of Research, we continue to proactively assess research needs in support of the Agency's mission and the staff's readiness for our regulatory actions.

Our modest sized research program includes activities designed to provide NMSS staff with the necessary information for decision making and tools to efficiently complete their safety reviews, identify areas where operating experience and knowledge of risk and safety significance can facilitate and expedite licensing and oversight activities, and assist the staff's readiness for the safety reviews of future technologies, such as accident-tolerant fuels.

The Office of Research is actively engaged with the Department of Energy's Spent Fuel and Waste Disposition Program, as well as other international research programs, to identify areas of cooperation. We continue to identify areas of synergy where we can leverage outcomes of these research programs to support spent fuel licensing and oversight activities, particularly in the areas of aging management, higher burnup fuels, and

transportation. Next slide please.

The Office of Research has been supporting initiatives to enhance NMSS safety review processes through four primary areas of focus. By enhancing NRC's suite of confirmatory codes and tools, by conducting assessments on technical issues such as aging management, by supporting expert elicitations to identify and rank safety-significant issues, and by developing processes and tools to risk-inform dry storage and transport operations through the evolution of risk assessments.

In support of NRC's confirmatory tools, we have been assisting NMSS with benchmarking, verification, and validation exercises for our thermal hydraulic codes, computational fluid dynamic simulation tools, and criticality and shielding confirmatory codes. These exercises are meant to supplement best practice guidelines, provide NMSS staff with comprehensive references for uncertainty quantification, and improve the staff's confirmatory analysis for margins of safety.

The Office of Research is also supporting various technical assessments and expert elicitations on spent fuel technical issues. We're supporting evolutions related to aging management, with a particular interest on verifying our current state of knowledge related to aging mechanisms and effects.

For example, on the potential of chloride-induced stress corrosion cracking of stainless steel canisters in dry storage, it is important to note that chloride-induced stress corrosion cracking has not been identified in any spent fuel canisters in the United States.

That it is a slow developing process which takes decades to

result in a defect that could compromise the confinement function of the canister. That licensees implement aging management programs to address potential indications of chloride-induced stress corrosion cracking, and therefore this mechanism is not expected to compromise the structural integrity of the canister, even if movement or retrieval operations are necessary.

However, we continue to sponsor activities to confirm our understanding of this as well as other aging effects in dry storage systems. For example, the NRC recently sponsored a demonstration activity conducted at Pacific Northwest National Laboratory in collaboration with the Electric Power Research Institute in order to demonstrate technologies for assessing potential flaws due to this aging mechanism.

Shown in the slide top center is an example of the robotic crawler developed by industry to access a non -- and deliver non-destructive examination technologies to assess the surface of a stainless steel canister.

These non-destructive examination methods provide signatures on the condition of the canisters, for example, the phased array ultrasonic scan that would be the green background image on the top right, which trained personnel use to assess potential indications of localized corrosion and stress corrosion cracking.

We're also supporting industry-led expert elicitations, also known as phenomena identification ranking table exercises, PIRTs. These PIRTs will assess the safety impacts associated with breaches in the spent fuel cladding and alternative fuel performance metrics.

The results of these solicitations will be used to incorporate risk

insights into our regulatory framework, which have the potential for transformational changes to the NRC's approach to licensing in areas such as thermal and shielding reviews.

We're also supporting NMSS by developing products and tools to risk-inform licensing and oversight activities. These products incorporate risk insights from probabilistic risk assessments and other consequence-based studies. As mentioned earlier by John McKirgan, NMSS will soon start the implementation of one of these tools in their licensing processes. Next slide please.

We have also initiated forward-looking research to keep abreast of future technologies being pursued by industry and ensure we have the information to be ready to support the reviews of those technologies. For example, the staff continues to evaluate progress on the industry's efforts on sensor and detector technologies for the continuous and periodic monitoring of dry storage systems, which we recognize may supplement licensees' inspections and provide valuable insights on their continued performance.

We continue to support technical assessment on mitigation and repair methods, such as the use of robotic cold spray repair technologies. We're actively engaged with industry's efforts on these technologies via the Extended Storage Collaboration Program, which is organized by the Electric Power Research Institute.

Over the last decade, this program has provided a platform for productive information exchanges that have led to multiple technical efforts. For example, the establishment of a confirmatory demonstration program for high

burnup fuel at the North Anna independent spent fuel storage installation. Next slide please.

The Office of Research has also been proactively engaged with industry and the Department of Energy, and we're working closely with NRR and NMSS to ensure the staff's readiness to support back-end operations associated with accident-tolerant fuels, also known as ATF, increased enrichments, higher burnups, as well as advanced non-light water reactor fuels that may require alternative technologies for storage and transportation.

