

UNITED STATES  
NUCLEAR REGULATORY COMMISSION

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BRIEFING ON REGULATORY RESEARCH PROGRAM ACTIVITIES

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THURSDAY,

FEBRUARY 24, 2022

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The Commission met via webcast, Christopher T. Hanson,  
Chairman, presiding.

COMMISSION MEMBERS:

CHRISTOPHER T. HANSON, Chairman

JEFF BARAN, Commissioner

DAVID A. WRIGHT, Commissioner

ALSO PRESENT:

ANNETTE VIETTI-COOK, Secretary of the Commission

MARIAN ZOBLER, General Counsel

NRC STAFF:

DANIEL DORMAN, Executive Director for Operations

RAY FURSTENAU, Director, Office of Nuclear Regulatory Research (RES)

THERESA LALAIN, Deputy Director for Division of Safety Analysis, RES

KENNETH ARMSTRONG, Chief, Code and Reactor Analysis Branch II, RES

NANCY HEBRON-ISREAL, Senior Grants Specialists, University Nuclear  
Leadership Program, RES

ROBERT TREGONING, Senior Level Advisor, Division of Engineering, RES

1

PROCEEDINGS

2

10:02 a.m.

3

CHAIRMAN HANSON: Good morning, everyone, we'll

1 now begin our briefing on regulatory research activities here at the NRC.

2 I think it's important to keep the public informed of the NRC's  
3 regulatory research activities that are essential for the Agency in its  
4 preparedness to evaluate novel nuclear technologies.

5 I've been impressed with our research program for some  
6 time.

7 We have a relatively modest budget and I think the way it  
8 collaborates with industry organizations such as EPRI as well as licensees  
9 directly, as well as the Department of Energy and the National Labs, in my  
10 view, does a remarkable job of leveraging the significant amounts of data out  
11 in the world as well as generating new data that directly benefit our regulatory  
12 activities here at the NRC. So, it's a real pleasure for me to have this meeting.  
13 It's been almost three years since we've heard from our research program and  
14 I'm excited about the presentations that we have before us this morning.

15 But before we begin, I'll ask my colleagues if they have any remarks  
16 they'd like to make? Great, we're going to hear first from Dan Dorman and  
17 then onto our Director of Research Activities, Ray Furstenau.

18 We're going to hear from Terri Lalain and Ken Armstrong  
19 and Nancy Hebron-Isreal and finally from Rob Tregoning. And I look forward  
20 to it, and Dan, I'll hand it off to you.

21 MR. DORMAN: Thank you, Chairman, good morning  
22 Chairman Hanson, Commissioner Baran, Commissioner Wright.

23 The Staff are pleased to be here today to provide an update  
24 on the Agency's regulatory research activities, which provide essential support

1 to agency preparedness across our business lines from the reactor to the  
2 materials programs.

3           The office is uniquely positioned to deliver on our agency  
4 vision as a modern risk-informed regulator. We achieve mission excellence  
5 in a diverse, inclusive and innovative environment with a highly skilled,  
6 adaptable, and engaged workforce.

7           The Office of Nuclear Regulatory Research is a powerhouse  
8 of deep technical expertise and they apply their knowledge and analytical tools  
9 to support programs across the Agency.

10           They help fuel Agency innovation through research.  
11 Additionally, they lead many collaborative activities with both domestic and  
12 international partners to smartly leverage resources to essential agency  
13 readiness for a variety of new nuclear technologies.

14           Next slide, please. I'd like to now follow up on the  
15 Chairman and introduce the panelists who will talk today about the Agency's  
16 research activities. First will be, as the Chairman indicated, Ray Furstenau,  
17 the Director of the Office of Nuclear Regulatory Research.

18           Ray will provide an overview of the Agency's research  
19 activities, program, and external engagement that plays a key role in  
20 supporting NRC's safety and security missions.

21           After Ray, Terri Lalain, the Deputy Director in the Division of  
22 Systems Analysis will talk about how the research program technical activities  
23 achieve results that support mission readiness and efforts that are underway  
24 to foster innovation.

1                   Kenneth Armstrong is a Branch Chief in Research for the  
2 Code and Reactors Analysis Branch and Ken has led Research's reviews of  
3 our scientific computer codes and has developed with peers a code  
4 investment plan to support Agency budgeting and planning to ensure  
5 readiness of state of the practice codes to support advanced nuclear  
6 technologies.

7                   Then Nancy Hebron-Isreal, a senior grants specialist who  
8 leads the Agency's University Nuclear Leadership Program, will talk about the  
9 benefits this program provides in advancing our research program and  
10 developing support to nuclear talent and leadership.

11                   Finally, Rob Tregoning, senior level advisor in Research for  
12 the Division of Engineering, will discuss the focused research program and  
13 how it supports agency readiness for emerging technologies.

14                   Rob will also discuss how the research program supports  
15 and strengthens the Agency as it conducts its mission. This concludes my  
16 opening remarks so without further ado, I'd like to hand the presentation over  
17 to Ray Furstenau.

18                   MR. FURSTENAU: Thank you, Dan, and good morning,  
19 Chairman and Commissioners, it's a real pleasure to be here today to talk  
20 about our research activities and how we are helping the Agency be ready for  
21 innovative nuclear technologies.

22                   It's hard to believe I've been with the NRC over three and a  
23 half years now and I've been so fortunate in these past three and a half years  
24 to be able to lead such an extraordinary group of people in the Office of

1 Regulatory Research.

2 I think to best summarize the progress and direction of the  
3 Office of Research over these past few years, I'd like to quote from a  
4 December 13, 2021 ACRS biannual review report on our safety research  
5 program, quote, We, the ACRS, note that RES is evolving from what was a  
6 static reactive organization to a more dynamic, forward-looking one.

7 Also from the summary of their biannual report, quote, RES  
8 programs, position the Agency well for the changing environment, as  
9 illustrated by improving ongoing processes, prioritizing projects, finding new  
10 ways to develop and maintain core competencies and exploring ways to apply  
11 existing capabilities.

12 These activities are all signs of a healthy research  
13 organization and should support the Agency's broader efforts to transform  
14 itself into a modern risk-informed regulator.

15 Next slide, please.

16 I'd like to touch briefly on how we're maintaining and building  
17 our capabilities in the Office of Nuclear Regulatory Research. I'll touch a little  
18 bit on people, scientific computer codes and tools and partnerships.

19 Starting with people, you'll see on the left there a little  
20 montage of some of our recent hires in the Office of Research over the past  
21 18 months or so, some external and some within the NRC.

22 I've been really most impressed by the competence and the  
23 credibility and dedication of our Staff to our nuclear safety and security  
24 missions.

1                   As a support organization, I think it's important for Staff to  
2 be able to articulate the relevance and impact of our research activities to the  
3 Agency. That can be difficult sometimes but I think our Staff is doing a really  
4 good job of that.

5                   We need to be adaptive in our office and ready for the  
6 application of advanced nuclear technologies to the current reactor fleet as  
7 well as to new and advanced reactors.

8                   I wanted to note our full-time equivalent utilization last year  
9 was slightly over 100 percent and since we're engineers, I'll give you a more  
10 precise number. We had a 197.2 actual utilization versus 197 as our target.

11                  But I bring that number up because it's important that we  
12 maintain our FTE utilization numbers up in order to support or adequately  
13 support our business line partners. And the strategic workforce planning  
14 process I think has really helped us anticipate our workforce needs to be ready  
15 for the future.

16                  Regarding scientific computer codes and tools, a key  
17 element of our capabilities is a suite of validated modeling and simulation  
18 codes to perform our confirmatory analysis for a wide variety of safety  
19 applications, for example source-term calculations, thermal hydraulics, fuel  
20 performance, and accident analysis.

21                  You'll hear more from Kenneth Armstrong later in the  
22 briefing about our computer code investment plan that will help us ensure our  
23 readiness to review emerging issues and new technologies.

24                  And lastly, I'd like to touch on partnerships. The Office of

1 Nuclear Regulatory Research relies heavily on strong partnerships within the  
2 Agency and externally.

3 Externally, we use those partnerships to leverage research  
4 and resources being supported by other organizations to address safety topics  
5 and anticipate future needs.

