From: Hiser, Matthew
Sent: Fri, 20 Oct 2017 13:10:25 +0000
To: Tregoning, Robert
Cc: Purtscher, Patrick;Audrain, Margaret
Subject: RE: IAEA PLiM Hiser 10-18-2017 rlt
Attachments: IAEA PLiM Hiser 10-20-2017.docx

Note to requester: Attachment is immediately following.

Hi Rob,

Thanks for your input – I think it reads better and more clearly. I cleaned up the formatting and references per PLiM guidelines.

I agree with your suggestion to refocus the one criteria from available inspection methods to confidence in AMP. However, given that we already have slides and a poster with the old language, I didn't change the title of that particular criteria in the paper, but I will take that into account in developing these criteria for us to discuss in a couple weeks.

If anyone else could provide input by noon today, then I will share with Steve this afternoon to hopefully smooth the path to approval by Monday from division management.

Thanks!
Matt

From: Tregoning, Robert
Sent: Thursday, October 19, 2017 5:04 PM
To: Hiser, Matthew
Cc: Purtscher, Patrick ; Audrain, Margaret
Subject: IAEA PLiM Hiser 10-18-2017 rlt

Note to requester: This email, with its attachment, was provided in the 9th interim response, as forwarded by R. Tregoning to himself on 10/19/17.

Allen:

Attached are my suggested revisions. I had to do this quickly, so please clean up any grammatical errors that I've made. Let me know if you want to discuss any of my suggestions.

Cheers,

Rob

HARVESTING OF AGED MATERIALS FROM OPERATING AND DECOMMISSIONING NUCLEAR POWER PLANTS

M. Hiser, P. Purtscher, A. B. Hull, R. Tregoning
U. S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research
Washington, DC
Email: matthew.hiser@nrc.gov

P. Ramuhalli
Pacific Northwest National Laboratory
Richland, WA, USA

Abstract

Recent developments, including strong interest in extended plant operation and plans to shut down a number of nuclear power plants (NPPs), provide opportunities for harvesting components that were aged in representative light water reactor (LWR) environments. Technical issues associated with extended plant operation, such as reactor pressure vessel (RPV) embrittlement, irradiation-assisted degradation of reactor internals and primary components, concrete structures and containment degradation, and electrical cable aging, may be used to focus harvesting efforts on high-priority issues. Harvesting can provide highly representative aged materials for research and may be the only practical source of representative aged materials in some cases. Harvesting can be expensive and time-consuming, which makes it essential to focus on those technical needs with the highest importance and cooperate with multiple organizations whenever possible to optimally leverage resources. NRC is interested in engaging with other organizations to prioritize data needs for harvesting, identify areas of common interest, and develop a database for sources of materials for harvesting.

1. BACKGROUND

Recent developments in the nuclear industry include stronger interest in extended plant operation and plans to shut down a number of nuclear power plants (NPPs). In the U.S., there is strong interest in extending NPP lifespans through subsequent license renewal (SLR) from 60 to 80 years [1]. Further research may be required to understand age-related degradation throughout the SLR period to help ensure that aging management programs are adequate. U.S. utilities and the U.S. Nuclear Regulatory Commission (NRC) are focused on the aging of systems, structures, and components in four key technical areas: reactor pressure vessel (RPV) embrittlement, irradiation-assisted degradation of reactor internals and primary components, concrete structures and containment degradation, and electrical cable aging [2]. In recent years, a number of NPPs, both in the U.S. and internationally, have shut down or announced plans to shut down for various reasons, including economic, political, and technical challenges. Unlike in the past when there were very few decommissioning plants, these plant shutdowns provide opportunities for harvesting components that were aged in representative light water reactor (LWR) environments. Additionally, harvesting programs can be costly and complex. Given these constraints, aligning interests and leveraging with other organizations is important to allow maximum benefit and value for future research programs.