The staff has already approved the transport of a small amount of spent ATF and was able to do so with limited information available due to the small scale of that shipment. However, it is important to recognize that data from post-irradiation examination tests will be important to understand the safety impacts of batch quantities of spent ATF and advanced reactor fuels on dry storage and transport operations.

We will continue to evaluate generated data from lead test assemblies and batch-loaded fuel to ensure future spent fuel reviews are as efficient as possible. In support of NMSS readiness for the review of spent ATF, we're currently supporting activities involving confirmatory code development, technical assessments, and expert elicitations PIRTs, all of which timelines are consistent with industry's plan to batch load by the mid-2020s.

We have completed an initial technical assessment focused on identifying information gaps on spent ATF, with an aim to start defining appropriate updates to safety review guidance and performance acceptance criteria.

We also recently finalized phase one of our plan to update our criticality and shielding confirmatory code, also known as SCALE, which identifies code updates to support future spent fuel licensing activities, specifically the calculations needed to support independent analysis, principally in the area of higher burnup fuels.

In support of NMSS readiness for the review of spent advanced reactor fuels, we have developed a generic technical assessment on back-end implications of these fuels. We have also developed a comprehensive plan for confirmatory code enhancements, which relies on an approach to identify information gaps and the methods that can be used to address those gaps for various advanced non-light water reactor fuels.

This concludes my presentation. Thank you again for the opportunity. I'll now turn it over to Margie.

MS. DOANE: This concludes the staff's presentation, and we look forward to the Commission's questions.

CHAIRMAN HANSON: Thank you to the staff and to you, EDO Doane. Let's start the questions with Commissioner Wright.

COMMISSIONER WRIGHT: Thank you so much, Mr. Chairman. And before I get started, I would like to echo Commissioner Caputo's comments to SECY and everybody who's -- on staff who's put this together. It's turned out very well. Minor glitches, everything as big as this is, first time, this is awesome. I think it's transformative, I like that.

I'd also like to thank each of you for your presentations as well. Today it -- we heard some comments from the first panel that was complimenting

you on the Agency's engagement, and I'd like to echo, you know, my gratitude as well for what you do and how you do what you do.

And you know, we've had this public emergency that's been going on as well. So you've been doing this all throughout that time too, and I'm very impressed by the, you know, the staff's efforts. And I'd like to kind of go to the COVID response part, if I could.

So Rob, thank you for sharing some of the history of the program and how it's adapted, and has changed over time. And I know personally for you it's got to be satisfying to see the strong foundation that you've helped establish to serve this program so well.

So as you mentioned, the program continues to adapt to external factors, which include COVID, right, during this public emergency. Can you highlight some of the actions the staff took to respond to the public health emergency for me? And you know, are there plans to continue any of those practices once the pandemic ends?

MR. LEWIS: Yeah, thanks for the question, Commissioner Wright. I'd be happy to start, and I think we have our licensing team here and inspection team, so they can answer the specifics about those programs.

COMMISSIONER WRIGHT: Absolutely.

MR. LEWIS: We have in licensing space adapted fairly well. We've been able to transition our decision making to all remote operations. Our license reviews have proceeded smoothly. As far as our technical reviews, enabled ability to share information within the staff.

I would say that an area that has been impacted is our ability

to do public meetings. So in the ideal case, if we're doing an environmental review, for example, we want to go out to the location of the site and do environmental meetings in person. And we have had several cases where we've had to switch to remote meetings for those interactions.

And remote meetings -- and we added actually extra meetings to provide for greater opportunities and we extended comment periods to provide for greater opportunities to comment. However, I think at the end of the day, nothing replaces for some people sitting face to face across from a person and talking about the issues. And I think we want to get back to that when, as soon as we can. And it makes us have more effective decision making.

In the inspection program, throughout COVID we've transitioned as much as we can to do what we can remotely, but in some cases we have traveled out to the sites. I think a good example is at Wolf Creek site was constructing their first ISFSI pad and pouring concrete. It's a once-in-a-lifetime chance to see that, so we did decide, even I think it was last April, you know, and COVID was, a lot of things were shut down.

But we decided that was one inspection we had to travel to go see in this program. And there have been a couple other instances like that, but for the most part, what we can do remotely we are doing remotely. And when we go, as I think Tony indicated, when we do go, we're trying to minimize our time onsite. So even if we do need to travel, we'll do what we need onsite while we're there, but still try to do the rest of that particular inspection remotely if we can.