6 Briefly, I'll mention some examples, our partnerships with  
7 DOE for example. Our partnership expansion with DOE was enabled by the  
8 Nuclear Energy Innovation Capabilities Act of 2017, also known as NEICA.

9 An MOU was created out of that Act and it was signed by  
10 the Chairman and the Deputy Secretary of Energy in 2019.

11 And then we had subsequent addenda to that MOU that  
12 provide for coordination between DOE and NRC for technical readiness and  
13 sharing of technical expertise on advanced reactor technologies and nuclear  
14 energy innovation, including through the DOE's National Reactor Innovation  
15 Center, also known as NRIC, that's located at the Idaho National Engineering  
16 Lab.

17 In fact, we're taking advantage of the opportunity to observe  
18 and learn about technologies developed through NRIC by having one of our  
19 Office of Research engineers assigned to a one-year detail to NRIC to learn  
20 about new and advanced construction techniques.

21 Internationally with the Nuclear Energy Agency, we're  
22 participating in joint projects using irradiation testing and post-irradiation  
23 examination facilities worldwide to gain knowledge and fill data gaps for new  
24 and existing materials and fuels.



1                   The NEA recently established a Framework for Irradiation of  
2 Experiments, also known as FIDES, to help fill the gap left by the 2018  
3 shutdown of the Halden test reactor in Norway. And I'm happy to be the  
4 Chairman of the governing board for FIDES.

5                   We also partner with DOE on some of the joint projects  
6 coming out of the FIDES framework. We have a separate agreement with  
7 DOE on how we partner on FIDES to best benefit both agencies.

8                   And with EPRI just recently in September of 2021, we  
9 renewed our MOU with the Electronic Power Research Institute for our  
10 cooperative nuclear safety research programs, which include six addenda that  
11 cover research areas such as advanced nuclear technologies, data science,  
12 management of materials and aging and degradation of long-term operations.

13                   The NRC and EPRI first established this cooperative  
14 research agreement in 1997 and I think it's really a good working relationship  
15 in sharing opportunities we have with EPRI.

16                   And of course, internally we work closely with our partners  
17 in NRR, NMSS, and NSIR to make sure we're performing timely research  
18 that's relevant to the mission.

19                   With that, I'll turn it over Terri Lalain to provide more details  
20 on our research activities.

21                   Terri?

22                   MS. LALAIN: Thank you, Ray. Good morning, Chairman  
23 Hansen and the Commissioners.

24                   Today it is my have pleasure to walk you through our

1 research innovation activities and share how the NRC is leveraging my 18  
2 years of experience with the Army in assessing new technologies being  
3 deployed in the field.

4 From 2018 to 2020, I participated in the NRC's Senior  
5 Executive Service Candidate Development Program where I shared best  
6 practices between the Army and the NRC.

7 Since joining Research last March, I've been using my Army  
8 experience enhancing NRC processes such as the code investment plan  
9 which you'll hear later today.

10 I'm enjoying my time at the NRC and one thing I particularly  
11 appreciate is the Agency's focus on its people, including how we make  
12 decisions, interact, innovate, and collaborate, and I look forward to the  
13 discussion today.

14 Next slide, please. The NRC Staff is committed to enabling  
15 nuclear innovation in the existing fleet through regulatory engagement and  
16 research cooperation.

17 We are supporting nuclear innovations in the areas of high  
18 burnup fuels, wireless technologies, and risk tools to better enable the  
19 adoption of these technologies in operating reactors.

20 We recently published a Research Information Letter to  
21 provide NRR with technical interpretations of fuel fragmentation, relocation,  
22 and dispersal, or FFRD, phenomena for high burnup fuel under LOCA  
23 conditions.

24 The RIL is one piece of information that can be used to

1 evaluate the safety of FFRD. Research will work with NRR and follow the  
2 progress of risk-informed FFRD efforts through early interactions with vendors  
3 and licensees.

4 Our electronic engineers and cybersecurity specialists are  
5 performing several research efforts to enable the safe and secure use of  
6 advanced wireless communications.

7 With NSIR, we are collaboratively studying the secure use  
8 of wireless by leveraging insights from other organizations who have  
9 implemented this technology in safety-critical facilities.

10 With NRR, we are researching the potential safety hazards  
11 associated with the increase use of wireless communication technologies and  
12 the considerations for enabling safe use at nuclear facilities.

13 Our engineers and cybersecurity specialists also participate  
14 in the external standards development organizations and intergovernmental  
15 working groups to maintain awareness of these developments.

16 The SPAR models are the Agency's independent risk  
17 assessment models used in several risk-informed regulatory programs. The  
18 SPAR-DASH project aims to make the SPAR model risk results easily  
19 accessible to the Staff for incorporating risk insights into their work.

20 SPAR-DASH uses complex data from SPAR models to  
21 develop simple dashboards for inspectors and technical reviewers to gain  
22 quick risk insights to inform licensing and regulatory activities.

23 The research project team collaborated with Staff in NRR  
24 and the regional offices to capture their insights and leverage modern data

1 science tools to automate extracting key risk results from the models and  
2 display them in a user-friendly dashboard.

3 The dashboard supports ranking important contributors to  
4 plant risk, prioritizing tasks and resources, and allows for quick assessment of  
5 potential degraded or off-normal plant conditions.

6 Next slide, please. Advanced reactor readiness is a priority  
7 for the NRC safety and security mission.

8 Our ongoing readiness efforts will require forward thinking  
9 and planning to use our risk-informed insights as we identify and resolve  
10 challenges associated with industry proposals to use new and emerging  
11 technologies.

12 A key element of our readiness strategy is the development  
13 of codes and analytic tools to support confirmatory analyses that may be used  
14 in advanced reactor licensing actions.

15 Our code investment plan, which you'll hear from Ken  
16 Armstrong today, is aiding us by long-range planning for the necessary  
17 investments to be ready to support the regulation of new and advanced  
18 technology.

19 Research is able to rapidly respond to NRR's request for  
20 assistance in non-LWR applications due to the successful execution of the  
21 SCALE neutronics and MELCOR severe accident code readiness planning.

22 Research is leveraging the fluoride salt-cooled high  
23 temperature reactor reference model to significantly reduce the lead time in  
24 performing design-specific analyses to support NRR's review of the HERMES

1 construction permit to develop safety-focused request for additional  
2 information.

3           The NRC Staff is developing guidance to facilitate licensing  
4 reviews for advanced reactors in support of the Part 53 rulemaking including  
5 scalable human factors engineering reviews, flexible staffing approaches, and  
6 tailored operating licensing requirements.

7           Given the wide variety of advanced reactors designs and  
8 concepts of operations, the new guidance aims to be risk-informed,  
9 performance-based and technology-inclusive to enable more flexibility in how  
10 the NRC Staff performs reviews based on the safety significance of human  
11 actions.

12           The Staff has developed a new regulatory guide, 1.247, for  
13 determining the acceptability of PRAs used in non-LWR regulatory activities.

14           The guidance benefits the 20-plus years of experience the  
15 NRC has gained related to the implementation of Reg Guide 1.2, the  
16 analogous light-water reactor guidance document.

17           Research is preparing for the review of advanced non-LWR  
18 designs related to high-temperature materials, component performance,  
19 molten salt fuel cycle, and consensus standard improvements from both  
20 technology-inclusive and design-specific considerations.

21           Our Staff issued a significant number of reports on molten  
22 salt compatibility, high-temperature materials and component integrity, and  
23 graphite aging and degradation.

24           Staff completed Reg Guides to endorse ASME Section III

1 Division 5 high-temperature materials, paving the way for Applicants to use  
2 code-qualified materials.

3 Staff is engaged with NMSS to address technical and  
4 regulatory considerations on the front and back end of the MSR fuel cycle and  
5 potential safety impacts to advanced fuel cycle facilities. Next slide, please.

6 Research is well respected across the nation and worldwide  
7 in nuclear safety and security research. Our research activities are  
8 performed by professionals who are experts in their field and their work directly  
9 supports the NRC mission.

10 In addition, Research supports the program offices by  
11 conducting in-depth confirmatory research on a breadth of safety and security  
12 topics. Central to our mission, our priorities are retaining our core technical  
13 capabilities, maintaining our worldwide recognition, and developing skills in  
14 emerging areas.

15 We are committed to ensuring our people have the right  
16 training, skills and abilities to accomplish the important work in front of us.  
17 We use strategic workforce planning to better identify skill gaps and workload  
18 trends.

19 To recruit the workforce of tomorrow, we are leveraging the  
20 NRAN, intern, and co-op programs to meet our priorities and support the NRC  
21 needs. Given the competitive marketplace for talent, recruiting experienced  
22 staff continues to be a challenge.

23 To attract this talent, we are utilizing recruitment incentives  
24 to the maximum extent possible. We are also cultivating the talent of our highly

1 skilled workforce by investing in comprehensive training and developmental  
2 opportunities.

3 Our primary product is knowledge. We are committed to  
4 establishing a self-sustaining knowledge management program which  
5 includes use of our wiki-type online encyclopedia called Nuclepedia.

6 We also provide formal transfer training sessions to  
7 strengthen our Staff's skills across the Agency. Lastly, as shown by the  
8 testimonials on this slide, Research Staff are dedicated to offer critical  
9 expertise and perspectives on nuclear safety and security research across the  
10 nation and the world.

11 Next slide, please. Strong partnerships across the Federal  
12 Government, industry, and international counterparts are essential for meeting  
13 our mission.

14 External awareness through these engagements is critical  
15 to our readiness to support future licensing actions and ensure we share  
16 experience, knowledge, and collaborate where possible.

17 The Halden Human Technology Organization Project has  
18 been conducting innovative research with cutting-edge simulation  
19 technologies. The research results support the NRC's review of innovations  
20 in the nuclear industry.

21 For example, Halden's research of evaluating operator  
22 performance in digital control rooms focused on teamwork, workload, and  
23 procedure use.

24 This research provided technical basis for the NRC's review

1 of innovative control room staffing strategy in advanced reactor design.

2 Halden's future automation lab develops various innovative  
3 automation prototypes and studies how adaptive automation works with  
4 human operators as a cohesive team.

5 Advanced manufacturing technologies, AMTs, offer  
6 innovative opportunities to produce optimal reactor components for improved  
7 performance. Research supported an Agency-wide AMT action plan to  
8 address technical and regulatory preparedness, expand external stakeholder  
9 engagement and knowledge management.

10 The Staff issued several reports on the assessment of near-  
11 term technologies, generic technical information and technology-specific  
12 guidelines to be addressed in AMT submissions and workshops.

13 Staff formed partnerships with research organizations in the  
14 international community to continue to develop the expertise and capabilities  
15 to enable future applications of AMTs in the nuclear industry.

16 Artificial intelligence is one of the fastest-growing  
17 technologies globally and is the next frontier of technical adoption for the  
18 nuclear industry.

19 Research is leading the Agency's efforts to ensure AI  
20 regulatory readiness and utilization of AI tools in our business processes.

21 To increase awareness of AI's technical adoption in the  
22 nuclear industry, we held three public workshops during 2021, bringing  
23 together the nuclear community through the current and future state of AI.  
24 Finally, the NRC is not alone when it comes to overseeing the safe and secure



1 deployment of AI.

2 We are meeting with other government agencies and my  
3 colleagues in the Army to identify new partnerships to leverage their expertise  
4 and experience in AI.

5 Next slide, please. Research has a be-ready mantra and  
6 is well positioned in supporting regulatory readiness for future technological  
7 innovations as we look to the next five to ten years now to be ready for that  
8 future.

9 Recognizing the unique worldwide situation with several  
10 nuclear power plants simultaneously decommissioning, Research has  
11 developed a novel strategy to assess harvested material, components, and  
12 concrete from previously operating reactors.

13 The strategy matches the component attributes with the  
14 Agency's priorities to reduce uncertainties associated with the long-term  
15 operation of safety-significant components in challenging nuclear  
16 environments and potentially provide a basis for updating regulatory positions.

17 Research participates in multiple cooperative research  
18 projects such as SMILE and FIDES that have enabled opportunities for the  
19 harvesting and testing of materials.

20 Research will pursue harvesting opportunities as they arise  
21 through domestic and international partnerships. As I mentioned earlier, I  
22 joined the NRC from the Army where one of the areas in my portfolio was to  
23 test infrastructure to assess the safety and performance of AI systems.

24 Coming to the NRC, the NRC and the nuclear industry have

1 a similar interest in the potential of these capabilities.

2 As a modern risk-informed regulator, we must keep pace  
3 with technological innovations and reduce barriers while ensuring the safety  
4 and security of AI in nuclear facilities.

5 To prepare the Agency for this future, Research has initiated  
6 development of an AI strategic plan that includes goals for AI partnerships  
7 cultivating the NRC AI-proficient workforce, utilizing tools to enhance NRC  
8 processes and ensuring NRC readiness for future AI decision-making.

9 In Summer 2022, Research will engage with Agency  
10 stakeholders in soliciting feedback on our AI strategic plan and we expect to  
11 finalize this plan in the fall of 2022. As we look further down the horizon, the  
12 future-focused research program supports the exploration of potential  
13 regulatory challenges three or more years out.

14 These projects enable Staff to explore these challenging  
15 areas as a first step towards readiness for future program office needs. Rob  
16 Tregoning will provide specific examples of these exciting projects in his  
17 briefing.

18 With our expert Staff, modern and adaptable analytical  
19 capabilities, and expensive external partnerships, Research is well positioned  
20 to support nuclear innovations for the existing fleet and advanced reactor  
21 licensing.

22 This concludes my presentation and I will turn it over Ken  
23 Armstrong. Thank you.

24 MR. ARMSTRONG: Thank you, Terri, and good morning,

1 Chairman and Commissioners.

2                   Scientific computer codes are used by the NRC, industry,  
3 academia, and the international community to understand advances in  
4 technology and support regulatory decision-making.

5                   The NRC generally uses these codes to support the  
6 development of independent technical basis along with any needed analysis  
7 to confirm the safety of the operating fleet, fuel cycle facilities, spent fuel  
8 storage and transportation packages, and new application and amendment  
9 requests.

10                  Next slide, please. In 2019, as part of the FY2021 budget  
11 review, the Commission requested a long-term investment plan to ensure the  
12 NRC's inventory of computer codes were appropriately resourced.

13                  In response, the Staff has developed a new process and  
14 implemented a comprehensive review and identification of long-term needs  
15 for our codes.

16                  This process provides the NRC with an integrated  
17 management tool for its codes, accounts for and stabilizes annual resource  
18 requirements, informs future budget formulations and helps to identify Staff  
19 expertise requirements.

20                  This plan is a living document with formal updates on an  
21 annual basis. This is our first year of formally using the investment strategy  
22 and we expect to continue to refine this process over the coming years as we  
23 gain experience using it.

24                  Next slide, please. RES surveyed the NRC offices and

1 identified 40 scientific codes which the agency was supporting for current and  
2 future development activities.

3 Most of these codes are led by Research, though several  
4 fall under NMSS.

5 The table shown in this slide groups these codes by  
6 technical analysis area. These range from complex integrated codes with  
7 close to a million lines of text that often take days or weeks to run to much  
8 simpler ones that can run in seconds.

9 Nine of these codes are not expected to support  
10 decision-making activities within the next seven years and were placed in an  
11 archival state.

12 31 of the codes require ongoing investments to support  
13 expected regulatory decision-making. These codes require ongoing  
14 maintenance and the development that represent the current pace of  
15 advancements made by industry.

16 4 codes are currently undergoing code modernization and 7  
17 codes are being consolidated into 2 codes in the radiation protection area.

18 Most of these computer codes are supported by  
19 international code-sharing programs, where resources provided by the  
20 participants assist the NRC in development, assessment, and training  
21 activities.

22 We also share codes with domestic users and other federal  
23 agencies like the Department of Energy. Next slide, please.

24 As mentioned, computer code investment plan provides a

1 proactive approach for identifying funding over a seven-year timeframe. For  
2 our active computer codes, major resource investments are depicted in this  
3 pyramid and looking at it from the ground up.