And we continue to adjust as local circumstances warrant and

CDC issues new guidance and things like that, we continue to adjust our programs.

(Simultaneous speaking.)

COMMISSIONER WRIGHT: Would any of you like to add on? Anyone? Okay. So Rob, let me follow up. NRR issued a report, which I believe Ricardo could talk to, but on COVID lessons learned and best practices. Do you plan to do something similar for NMSS?

MR. LEWIS: Yes, Commissioner, short answer's yes. We do plan to do that. We have an active team in house looking at internally and externally for lessons learned with respect to COVID, how we interact with each other, how we use telework, things like that.

We also have, as part of that project we're looking at how to work with applicants in meetings, what meetings can be done remotely in the future, whereas before COVID we would have done those in person, perhaps there's better ways. So we are working actively on COVID lessons learned in our program, and I expect over the next year, several months, we'll be issuing something similar to what NRR has been working on.

Last July we did issue guidance to the regions about how to handle inspections during COVID, just like NRR did. And we also have had to collect lessons learned. We've had several town halls with the entire DNMS program and NMSS program. In fact, we're having another one next week with John Lubinski and myself and Region III is hosting for us. But all the program is invited to share lessons learned with respect to COVID inspection activities.

COMMISSIONER WRIGHT: Sure. I've got one final

question for you. What do you see as the biggest challenges for the future of dry cask storage and transportation of spent nuclear fuel?

MR. LEWIS: Okay, thanks for that question. You know, when I try to do strategic thinking, I try to break up our future drivers into a few categories, three categories. So there's workload drivers, workforce drivers, and innovations. And I think over the next several years, the latter two, workforce and innovation, present the top challenges for us.

With respect to workforce, I think Chris talked about it. We, you know, we have a very experienced staff, but we've lost a fair number of people over the last several years. And we have had a period of limited hiring as an agency. So attracting top talent and developing them is one of our main management priorities for the office.

To ensure we have a good work environment that people are attracted to and want to come work in. To get that top talent, we focused on several things. We've cross-trained people. We have reinvigorated hiring, promotion, and development opportunities in the Division of Fuel Management. We've used the strategic workforce planning process and explained to our entire staff how we're using that so they can see where the opportunities are in the future.

We've proactively jumped into -- leaned into the Agency culture initiative and use of the leadership model. We are -- we're actively pursuing IT adaption so that, you know, when I look at my kids, for example, when they graduate college, they want to go to a workplace that doesn't necessarily look like the workplace that I went to in 1992 where you had the cubicle and you know,

you know, there's a lot less collaborative writing and stuff like that.

So we're trying to build that system that'll be attractive to people. I think it's a big challenge for the Agency.

I was excited to see OCHCO has the career enhancement portal. We're actively promoting that in NMSS as well, and we were a pilot office for the skills-based mentoring program they ran.

Quickly about innovation drivers, I think over the next few years we'll have to focus on innovation in terms of incorporating risk insights into storage and transport. You know, for example, transport, you know, there's package tests in the regulations, 30-foot drop, 800-degree fire, a puncture test, and a water immersion test.

Those same package tests are prescriptive and apply to a small package that might be handled by a FedEx employee, or a 120-ton rail cask. So the skill of translating those -- the forces that those tests represent to real-world accidents, and then using the insights from that to make cask design decisions is very challenging. It's work -- we have a lot of good projects, but it's very challenging.

You heard David Victor mention that it is very challenging especially to do the communications regarding that because although those studies show the risk is very low, the public interest is very high. So how to factor in risk more broadly than just the strict safety risks, that's a challenge for the NRC staff over the coming years in this program.

COMMISSIONER WRIGHT: Right. Well I wish I had more time, but because I have more questions too. But I do appreciate everyone's

time and perspectives on this topic today. You know, what's come through to me is that, you know, while there are some concerns, the NRC has a strong history.

And we also have, what, thousands of years of operating experience as well on it regulating this technology, so. And it's pretty clear the technology's only getting better, so with that, I'm going to turn it back over, Mr. Chairman.

CHAIRMAN HANSON: Thank you, Commissioner Wright. And thank you to the staff for being here this morning. I mean, you know, I listen to this presentation and I'm struck once again at kind of the long tenure of the staff and the deep technical expertise and their willingness to really dive into the data and the long history of experience that we have in this country of safety storing spent fuel. So thank you all very much for that.

Chris Regan, I want to start with you. You mentioned that we anticipate longer storage periods, you know, and almost every day is a new horizon, I think, in spent fuel storage in the U.S. if you think about it that way. And you mentioned that NRC is enhancing the oversight program for aging management-related activities. Could you talk a little bit more about that and talk about what some of those specific enhancements are?