4 First, we need to maintain our computer codes to ensure  
5 usability and distribute updated versions to our user groups. We do this by  
6 fixing bugs identified by the user groups and making sure that we are ready  
7 for the latest operating system and IT security requirements.

8 Next, we develop these codes in line with regulatory drivers  
9 from industry and needs from the regulatory offices. Examples of this would  
10 be in ensuring that we are able to model accident-tolerant fuel, high burnup  
11 fuel, and advanced reactors.

12 These efforts continue to be closely aligned with the NRC's  
13 licensing offices as future needs continue to evolve. We also enhance our  
14 codes through new features to improve analysis run time and confidence in  
15 the models.

16 Finally, this approach allows us to plan large resource needs  
17 over time, like computer code modernization where the code is fundamentally  
18 updated to take advantage of modern programming practices, and co-  
19 consolidation, where multiple codes are combined into one.

20 Next slide, please. We plan to initiate the investment  
21 planning process each summer, in advance, to help inform future budget  
22 planning.

23 The investment process at a high level starts with justifying  
24 the need for a computer code and being aware of options that exist to meet

1 the intended purpose.

2 Then one will identify ongoing maintenance and distribution  
3 resources needed as well as any developments to the code to ensure utility  
4 for an intended application.

5 Finally, all this gets planned out over time using the intake  
6 chart shown on the right.

7 For each code this chart includes a description of the code's  
8 current state, if it meets requirements for that code, the impacts for not funding  
9 those activities, deliverables such as new code releases and a resource table  
10 that consolidates those needs over time.

11 These resource numbers are entered into the annual  
12 research prioritization list in support of future budget formulation. This  
13 concludes my presentation and I'll turn the presentation over to Nancy.

14 MS. HEBRON-ISRAEL: Thank you, Ken. Good morning,  
15 Chairman and Commissioners, my name is Nancy Hebron-Isreal and I am a  
16 senior grant specialist within the Office of Research.

17 I have a wealth of experience and knowledge with grant  
18 management and implementation. This morning I'll be providing some  
19 information about how the University Nuclear Leadership Program, UNLP,  
20 encourages researchers at U.S. institutions to bring innovative ideas to the  
21 NRC, as well as the program's benefits to the workforce needs of the Agency  
22 and the nuclear industry broadly.

23 Next slide, please. The UNLP began in fiscal year 2020.  
24 Formally, it was known as the Integrated University Program.

1                   This program traditionally supported educational grants for  
2 students and faculty through scholarships, fellowships, and faculty  
3 development.

4                   In 2020, the program was broadened to support research  
5 projects relevant to the programmatic mission of the Agency. As a result,  
6 RES invited the submission of university-led R&D projects to complement  
7 current and future research needs.

8                   RES seeks to leverage universities' capabilities through  
9 these R&D grants. Next slide, please. We recently completed the second  
10 year of the UNLP.

11                   We're excited at the overwhelming response to the R&D  
12 funding announcement where we received and reviewed over 200 proposals  
13 for Fiscal Years '20 and '21.

14                   Our Fiscal Year '22 research funding opportunity  
15 announcement is now open and will close on April 5th. We also continue to  
16 coordinate with our UNLP partners, DOE, and NNSA.

17                   This coordination ensures that our programs are  
18 complementary and provide adequate coverage of technical areas.  
19 Additionally, RES began hosting research recipient presentations to learn  
20 more about the research institutions are conducting under the program.

21                   To date, four recipients presented to NRC Staff. Last  
22 month, Oregon State presented on its research project related to nuclear  
23 cybersecurity. This event was announced to NRC Staff and resulted in nearly  
24 90 Staff attending and participating.

1                   This project directly addresses the objectives of the NRC,  
2 providing risk-informed security through understanding of cyber risk and  
3 vulnerabilities associated with nuclear plant instrumentation and control  
4 systems.

5                   An area where we've recognized where the program is  
6 lacking is in the participation of minority-serving institutions. To incentivize  
7 this, our recent funding announcement for research projects encourages  
8 institutions to include partnerships with MSIs.

9                   We are also exploring how the UNLP funds can be utilized  
10 to support the reinstatement of the MSI grant program managed by the Office  
11 of SBCR. These R&D grants complement our research portfolio.

12                   As an added benefit, these grants directly engage students  
13 in work of relevance to the Agency, and thus, they also provide a pipeline of  
14 capable and experienced university graduates.

15                   Next slide, please.

16                   Turning now to educational grants, under the UNLP, student  
17 recipients are required to obtain nuclear-related employment. This  
18 employment may be with nuclear-related industries, the NRC, other federal  
19 agencies, state agencies, national laboratories or academia.

20                   The UNLP provides direct benefits to the NRC's workforce  
21 development staffing needs. OCHCO recruited NRC grant recipients for the  
22 Agency's NRAN program, the resident inspector development program and  
23 other entry-level positions.

24                   Of the 45 members of the inaugural 2020 NRAN cohort and



1 the incoming 2022 cohort, 35 members were grant recipients.

2                   Recently, under the resident inspector development  
3 program, two trainees were from the grant recipient pool and one resident  
4 inspector position was filled by a grant recipient.

5                   Several other grant recipients were referred NRC program  
6 offices and regions for immediate entry-level opportunities, and some are in  
7 the process of receiving offers.

8                   The UNLP is an important tool to fill entry-level skill gaps  
9 identified through the Agency's strategic workforce planning process. NRC  
10 grant-funded scholarship and fellowship recipients who meet eligibility  
11 requirements may be non-competitively selected for NRC positions.

12                   As an example, in 2020 RES utilized a grant program and  
13 onboarded two grant recipients, one in the Division of Systems Analysis,  
14 supporting specialized research and analysis in fuel and cladding  
15 performance and design, and the other in the Division of Engineering to  
16 support the Agency's Regulatory Guide program.

17                   This concludes my presentation and I'll now turn it over to  
18 Rob Tregoning.

19                   MR. TREGONING: Thank you, Nancy.

20                   Good morning, Chairman and Commissioners, I'm Rob  
21 Tregoning, the senior level advisor for materials in the Division of Engineering  
22 in the Office of Research and today I'm providing an overview of the Agency's  
23 future-focused research or FFR initiative.

24                   Next slide, please. The program was developed to position

1 the Agency for upcoming technical and regulatory challenges by initiating  
2 research on topics that are expected to be important.

3 In essence, the program is attempting to identify what's next  
4 for the Agency, and then using modest resources, implement some initial  
5 research and planning so that the Agency can most effectively fulfil our  
6 mission in the future.

7 The FFR program is fueled by the Agency's best resource,  
8 our Staff. The program encourages Staff to momentarily step back from daily  
9 near-term activities and identify potential regulatory topics within the next  
10 three to five years that may require new knowledge, tools or skills.

11 The FFR program then provides an opportunity to develop  
12 cognizance of the cutting-edge research underpinning these topics and  
13 determine if enhancements to the Agency's framework could promote  
14 effective regulation on that topic.

15 The program also promotes outreach to academic,  
16 Government, and industry leaders to identify relevant partners and programs  
17 that may be leveraged if the Agency pursues future development in these  
18 underlying technologies.

19 In this manner, the FFR program intends to energize Staff  
20 by directly investing them in the Agency's future success while simultaneously  
21 building essential long-term capabilities.

22 Next slide, please. There are three components of  
23 research and development, or R&D, that support regulatory decision-making.

24 The most fundamental piece is foundational knowledge,

1 which consists of the expertise, experience, skills, and creativity needed to  
2 address a particular challenge.

3                   This knowledge is then applied to develop those general  
4 analysis tools and information that buttress the supporting technical basis.

5                   These tools are then exercised using the specific  
6 characteristics of the problem at hand to ultimately reach the intended  
7 decision.

8                   To provide a simple example, foundational knowledge of  
9 fluid flow, thermodynamics, computational modeling and programming were  
10 used to develop the NRC's TRACE thermohydraulic code, which has then  
11 been used to evaluate a plethora of design basis accident scenarios in reactor  
12 licensing applications to assess the likelihood of subsequent fuel damage.

13                   It is the strategic development of foundational knowledge  
14 that the FFR program intends to address. Such knowledge supports a more  
15 flexible, agile workforce as the underlying skills and capabilities can be applied  
16 to a broad array of challenges.

17                   Sometimes the return on the investment in foundational  
18 knowledge may not be readily apparent, especially in the near term. As an  
19 example, in the early 2000s, the Agency devoted significant resources in  
20 developing structural graphite expertise to support the next-generation  
21 nuclear project, or NGNP.

22                   In 2013, the NRC suspended all NGNP activities after DOE  
23 decided not to proceed with that effort. At that time, it certainly appeared the  
24 NRC's investment in developing structural graphite expertise was worthless.

1                   However, about five years later, the expertise gained a  
2 decade prior was leveraged to review proposed ASME code rules on structural  
3 graphite for its potential use in several advanced non-light-water reactor  
4 designs.

5                   The actual application of this foundational knowledge was  
6 most certainly not envisioned when the decision was made to develop that  
7 capability.

8                   Thus far, in the incipient stages of the FFR program, Staff  
9 have submitted ideas that would enhance foundational knowledge associated  
10 with all aspects of the NRC's mission, including nuclear material tracking and  
11 inventory, licensing, rulemaking, inspection, waste storage and transportation,  
12 and decommissioning.

13                   These ideas could impact existing, new, and advanced  
14 reactors.

15                   It would establish new capabilities and expertise within well  
16 established technology areas, such as materials, consequence analysis,  
17 radiation protection and probabilistic risk assessment, as well as more  
18 nascent technology areas such as automation, artificial intelligence, and  
19 machine learning.

20                   Next slide, please. The FFR program is not quite two years  
21 old, however, there have already been enough early successes to be  
22 optimistic about the role that this program can play in supporting the Agency's  
23 readiness for tackling future challenges.

24                   I want to discuss three FFR programs initiated in 2020 to

1 illustrate this point; the first is a digital twin project. A digital twin is a  
2 connected digital representation of a physical asset.

3           The digital twin FFR project explored the technical issues  
4 and infrastructure needed to prepare the Agency for regulating digital twin  
5 applications. The project held two widely-attended workshops, published  
6 multiple technical reports, and identified likely nuclear digital twin applications,  
7 key technologies, and their associated technical challenges.

8           Currently, the FFR project is transitioning to business line  
9 funding to support significant industry interest in broadly applying this  
10 technology.

11           Another example is the FFR project to apply licensing  
12 modernization project, or LMP, to operating reactors.

13           This project combines the licensing modernization  
14 methodology developed to establish the licensing basis for advanced non-light  
15 water reactors with existing Level 3 risk insights for operating reactors to  
16 identify Part 50 requirements that could be risk-informed.

17           An initial pilot study evaluated the dose associated with  
18 internal events to demonstrate that the LMP methodology is feasible for light-  
19 water reactors and that the safety profile was consistent with non-light water  
20 reactor risk targets.

21           Additionally, the pilot study gleaned insights on both non-  
22 light water reactor licensing and light water reactor safety that had been  
23 shared with stakeholders.

24           The next phase of the FFR effort is using external event

1 probabilistic risk assessment to identify aspects of the standard review plan  
2 for transient and accident analyses that can be risk-informed.

3           The System-Theoretic Accident Model and Processes, or  
4 STAMP, is a causality model developed using system theory that can be used  
5 in lieu of or in conjunction with traditional PRA to identify risk-significant  
6 scenarios.

7           This approach has already been successfully applied in  
8 many industries. The FFR project confirmed that STAMP could potentially  
9 improve the efficiency of NRC's digital systems reviews and identify potential  
10 system errors that would not otherwise be considered.

11           Two Agency-wide workshops and other forums were held to  
12 increase Staff awareness of STAMP and identify enhancements to facilitate  
13 learning and applying STAMP.

14           The STAMP FFR provided Staff with timely knowledge to  
15 support growing industry interest in STAMP-based methods such as its limited  
16 use in NuScale design certification document application.

17           Currently, a business line activity is being developed to  
18 explore future implementation of STAMP at the NRC, Next slide, please.

19           While the FFR program is off to a promising start, the next  
20 challenge is to grow the program into an Agency-wide resource.

21           The intent is that FFR will become an incubator of those  
22 research ideas culled from across the Agency that align with being a modern  
23 risk-informed regulator.

24           We know that good ideas benefit from diversity and

1 crowdsourcing. Inspectors, licensing assistants, technical reviewers, project  
2 managers, administrative assistants and, yes, even managers all have unique  
3 perspectives that can germinate into a powerful idea.

4 To reach its full potential, the program's visibility needs to  
5 be increased and ultimately ingrained into the Agency's culture and collective  
6 consciousness such that when someone has a good idea they immediately  
7 think of sending it to the FFR for consideration.

8 The FFR uses a streamlined and simple submittal process  
9 to facilitate Agency-wide involvement and the program can provide support to  
10 nurture and execute good ideas if the submitters are not positioned to  
11 implement their idea.

12 We also need the FFR program to be flexible and agile.  
13 Resources will remain modest compared to the Agency's budget and the  
14 program will need to effectively steward those resources.

15 To do this, we intend to create synergies with both internal  
16 and external programs.

17 For example, research on promising FFR topics can be  
18 solicited through the NRC's University Nuclear Leadership Position that Nancy  
19 just discussed to promote contributions from the brightest academic minds.

20 Finally, it's recognized that other agencies such as DOE and  
21 DoD extensively fund basic technology development and FFR activities  
22 should explore leveraging these efforts to most efficiently tackle unique NRC  
23 challenges.

24 So, while we're off to a good start, much remains to be done

1 to realize the full potential that the FFR program offers. Next slide, please.

2 In summary, you've heard today about several ways in  
3 which the Office of Nuclear Regulatory Research provides integral support to  
4 ensure that the Agency effectively fulfills its mission.

5 This starts by identifying the right research.

6 We work closely with our partner offices to understand their  
7 technical needs, schedules, and priorities so that we can tailor our research  
8 activities to most effectively address these needs.

9 Our activities remain focused on safety as we seek to  
10 understand and address those issues that most impact safety through  
11 assessments guided by the Agency's risk-informed principles.

12 We're continuously striving to innovate our methods to  
13 provide new risk insights and ways to most effectively communicate this  
14 information to decision-makers.

15 However, pursuing these goals requires a continual  
16 investment in the assets needed to perform this work, particularly our research  
17 tools and the skills and capabilities of our Staff who are integral to our ultimate  
18 success.

19 We also realize that we can't do this alone, and we rely on  
20 a network of domestic and international partnerships with private and public  
21 organizations to both grow and augment our capabilities.

22 Finally, we would be remiss if we didn't keep one eye on the  
23 future so that the Agency can continue to best serve the public and nuclear  
24 community.



1                   The FFR program, as you heard today, is a small but  
2 integral piece to ensure the NRC will be ready to meet our upcoming  
3 challenges. Thank you for your time and now I'll turn it back to Dan for closing  
4 remarks.

5                   MR. DORMAN: Thank you, Rob. In conclusion, I want to  
6 again thank our Staff who continue to demonstrate NRC's commitment to  
7 supporting regulatory readiness through Agency research activities.

8                   Their dedication, energy to innovate, and technical results  
9 provide the Agency with essential tools to aid efforts to accomplish our safety  
10 and security mission. We've now completed our presentation and we look  
11 forward to answering your questions.

12                   Thank you.

13                   CHAIRMAN HANSON: Thank you, Dan and Ray and the  
14 rest of the group. I'm starting off with questions this morning. I was really  
15 pleased with the presentations. I think there's a lot to celebrate and a lot to be  
16 proud of in the efforts of the Office of Research.

17                   I want to just highlight one thing to start before I dive in on  
18 another topic and that's just the UNLP program.

19                   I want to applaud some of the thinking that's going on there  
20 about how to engage with minority-serving institutions and I'm looking forward  
21 to getting, and I know the rest of the Commission is too, the paper from the  
22 Staff on the resurrection, if you will, of the minority-serving institution grant  
23 program and I look forward to hearing about how that will be connected to and  
24 potentially integrated with UNLP.