MR. REGAN: Thank you -- thank you, Chairman, for the question. So we, you know, aging management as we move into periods of extended operations and the licensing of renewal periods is going to be key to the success of continued safe storage.

We actually recently completed a temporary instruction, which

is kind of a pilot inspection program for aging management programs where we inspected a sampling, a wide range of storage designs to ensure that we encompass as many of the different parameters regarding an inspection program.

We completed an extensive study of aging issues in our -- in a NUREG, documented, as we call it the MAPS report. As far as the inspection program itself, so looking forward, we actually are in the process of developing an inspection procedure based on the information and lessons learned from the temporary inspection.

Specifically regarding things to look at, you know, one is the effectiveness of the licensee's program itself. As you heard from several of the representatives on the external panel this morning, you know, can they adequately identify issues before they become problematic, do they have an effective program to institute appropriate corrective actions to address that issue, and to do it in a timely manner is critical to the effectiveness of an aging management program.

So really we're relying on the licensee's program. Our inspection activities is really to confirm and verify the adequacy and robustness of the licensee's aging management program itself.

CHAIRMAN HANSON: Okay, thank you. This next question, I'm not sure, you know, it's Chris or Tony or John on this, but it's really a question about transportation. And you know, I appreciated the graphic that was shown about -- that had the various agencies on it. And I'm thinking about kind of three in particular when it comes to spent fuel transportation -- DOT, of course the

NRC, and the Department of Energy.

And could, you know, kind of for the benefit of the public, can you talk about the interactions and the various jurisdictions of each of those agencies and how we are kind of making sure that the seams between those agencies and their jurisdictions are sewn up, if you will, so that, you know, the public has confidence that when spent fuel moves, that it's being moved safely and under the auspices of these federal -- you know, these various kind of federal powers.

MR. REGAN: Chairman, if you'll allow, maybe I'll start.

CHAIRMAN HANSON: Yeah, sure.

MR. REGAN: And then if any of the staff want to augment it, I can, sir.

So we mentioned our transportation regulatory readiness assessment that we launched to try and look at this particular challenge of defining and ensuring clarity in the NRC's roles and responsibilities among all those folks that have a vested interest in the transportation of spent fuel. And that includes, you know, our governmental counterparts, other external stakeholders, tribal nations, and most importantly I would dare say, members of the public because of the transparency that we want to maintain as a regulator.

One of the key aspects of this regulatory readiness review is our communications strategy. And I thought -- I think you've heard in part of our presentation that we have engaged with the New Mexico legislature -- legislative bodies regarding consolidated interim storage and related transportation issues.

We participated in the NEI transportation symposium to reach

a different audience. And recently myself, I engaged with the TRMTC, or the Tribal Radioactive Materials Transportation Committee, to ensure that we are -- have an avenue for communication with the tribal nations.

It's very important that we -- that folks understand what the NRC's roles and responsibilities are. Because as you, you know, infer, it's very complicated. There are lots of players in ensuring safe transportation of fuel.

The NRC's role primarily is involved with ensuring the cask designs are safe for transport. We inspect the cask to make sure it meets Part 71 transportation regulations before it leaves the site. We do a handoff to DOT in a sense, and they regulate the actual transportation evolution. And then at the other end, we will -- we are going to be inspecting the package when it arrives at its destination.

Throughout all this, there's engagement and notifications of those communities and areas that are affected by a transportation route. We also, I should mention that regarding route approvals, this is something that often comes up in conversation about the NRC's role, from a security perspective we, you know, we do approve routes.

We don't select the routes, we approve what the route is proposed to us, and we determine whether it meets our regulatory requirements for the secure transportation along that route.

Back to the original thrust of your question though, you know, how do we ensure communication, collaboration. That's part of our -- you know, strategy for outreach to all these entities in the multiple avenues where we are engaging with our counterparts and interested stakeholders. And I hope I

answered your question. And any of my colleagues, feel free to augment my response if you have additional details.

CHAIRMAN HANSON: Anyone else? No? Okay. I think that's it for me. Thanks, Chris, very much for that. Commissioner Baran.

COMMISSIONER BARAN: Great, thanks. Well thank you all for your presentations and all the work you do in this area. It's work that doesn't really get highlighted enough. You know, usually, it's just one little sliver of a business line meeting.

So it's good, I think, to be able to do a deeper dive into some of these issues and really to hear from a range of stakeholders about the issues and your thoughts about what you've heard from those stakeholders. So thanks for being here and for your presentations.