1                   So, thanks to Nancy very much for your presentation. With  
2 that, I want to start with the issue of FFRD, that is fuel fragmentation,  
3 relocation, and dispersal.

4                   I think it's a really important technical issue needing some  
5 regulatory clarity, in my view, to support the effective licensing of accident-  
6 tolerant fuel and high burnup fuel.

7                   The Office of Research Staff recently issued a regulatory  
8 information letter, or a RIL, on this topic and the ACRS recently wrote a letter  
9 on it as well.

10                  The ACRS stated that the current data set on FFRD has  
11 been expanded but that there remains a significant degree of uncertainty in  
12 large part because the problem is multivariate and the experiments from which  
13 data are developed did not always represent actual light water reactor  
14 conditions.

15                  From this, both the NRC Staff and the ACRS Staff appear  
16 to recognize there are some data gaps associated with the FFRD  
17 phenomenon.

18                  In the meantime, industry is really interested in pursuing  
19 high burnup fuel and accident-tolerant fuel, and NRR, our Office of Nuclear  
20 Reactor Regulation, is already reviewing topical reports from fuel vendors.

21                  But it's not clear, to me at least, that there's the regulatory  
22 line of sight that's needed to efficiently and effectively regulate these new fuel  
23 designs.

24                  Terri, you touched on this earlier but I was wondering if you

1 could expand on how the Agency is planning to address FFRD for high burnup  
2 licensing applications and what's Research doing to help establish the  
3 appropriate technical basis for our reviews.

4 MS. LALAIN: Thank you, Chairman.

5 So, to help build Staff expertise and address data gaps  
6 important to the NRC interest, Research is participating and leading the  
7 technical discussions in several OECD NEA experimental programs, like the  
8 Studsvik Cladding Integrity Project for SCIP, and the Framework for Irradiation  
9 Experiments, or FIDES.

10 Research is also working on methodology to estimate for  
11 core-wide fuel dispersal during loss of coolant accident using our computer  
12 codes.

13 And Research is also assessing the potential impacts of  
14 FFRD on the regulatory and technical basis of containment source term in  
15 Regulatory Guide 1.183 on alternative source terms for design basis accidents  
16 at nuclear power plants.

17 This guide will be used by Staff in NRR to support the high  
18 burnup fuel reviews and licensing. With that, Ray, is there anything else  
19 you'd like to add?

20 MR. FURSTENAU: I think that's a pretty good summary  
21 there. I think what you said, Chairman, with regards to your comments and  
22 those of the ACRS, I think the recent RIL, as you mentioned, it provided some  
23 insights that the licensing folks can use based on experimental data that was  
24 performed using testing in the past several years with zirconium cladding and

1 uranium dioxide fuel.

2 Which, of course, is a type of fuel being used now but there  
3 are going to be variants of that in the accident-tolerant fuel.

4 And some of the experiments we're planning, like Terri  
5 mentioned, with the OECD NEA and others will help fuel some of those data  
6 gaps and help reduce the uncertainties.

7 Because the research information letter does note there's  
8 large uncertainties with experimental data with the release of fission gas  
9 products that can have a significant impact on if and when a fuel rod in an  
10 accident condition would balloon and burst in a LOCA-type accident.

11 So, I think we do have more work to do on it, but it's kind of  
12 setting the stage for helping to know when to analyze for FFRD and what the  
13 missing data gaps may be that we need to address in the future.

14 CHAIRMAN HANSON: Thanks. Ray and Terri, that's  
15 super helpful.

16 As we think about how to set that research agenda which  
17 you've spoken a little bit about, we've gotten some comments from outside the  
18 Agency but we've also tried to tackle this issue of risk-informing our approach  
19 to high burnup fuel and ATF.

20 And of course, this FFRD issue is at the center of that and  
21 so, are we crafting our supporting research agenda on this issue to support  
22 risk-informed approaches to this.

23 And if so, how does a risk-informed mindset shape our  
24 research agenda there?

1 MR. FURSTENAU: I'll take a stab at that, Chairman. I  
2 think the point you bring out about how this is risk-informed with the research  
3 information letter that we had on this, of course, it's based on empirical data.

4 And then you have a lot of uncertainties and you have a lot  
5 of separate effects testing, but I think it starts to build the framework to look at  
6 what matters with regards to identifying the risk involved.

7 As you do these tests, you start to zero in on the phenomena  
8 that contribute to a bad day in case of a LOCA dealing with an FFRD. So, I  
9 think what we have to do in looking at this is trying to understand what matters.

10 To me, that's part of risk-informing, reducing those  
11 uncertainties and looking at sensitivities of what matters in an experiment  
12 program and zero in on those things that matter.

13 As we were talking about, there's a lot of factors that are  
14 involved in FFRD and we've got to use the experiment program and our  
15 research to help focus on the ones that matter from a regulatory standpoint.

16 CHAIRMAN HANSON: Ray, you're doing a great job of  
17 teeing up my next question on these things.

18 I want to take what you said with some of the stuff we heard  
19 from Ken about the codes and about probabilistic fracture mechanics and I'll  
20 call it the explorer code, XLPR code, and how what you previously said with  
21 our code efforts might come to support, again, these risk-informed approaches  
22 to this stuff.

23 MR. FURSTENAU: I'm fortunate on the panel here we  
24 have one of our experts on XLPR codes. So, if it's okay with you I'd like to

1 turn the question to Rob Tregoning who can address that. Rob?

2 MR. TREGONING: Thanks, Ray, and thanks for the  
3 question, Chairman. I don't know about expert, but I'll do my best. As you're  
4 probably aware, Chairman, XLPR is one of the codes we developed jointly  
5 with industry.

6 In fact, it was about a 50-50 split and while the initial  
7 applications of FFR were to do risk-informed evaluations of leak before break  
8 and some issues related to stress corrosion cracking that we've had in our  
9 pressurized water reactors.

10 And I might admit that it was very successful in addressing  
11 the initial intended purpose but from the beginning everyone recognized that  
12 XLPR would have broader applications and we're certainly starting to see  
13 interest in many of these applications, including we've heard from the industry  
14 that they're interested in using XLPR to address potential challenges  
15 associated with high burnup and accident-tolerant fuels.

16 And we also know that there has been a long-standing issue  
17 in using it as part of the design process for new reactors as well as, again, to  
18 help identify what the most risk-significant challenges are.

19 So, we continue to maintain and use and update XLPR with  
20 the notion that it will continue to have broader applications throughout not just  
21 the materials community but then also being able to inform some of these  
22 cross-cutting issues with very complex topics such as fuel fragmentation,  
23 relocation, and dispersal.

24 CHAIRMAN HANSON: Thanks very much, that's really

1 helpful and interesting. I have to say in my enthusiasm about FFRD I've  
2 completely lost track of whether or not I'm in my 10 minutes or not.

3 So, I'm just going to assume I'm way outside the bounds and  
4 thank everybody for a really interesting discussion this morning and I'll hand it  
5 over to Commissioner Baran.

6 COMMISSIONER BARAN: Thank you all for your  
7 presentations and your work. I'm really excited about the work the Office of  
8 Research is doing and the progress you're making. I want to make a few  
9 quick points before I ask my questions.

10 The SPAR models are so important for NRC's independent  
11 oversight role and you've taken their usefulness to a whole new level with  
12 SPAR-DASH. What a great way to leverage those models to gain risk  
13 insights for our licensing and oversight work.

14 I also appreciate your full utilization of FTE. We have a  
15 large number of employees who are eligible for retirement and we're seeing  
16 attrition each year of about six to eight percent.

17 That means we need to hire about 200 people from outside  
18 the Agency every year to sustain our workforce. It's about 300 this year. In  
19 the context of that increased external hiring, full utilization of budgeted FTE is  
20 critical.

21 The future-focused research program also is developing as  
22 well. As an Agency, we need to be ready for innovative technologies and part  
23 of being ready is looking a bit over the horizon at what is coming in a few years  
24 and then building the expertise and doing the foundational research in that

1 area.