As we discussed during the first panel, the San Onofre Task Force assembled by Congressman Mike Levin recommended that NRC should require a 100-year design life for dry casks. How does that compare to what NRC requires now? Does an applicant for an initial 20-year license or a 40-year renewal need to demonstrate that the dry cask will function safely for 100 years or for some period beyond the licensing term?

MS. DOANE: Commissioner Baran, I'm going to start off taking this question, and then I'll, you know, anybody else can chime in once I'm through. So the report itself is -- talked about legislation, so I just want to start out saying that, you know, the potential for or substance of any legislation obviously is up to Congress. And nothing that I'm saying here is a remark about that at all.

So with respect to the proposal, we -- our review is of the system for the period of time within which the system is approved for. So as you know I think, our systems are currently licensed or certified for an initial period of up to 40 years, with possible renewals and intervals of 40 years upon application with justification and safety analysis.

So analysis does come in for lengthier terms for the life of the canisters, but the actual -- the bounding of the regulatory review is for that period.

So I think -- and I would say that at the same time, because there's a suggestion that this would be better, I just want to point out that because of the robustness of our license reviews, we've also done environmental studies, we've done work on the waste confidence rule, is indicative that we can make findings, proper findings, even as these -- when there is renewals and you have a lengthier time that, a lifespan of these canisters.

And we make assumptions in other -- in rulemakings and things like that that might go beyond that licensing interval. But for purposes of licensing, we've bound it by the time period.

COMMISSIONER BARAN: And Margie, I mean do we -- and others obviously can chime in on this -- do we think that that makes sense? I mean, I get the logic of basically saying someone's applied for a 40-year period and so we're just going to look at the 40-year period to determine whether it would function well in that situation.

But you know, we've had conversations about, well it could be longer. And in some cases, you know, I guess we have casks that are over three decades already in use. You know, if the data's there to make findings for much

longer periods, or if applicants are in a position to say, well here is the data that would show that it would last much longer than 40 years safely, is there some reason we wouldn't want to have that?

Given that options might be pretty limited if you get to the end of the 40 years and something wasn't working, would we want to satisfy ourselves that it would function much longer?

MS. DOANE: So I would just offer, and anybody can chime in, that the way that the construct of our regulatory reviews is that, you know, we're looking at the system for that interval. So that would suggest that maybe you would go 100, have 100-year interval for -- before you would do license renewals. So then you would look at the package for 100 year period.

But of course, the disadvantage of that is then your renewal proceedings would also lengthen, and you wouldn't be able to realize all the advantages of a renewal, which is an opportunity to say to the licensee, demonstrate that you can, that this will be safe for an additional 40 years, and all of the review that goes with that. So that's -- so I'd say --

COMMISSIONER BARAN: Is it really -- is it really that -- does it have to be either/or that way? I mean, could NRC have an approach that says you're seeking the 40-year period, and as part of the demonstration of getting a license for 40 years, you show us that it could function for 100 years.

MS. DOANE: I think that you -- I think that we have discretion to put frameworks around our regulatory processes. We have a lot of discretion.

But I would tell you that it would be very confusing, because if you're really looking at one period, and you would not want to bind yourself at

that early time to say oh yeah, you just showed 100 years, then you get to the renewal and you have to -- then you would say to yourself, okay, well we really weren't binding ourself to 100 years. You now need to show that you can really -- you see what I mean?

COMMISSIONER BARAN: Mm-hmm.

MS. DOANE: So you lose the opportunity to make sure that you're looking at the 40 years and that's what you're certifying. And then you're going to look at the next. Because then you would certify this long period, then you would get to the 40 years, and what would you really be doing? And you would have a lot more information after the 40 years, of course, than you did at the very beginning.

So I would tell you there would be some distinct disadvantages, but maybe there --

COMMISSIONER BARAN: Yeah, I just --

MR. LEWIS: No, I agree with you, Margie. This is Rob Lewis, and then also, you know, reflecting on some of the comments from the first panel.

I think, I feel confident we have the tools within Part 72 approach, within the way we're doing license renewal with the aging management programs. Using the past risk studies and environmental reviews that we've done.

I think we have the tools to make the conclusion that -- that the cask is safe and provides reasonable assurance, and meets the requirements, regardless of design life issues at any point in time.

And if we do see issues with a cask or a canister within a cask, or have signs that the fuel contents within a cask might have some kind of issue, I think that as you heard in the first panel, there's ways to deal with that. And there's tools available to deal with that in a timely way that, that I think again, we conclude based on all we, based on all I know, the technical decision could be made that that could be done with reasonable assurance of adequate protection safety.

COMMISSIONER BARAN: My sense, you know, in listening to the first panel and really just generally from hearing from stakeholders over the years is that one of the, one of the concerns out there is that dry casks could crack over time, say from stress corrosion cracking. And that that's a concern folks have out there.

If that, if we or a licensee were to find that condition in a dry cask at a site, what would NRC do in that situation?

What would we require a licensee to do?

DR. TORRES: So, this is Ricardo Torres. I'll chime in since I have experience licensing this cask for eight years with NMSS before.

So, if degradation is identified on any dry storage system, whether it be CISCC, chloride-induced stress corrosion cracking related or not, licensees will have to initiate an assessment and corrective action that's necessary per their NRC-approved quality assurance program.

Licensees need to address these conditions in a timely manner. And what we have done is, we've provided guidance via example aging management programs, with acceptable characteristics, as Chris Regan alluded

to.

We have developed the Managing Aging Processes and Storage Report, with example AMPs for instance, for localized corrosion and stress corrosion cracking, which defines specific requirements for visual inspection per ASME code requirements.

Then if indications of localized corrosion such as pitting, is identified, then there needs to be a follow-through assessment via a volumetric examination, per performance requirements in the ASME code as well. In addition, there needs to be an extent of condition assessment to identify if other canisters may have been affected by the same condition.

And I also highlight that it's similar to what you've heard this morning. Industry has made significant progress on the development of robotic technologies for the deployment of both visual inspection, ultrasonic testing, eddy current testing, all sorts of volumetric examination methods that can be used to assess the condition and do -- and determine the extent of the condition identified, as well as the potential for any crack, which licensees would evaluate per the data that's available, per the research data and the crack growth rates that are available to identify, okay, how often do we need to start inspecting? How much time do we have before we take additional action.

COMMISSIONER BARAN: And I guess that was really more of my question. I mean, I do appreciate the discussion on the inspection and monitoring side, because that's obviously an element of it.

But, I think that the concern I'm hearing is, what if you have a crack that's determined through inspection, to be of significance? You know, in

terms of a concern about the viability of the cask going forward.

What would happen? What would we do? What would we require in that situation to make sure that you didn't end up having a failure of the canister, or of the dry cask, rather?

DR. TORRES: So, I think that the NRC would, the inspectors would coordinate with the technical experts that had clearance to evaluate the data that's being generated through the inspections.

To identify the, again, the progression of the aging effect. Identify how far the crack has progressed if there has been, if there is any indication of that crack.

And what are the consequences associated with the mechanical performance of the cask under all conditions of storage? Normal, abnormal, and accident.

Whether it be fatigue-related, whether it be drop scenarios, design basis drop scenarios, there would be an assessment to determine the viability of the, of the system to perform as intended, even though there could be an indication or a flaw.

And decide on a maintenance plan for that, that specific system. How often does it need to be inspected to ensure that it does not progress through wall.

COMMISSIONER BARAN: Well, you know, I'm over my time. So, I'll leave it there, I guess.

But, I just -- what I'm not hearing, is like a pithy response about what would we do if we got to the point that there was a through-wall crack, or

there was a real problem?

I'm hearing a lot about evaluation. And I appreciate that these are slow-moving conditions. And that they're things you would monitor over periods of years and maybe even decades.

But, I think, I think our stakeholders, and I think the public's going to want to understand, what would we do if there was a problem? If this cask, if a cask failed, what would we do?

I'm not hearing any answer to that. And I think that that's an answer people are going to want to hear.

So, I'll leave -- I'll leave it there. But, unless you want to respond. But, I'm a little over my time.

DR. TORRES: Well, I'll just mention that there are options, for example, what was mentioned by Holtec and Orano has the same capability to pull out the canister, place it in another overpack that provides the new confinement boundary.

And there would be additional assessments to ensure that that new confinement boundary would remain as, would perform appropriately to prevent a release of radioactive materials.

COMMISSIONER BARAN: Okay. Thank you. Thank you, Mr. Chairman.

CHAIRMAN HANSON: Thank you, Commissioner Baran. Commissioner Caputo?

COMMISSIONER CAPUTO: Sure. I'm actually going to just follow on with Commissioner Baran's line of questioning.

And just ask perhaps Margie or anyone else on the panel, do we have the authority we need to compel licensees to either fix or replace a canister that might develop a flaw over time?

MS. DOANE: Absolutely we have the authority. And we would first, as you would see in any situation where we would have a licensee that has a potential, they're either out of compliance with their license, we would absolutely go in and first, you know, make sure that there are mitigative measures. And that we don't need to take any kind of emergency action to protect the public.