2 We don't want to find ourselves behind when a new  
3 technology is submitted for review. So, this is an important facet of what the  
4 Office of Research does. Now, let me turn to a few questions.

5 The high energy arc fault research has been an important  
6 ongoing activity. Ray, can you give us an update on the status of the HEAF  
7 research and what the Staff is finding?

8 MR. FURSTENAU: Sure, I'd be happy to do that,  
9 Commissioner Baran.

10 The HEAF research is really intended to reduce the  
11 uncertainty and really provide a more accurate assessment of the fire hazard  
12 associated with the HEAF and bring more realism to it.

13 Our current research shows the hazards that are posed by  
14 these events are highly dependent on a number of things, like the type and  
15 configuration of the electrical equipment, the energy involved in the HEAF  
16 event, some differences in copper versus aluminum.

17 And what we're doing in research and should be finishing up  
18 by summer is develop an improved methodology for analyzing the risk, the  
19 overall risk posed by these events. And we'll document those and seek  
20 public feedback.

21 And the NRR is using some of this new methodology as they  
22 do their LIC-504 review of HEAF events.

23 So, HEAF events are very plant-specific and the fire  
24 damage and plant impacts are specific. So, all of that need to be taken into



1 consideration, zones of influenceS are different, one size doesn't fit all.

2 And so those are those types of things we're looking at as  
3 we conclude our research on the HEAF events. Does that help?

4 COMMISSIONER BARAN: I'm look forward to seeing  
5 your results and the analysis and following the issue as we go forward and  
6 you continue your work.

7 I also appreciate the work the Staff is doing on harvesting  
8 passive components from decommissioning nuclear power plants for  
9 research.

10 We can use the resulting data to strengthen aging  
11 management programs for reactors operating long term. Ray or Terri, can  
12 you talk more about Research's current and future plans for harvesting  
13 materials?

14 You've touched on it a little bit in the presentation, I'm  
15 interested in a little more detail about that. My sense is there are several  
16 opportunities out there?

17 MR. FURSTENAU: Thanks for the question,  
18 Commissioner Baran. Why don't I start and then, again, we're fortunate to  
19 have Rob Tregoning who's been leading some of the harvesting efforts.

20 But like you said, there are good opportunities with plans  
21 being in the decommissioning mode. We've got a good sense of the type of  
22 maybe data gaps there may be on passive components and which plants and  
23 the conditions they operated at and for how long.

24 We can start to zero in on where our data needs are at and

1 we're working with our partners in DOE to help do that as well. Rob, can you  
2 add some specifics on what we're looking at?

3 I know we have harvesting being supported in the budget  
4 and we're going to take advantage of that with what I think is a well thought  
5 out program for harvesting. Rob?

6 MR. TREGONING: Thanks for that Ray, and  
7 Commissioner Baran, thanks for that question.

8 As you both alluded to, we're in a very unique time with  
9 respect to the nuclear community in the sense that there is a surplus of  
10 decommissioning plants worldwide that really offer us with a unique  
11 opportunity to understand how certain key components and systems have  
12 operated over, in some cases, more than 40 or 50 years of service.

13 So, I can tell you that we are pursuing, along with not just  
14 DOE but also the nuclear industry, several opportunities domestically to  
15 harvest. And we've also most recently done some concrete harvesting from  
16 SONGS as an illustration of that.

17 And we're in the process of developing contracts to finalize  
18 and actually put into play our harvesting plans domestically at several of these  
19 plants. But we just don't look domestically, we're looking internationally as  
20 well.

21 Terri mentioned the SMILE program, the SMILE program is  
22 getting materials from Oskarshamn 1 and 2, which are Swedish BWRs as well  
23 as Ringhals 1 and 2. Ringhals 1 was a BWR but Ringhals 2 was actually a  
24 Westinghouse 3 loop PWR that is essentially a sister plant to both Surry and

1 North Anna.

2 And there are some very unique characteristics of especially  
3 the Ringhals 2 plant that we think our broadly applicable to the remaining U.S.  
4 fleet.

5 So, the SMILE program in particular, I think right now there's  
6 12 organizations from 7 countries and it's actually being run by NEA.

7 And these group-sponsored programs are really an effective  
8 way for us to leverage our resources because again, when you look at  
9 harvesting, especially of irradiated components, it's a costly proposition.

10 So, I think I'm being a little bit coy because I don't want to  
11 speak about the domestic plants because we haven't entered into agreements  
12 with but I think as we do we'll be able to announce publicly what some of those  
13 plans with the domestic plants.

14 And the Commission and the public will be hearing more  
15 about this topic, I would expect, in the spring or summer timeframe.

16 COMMISSIONER BARAN: Great, well I look forward to it.

17 As we think about new technologies that may be coming to  
18 the Agency for review in the coming years, fusion is a big one. Where are we  
19 on building the necessary expertise for those potential reviews in either areas  
20 of future-focused research related to fusion that we should be thinking about  
21 as an Agency?

22 MR. FURSTENAU: If I may, I'll take that question,  
23 Commissioner Baran.

24 In the area of fusion technology, the NRC Staff has formed

1 a working group with our technical experts from NRR, Research, and NMSS  
2 to look at and build the necessary capabilities to help develop a framework for  
3 regulating fusion technologies.

4 And to inform future activities, DANU in NRR is organizing  
5 a series of public meetings this spring to improve our understanding of  
6 proposed fusion technologies and to help develop a SECY paper in the fall on  
7 options for fusion regulation.

8 So, these public meeting interactions will help to scope and  
9 identify areas of technical need for us. With regards to FFR, future-focused  
10 research, we do have a proposal that was accepted and is funded in Fiscal  
11 Year '22 to review advanced manufacturing technologies for fusion reactor  
12 materials.

13 And because with fusion, it's a lot about material  
14 applications for fusion, high-temperature material applications is a big deal in  
15 choosing materials to confine the plasma.

16 So, FFR will enable our Staff to broaden their knowledge of  
17 state-of-the-art fusion materials and specialized advanced manufacturing  
18 technologies in challenge to their deployment.

19 We also included in the mission-related R&D notice of  
20 funding opportunity announcement that recently went out, we included fusion  
21 as one of the topic areas we're interested in hearing proposals from the  
22 universities on.

23 So, that's where we're at right now, Commissioner.

24 COMMISSIONER BARAN: Thank you all very much.

1 Great discussion. I really enjoy these meetings where we just hear a broad  
2 spectrum of what Research is doing, it's so important.

3 So, thank you, and I'll turn it back over to the Chairman.

4 CHAIRMAN HANSON: Thank you, Commissioner Baran.  
5 Now to Commissioner Wright?

6 COMMISSIONER WRIGHT: Thank you, Mr. Chairman.  
7 And again, we've all heard in the questioning, a lot of the questions are already  
8 taken so I'm going to endeavor to try to get some good ones to you with what  
9 comes to mind.

10 Great discussion and thank you for your presentation. I'm  
11 a fan of Research and what you do in your area. It just continues to guide  
12 the Agency as a whole and helps us make decisions.

13 You touch almost every aspect of what we do through your  
14 findings and insights and expertise, so again, thank you for what you do. I'm  
15 going to start with Terri, so good morning, and nice job on the presentation by  
16 the way.

17 I'm interested in the innovation steps you're looking into, for  
18 example I believe you talked about the SPAR-DASH thing and Commissioner  
19 Baran referred to it as well.

20 And I agree, I think it's a great step in the right direction in  
21 continuing our journey as a modern risk-informed regulator.

22 So, my understanding is that the survey results on the  
23 Agency's transformation efforts indicate that maybe some external  
24 stakeholders have some uncertainty about how the Agency uses risk

1 information in making decisions.

2 Can you maybe speak a bit about how this effort could  
3 influence that perspective?

4 MS. LALAIN: Yes, so for the licensees, they have access  
5 to their own SPAR models and SPAR-DASH, so they have that information  
6 and for the use of SPAR-DASH it can be described on the NRC's public  
7 website along with the other risk tools that are being used.

8 And the Staff are engaged with external stakeholders on  
9 how it applies SPAR-DASH in its oversight and licensing activities during  
10 public meetings and other public forums.