And then once we've established that, you know, there isn't something that's exigent, then the licensee would be compelled to provide us with their plan to get back into compliance. Which would address anything like a, you know, just anything that would come up, like a crack or something like that that would be causing some kind of an issue.

And as you heard with the first panel, the innovations in this area are tremendous. And so, and you get the impression that they're learning every day.

So, what exactly they would do, would depend on the specific technical issue at hand. But, absolutely we have the authority if that's what you were getting at, Commissioner.

COMMISSIONER CAPUTO: Yes. Thank you. And I do want to take just a moment to say, I have a lot of confidence in the integrity of our inspectors.

And the work that they are doing in spite of COVID challenges,

you know, to keep their inspection efforts focused on the items most significant to safety. I have a lot of confidence in our regional and headquarters staff who support those inspection efforts.

And I really appreciate how everyone's maintained a focus on our safety and security mission, given the challenges that COVID presents. So, thank you all for your effort in this area.

Mr. McKirgan, you talked earlier in terms of transformation efforts and looking at documentation. One of the challenges, I think, that I at least wrestle with when it comes to dry cask technology is there is a constant stream of certifications and licensing and so on.

And you talked about trying to address, sort of, I want to say the paperwork burden where things may or may not change over time. But being able to make changes in a technology without going through a full license amendment.

Some folks would look at that and say, oh, they want to make changes without a look by the NRC. Is that cutting corners on safety?

And I would ponder that the opposite could be said. Which is, this gives people the opportunity to incorporate advancements in a more streamlined fashion as well.

Can you just clarify that a little bit?

MR. MCKIRGAN: Certainly, Commissioner. Thank you. Thank you for the question.

I guess I'd like to begin with the first part of your question, about what we're trying to do to provide additional flexibility to licensees and vendors

through these things like the method of evaluation topical report for shielding. There are some other topical reports underway.

So there the staff is focused on ensuring that safety is maintained. That is paramount in all of our reviews.

What the staff has observed over the decades is, is that the methods that are being applied by the vendors are very familiar now to the staff. After having gone through numerous amendments, we've seen these methods.

And what the staff has realized is that they can generalize these, approve the method, and as long as the industry applies those methods correctly, and we would have an oversight ability to ensure that that continues to happen, as long as they're applying these methods, that we can continue to do that safely, and it would avoid that paperwork burden of coming into the agency for review, where we're looking again just at a method we've seen before.

So, that's certainly --

COMMISSIONER CAPUTO: Okay. Thank you.

MR. MCKIRGAN: I'll stop there.

COMMISSIONER CAPUTO: Mr. Regan, Ms. Gilmore from the earlier panel indicated that the NRC exempts dry casks from the ASME N3 certification for nuclear pressure vessels.

Considering dry casks aren't reactor pressure vessels, is a certification even applicable?

MR. REGAN: So, I'll start by answering, you know, I think that if I may defer that question to Ricardo, who has extensive experience and knowledge of the ASME code. If you would allow me to do that?

DR. TORRES: Yeah. So, Commissioner Caputo, you're absolutely right. That stamp is -- has not been required in the past.

It's not something that is necessary to ensure safety of the systems. For the last 30 years we have designed -- we have accepted design criteria per ASME code, Section 3, Edition 1, which, as you noted, is applicable to nuclear power plants' components.

And yes, we grant exemptions from certain requirements of the ASME code, because they're just simply not applicable to dry storage systems or transportation packages.

I would also note that the ASME has been developing an entire new section, a new division of the code for transportation packages and dry storage systems. That would be Division 3.

And we're actively engaged with them to ensure that they address our comments, our recommendations, so we can finalize our endorsement of that Division. Which, if complied with it, would imply a stamp associated with that --

COMMISSIONER CAPUTO: Okay.

DR. TORRES: With compliance of that.

COMMISSIONER CAPUTO: Thank you. Dr. Torres, I'll continue with you with another question.

So, we've heard concerns that canisters are at risk for early cracking. And that, quote, no one knows how many cracks or the size of cracks in 3,200 canisters.

However, I've heard it stated repeatedly today that, to date,

there has been no evidence of chloride-induced stress corrosion cracking. And I'll also note, licensees are required to have aging management programs in place to prevent degradation, that degradation is unlikely but there are technologies in place and procedures for addressing it if it were to be encountered.

So, Dr. Torres, Mr. Regan perhaps, given this combination of factors, is this -- are these factors the basis for ensuring adequate safety without requiring decommissioned licensees to maintaining -- to maintain the ability to repackage onsite in either a hot cell, or a pool, or any other facility?

Is that the reason why we don't require sites to maintain repackaging?

Don't everybody speak at once.

CHAIRMAN HANSON: Apparently you're on mute --

COMMISSIONER CAPUTO: All are apparently on mute.

CHAIRMAN HANSON: Doctor, you have your mute on.

DR. TORRES: Apologies. So, I'll start by saying that in the unlikely event that there were to be an indication, as I said, identified in the dry storage system, there are mitigation and repair techniques that are available to address them.

There are also other alternatives aside from the spent fuel pool. There are transportation package overpacks that are designed to handle the decay heat associated with these canisters that could be implemented in lieu of having a spent fuel pool, and reflooding and opening the cask.

You know, it's important to recognize that taking a canister

back to the spent fuel pool and immersing the fuel back in, in the pool, could potentially cause a significant -- significant phenomena on the fuel itself. And also, it would impart significant doses when opening these casks.

So, we believe that there are other alternatives that are less strenuous on occupational personnel, as well as there are technically sound techniques to approach the problem.

COMMISSIONER CAPUTO: Okay. Thank you. And I think I'm close to my time. But, Mr. Regan, I'd like to ask one last question.

Ms. Gilmore based canister cracking concerns on statements attributed to an NRC inspector and documented in a Southern California Edison conversation record.

Would you please share your thoughts on why it's important for inspectors to be able to take draft field notes, interact with licensees, and review technical data back in the office before finalizing and documenting their conclusions?

MR. REGAN: Yeah, thank you, Commissioner, for that question. So, you know, our inspectors they are, they are the eyes and ears of our agency.

They are the boots on the ground. They see things. They hear things that only they have access to, given their proximity to the licensee's activities.

And throughout an inspection evolution, their opinion and perspectives on what the licensee is doing evolve over time as they learn new information. So, it's part of, part of the practice of the, you know, of the skill of

the trade of an inspector to ask and probe from a variety of angles with a licensee.

And challenge a licensee on the adequacy of their analyses to ensure that we, the inspector gets all the information necessary for them to draw any conclusions or findings about -- about the adequacy of a licensee's activities.

And in this -- in the case of San Onofre that was alluded to by Ms. Gilmore, that inspection occurred over many, many months.

So, in the early stages, you know, we had somewhat limited knowledge and familiarity with what the licensee was doing, and we continued to explore that.

And I think the statements that were attributed were earlier on during our inspection. As we learned more information, our awareness and the information we had available caused us to look at, you know, many different aspects of that.

And came to a, the agency came to a conclusion several months after that statement was made that was different than what was -- what was made earlier.

So, you know, all that is, like you said, field notes or documentation or just the angle of a snapshot in time of that particular inspector would not be reflective of how we -- how we would go about doing something like that.

So, you know, I'd kind of pull back from that specific example and just reflect on the fact that the agency values diversity of opinion very, very highly.

We want to hear from the staff and our inspectors on what

they're seeing, what they think. Because that results in a more fully informed final decision.

If we didn't hear the diversity of perspectives, I think that we would, we would probably be more akin to the groupthink mentality, which is what we do not want.

So, allowing the inspectors the leniency to explore avenues during the course of an inspection, and probe from different perspectives is important to the success of our oversight program.

Hopefully that is responsive to your question. But, that's my opinion of how inspectors work.

And to put that kind of comment and information in perspective or context in the whole, you know, with respect to our inspection program as a whole.

COMMISSIONER CAPUTO: I appreciate your comments very much, and I wholeheartedly agree. First impression isn't necessarily a complete picture.

And I certainly feel that our inspectors need the freedom to, you know, follow the leads and do a fuller, more thorough examination without having their integrity impugned.

So, thank you for your remarks. And I don't have any further questions. Thank you, Mr. Chairman, for your indulgence.

CHAIRMAN HANSON: Thank you, Commissioner Caputo for that line of questioning.

I think that's a great way to wrap up today's meeting, talking

about the rigor of the work that our inspectors do, and the continued good work of the staff, particularly in this evolving and kind of complex technical area.

So, I really want to thank everybody for being here this morning. The staff, particularly, and the panel led by EDO Doane and Rob Lewis.

I want to thank our external participants for a very kind of robust and vigorous technical exchange. I want to especially thank the Office of the Secretary for putting all of this online today.

Remind everyone that this has been recorded, so there may have been some technical glitches here and there. But it will be online and available to the public by noon tomorrow, so people can tune in as they see fit for this.

And with that, and thank you's all around for everyone on a snowy Washington day. We are adjourned.

(Whereupon, the above-entitled matter went off the record at 12:32 p.m.)