11 So, the communication is underway to help with that.

12 COMMISSIONER WRIGHT: How does that seem to be  
13 going right now?

14 MS. LALAIN: From the licensee reviewers, the SPAR-  
15 DASH team there has been receiving feedback from the users and the ability  
16 to use the dashboard.

17 They're getting the information on the level of risk  
18 significance for a proposed licensing amendment so there's good feedback  
19 coming back in from the users of the SPAR-DASH tool.

20 COMMISSIONER WRIGHT: Thank you for that. Are  
21 there other similar applications being developed to provide risk-informed tools  
22 to inspectors, particularly our residents so that we continue to focus on the  
23 most important safety-significant issues?

24 MS. LALAIN: Yes, so for the inspectors the SPAR-DASH

1 is applicable for them to help prioritize inspection activities, select  
2 risk-informed inspection samples, compare with licensee's PRA information.

3 So, there's a wide range of tools for the inspectors as well  
4 with that.

5 COMMISSIONER WRIGHT: Thank you. There's been a  
6 lot of focus and talk on the whole artificial intelligence and with respect to the  
7 artificial intelligence that's being planned, what type of artificial intelligence  
8 tools and outcomes do you anticipate possibly being integrated to improve our  
9 agency's processes?

10 MS. LALAIN: AI can be used to enhance our NRC  
11 processes to help us better allocate our resources to higher-value activities  
12 and emerging priorities.

13 So, examples of some current business process  
14 applications would include a natural language processing type tool for  
15 resource prediction so we can compare historical actions to get better  
16 estimates for new actions.

17 Use of things like RESbots to help the researchers and  
18 machine learning for operating experience of that classification.

19 So, all of this, as we're drafting and working on the evidence-  
20 building plan that the NRC intends to finalize in March 2022, as required by  
21 the Evidence Act, the Agency will identify what NRC decision-making  
22 processes could then benefit from some of these tools that I've described and  
23 prioritize the data collections that would have the most significant impact on  
24 Agency decision-making, selection of the AI tools, and even future stakeholder

1 use.

2                   So, all of that will come through that evidence-building act  
3 to hopefully and potentially make decision-making easier, faster, and more  
4 efficient for everyone.

5                   COMMISSIONER WRIGHT: I'm going to skip to  
6 harvesting and we may go back to Rob again but if you want to jump in, or  
7 Ray wants to jump in, that's fine too. I'm really a fan of the harvesting idea  
8 and what happens there.

9                   Unfortunately, we have more harvesting opportunities than  
10 we would probably like because we don't like to see any plants close when we  
11 see things can operate.

12                   So, Rob, you're being a little bit coy, you've admitted that  
13 about where you can go because there were some agreements in place with  
14 certain people. Are you working with EPRI on this too by chance or DOE?  
15 Who else are you working with on this?

16                   MR. TREGONING: We have both international and  
17 domestic harvesting teams, so we meet about every six weeks with both DOE  
18 and EPRI, and it's a strategic meeting related to harvesting where we review  
19 the current status of each other's harvesting plans and look for ways to  
20 leverage and cooperate.

21                   So, that's been an ongoing interaction that we've been doing  
22 for the last two or three years. And then we also have a periodic similarly,  
23 but with an international community because, again, we're aware not just of  
24 opportunities in Sweden but also Korea and some other countries that we think



1 would be beneficial for the U.S.

2                   The international ones are a little bit harder to pull off, as you  
3 might imagine, but still, we have to pursue every possible lead and it's one of  
4 these things where we have multiple contingency plans and we try to pursue  
5 all of them simultaneously because you recognize each individual one might  
6 have a relatively low likelihood of success.

7                   But I think as we look over the next year, I think we're going  
8 to have some significant successes with respect to harvesting.

9                   COMMISSIONER WRIGHT: That answers my next  
10 question. Do you think some of these agreements domestically will be put in  
11 place within the next year?

12                  MR. TREGONING: I'm as confident as I can be given the  
13 current budget situation and the fact that we don't even have an approved  
14 budget. But I'm confident regardless of that particular fact.

15                  COMMISSIONER WRIGHT: Thank you so much for that.  
16 I look forward to following up on that, it's very interesting when I've traveled  
17 around and seen components that have been harvested and some of the work  
18 that's being done on them; the concrete and steel.

19                  So, thanks for that. I want to move over real quick to Nancy  
20 and ask you a question. I know the Chair brought up minority-serving  
21 institutions topic and he referred to the reports and papers that were coming  
22 up.

23                  I don't particularly want to get into where you're at in all of  
24 that but I have an issue about communication on that, if you could answer

1 that? How are the institutions that are being made aware or will be made  
2 aware of the funding opportunities take advantage of them? What's the  
3 process for that?

4 MS. HEBRON-ISREAL: We do outreach to the institutions  
5 and the communities, making them aware of the funding opportunity  
6 announcements.

7 We communicate with the different organizations for nuclear  
8 engineering department heads, the Health Physics Society, as well as the  
9 MSI, HBCU, and HSI communities to make them aware of when our  
10 announcements are open and be assistant if they have any questions or  
11 anything regarding the announcement and what it entails.

12 So, hopefully that covers your question. If not, I'd be glad to  
13 clarify any areas.

14 COMMISSIONER WRIGHT: I just wanted to know what  
15 the process was for getting the word out. Is there a certain pipeline or do you  
16 go directly to the different institutions that would be able to apply for these  
17 things directly and to whoever that person is at that institution.

18 MS. HEBRON-ISREAL: We do have contacts that we  
19 communicate with for nuclear engineering department heads organization as  
20 I mentioned. They reach out to all the nuclear engineering schools for us.

21 We communicate with Health Physics Society. We work  
22 closely with the Office of Small Business and Civil Rights to ensure that we  
23 make the minority-serving institutions community aware of our  
24 announcements when they are available as well.

1 So, we collaborate with all.

2 COMMISSIONER WRIGHT: Ray, maybe you can chip in  
3 here. We've had some conversations about the university-level things and  
4 that program. So, does it follow the same process there?

5 MR. FURSTENAU: Yes, I wanted to add, if I may, one  
6 thing that we're trying to do in the current funding opportunity announcement  
7 as well for the mission-related R&D that Nancy mentioned that is open right  
8 now for applications.

9 We included in the evaluation criteria, points-weighted  
10 evaluation criteria for universities that partner with MSIs or HBCUs, and we  
11 think that'll help where schools that don't have large engineering programs  
12 can team up with those that do to encourage some participation by MSIs.

13 So, that's a very recent thing we're doing as well.

14 COMMISSIONER WRIGHT: This just came to mind, I'm  
15 going to close with this, Mr. Chairman, then you can take it back. I was at a  
16 meeting just last week at NARUC down in D.C. and I heard the outfit E4 that's  
17 in North Carolina, South Carolina, we have a former Commissioner who was  
18 involved there.

19 I just happened to hear that they're putting a program  
20 together that's going to focus on MSIs as well, and it sounds like to me that  
21 might be something that can work as a partnership.

22 So, you might want to reach out to E4 and see if there's an  
23 opportunity to maybe do something even bigger. If that opportunity is out  
24 there, why not?

1 MR. FURSTENAU: Thank you for that.

2 COMMISSIONER WRIGHT: Mr. Chairman, thank you so  
3 much.

4 CHAIRMAN HANSON: Thank you, Commissioner Wright.  
5 I want to wrap this up this morning and thank the Staff for their presentations.

6 I want to particularly thank my colleagues. I think once  
7 again, I hope people see the benefits of a Commission approach where there's  
8 a lot of I think shared support for the research program on the Commission  
9 but also different areas of emphasis. I appreciated Commissioner Wright's  
10 interest in artificial intelligence and some of these questions about the grant  
11 programs.

12 Commissioner Baran did some deep dives on the harvesting  
13 for decommissioning plants and there are a whole set of other things that we  
14 probably didn't touch on but could have given more time.

15 So, I want to express appreciation for my colleagues and  
16 appreciation for the Staff and thank you all again. With that, we are  
17 adjourned.

18 (Whereupon the above-entitled matter went off the record at  
19 11:22 a.m.)