2. NRC EXPERIENCE WITH HARVESTING

NRC has significant experience with harvesting plant components and performing research on harvested materials to address technical issues. This experience includes a range of components from plants in various stages of operation both in the U.S. and internationally. Some of the harvesting projects that the NRC has participated in have studied the following materials or components:

- RPV materials from the decommissioned Gundremmingen plant to study fluence rate effects on RPV embrittlement [3],
- Cast austenitic stainless steel (CASS) materials from the decommissioned Shippingport reactor. to study CASS thermal embrittlement [4],
- RPV materials from the unfinished or never-operated Shoreham and Midland plants to improve understanding of flaw distributions for RPV embrittlement concerns [5-6],
- RPV head control rod drive mechanism penetrations from the operating North Anna and Davis-Besse plants to study primary water stress corrosion cracking (PWSCC) of nickel alloys and the effectiveness of non-destructive evaluation (NDE) methods [8-12],
- Reactor coolant system (RCS) piping nozzle weld materials from the operating V.C. Summer plant to study PWSCC of nickel alloys [11-12],

- Reactor internals materials from the decommissioned Jose Cabrera (known as Zorita) plant to study high-fluence irradiation effects on stainless steel alloys [13],
- Aluminum-based neutron-absorbing materials from the decommissioned Zion plant to study degradation in the spent fuel pool environment [14],
- Electrical cables from the decommissioned Zion and Crystal River plants to investigate cable degradation [15],
- Electrical bus ducts from the decommissioned Zion plant to study high-energy arc faults in electrical enclosures [16].

As illustrated by these programs, NRC's experience is that harvesting has contributed significantly to improved understanding of important technical issues for nuclear safety. For RPV materials, harvesting has increased knowledge of embrittlement mechanisms and the underlying flaw distributions in the RPV to allow reduction in unnecessary conservatism. For nickel alloys, harvesting has improved understanding of PWSCC and the development of acceptable inspection intervals, while also increasing confidence in the ability of NDE methods to detect and characterize flaws. Finally, recent work on electrical enclosures has helped to identify a potential new safety issue associated with high-energy arc faults in electrical components containing aluminum [16].

3. NRC PERSPECTIVE AND LESSONS LEARNED FROM HARVESTING ACTIVITIES

From NRC's perspective, a principal role of harvesting is to confirm other research results from simulated aging conditions. In many situations, accelerated aging through higher flux test reactor irradiations or elevated temperatures can be used to generate significant data to understand aging effects in a more cost-effective manner. Limited harvesting efforts of materials from highly representative service environments can help confirm the adequacy of the knowledge gained from accelerated aging studies, and thus increase the confidence in the broader knowledge base.

However, in certain situations, harvesting may be the only practical source of representative aged materials. For example, achieving high fluence levels with representative irradiation conditions through accelerated aging can be very challenging. Additionally, it is essential to gain as much information as possible regarding the materials and environment (temperature, fluence, irradiation conditions, chemistry, humidity, etc.) in advance before committing to a specific harvesting project so that the implications of the results from evaluating the materials can be properly understood.

Pragmatically, harvesting can be expensive, complex, and time-consuming; therefore, focusing on technical needs of high importance will help ensure good value. Likewise, leveraging and cooperation among multiple organizations helps to mitigate cost challenges. It is also quite challenging to transport irradiated materials, particularly internationally, so minimizing or avoiding transportation of such materials is highly recommended.

4. NRC ACTIVITIES ON HARVESTING

NRC is potentially interested in harvesting materials to assess age-related degradation in the four technical areas identified previously: reactor pressure vessel (RPV) embrittlement, irradiation-assisted degradation of reactor internals and primary components, concrete structures and containment degradation, and electrical cable aging [2]. The focus is to understand the impact of extended plant operation on material behavior, including the effects of higher fluences and longer exposures to aging conditions.

NRC has recently undertaken an effort, with the assistance of Pacific Northwest National Laboratory (PNNL), to develop a strategic approach for harvesting aged materials from NPPs. Past harvesting activities have been narrowly focused on the relatively few opportunities to get materials from decommissioning plants. Given the expected availability of materials from numerous plants and identified research needs to better understand aging out to 80 years of operation, the NRC is developing a more proactive approach to prioritize the data needs best addressed by harvesting and identify the best sources of materials to address high-priority data needs for regulatory research.

5. PRIORITIZATION OF DATA NEEDS BEST ADDRESSED BY HARVESTING

The first step in this strategic approach is to prioritize data needs for harvesting. A data need describes a particular degradation scenario (i.e., combination of material and environment) and should be defined with as much detail as appropriate in terms of the material (e.g., alloy, composition) and environment (e.g., temperature, fluence, chemistry).

A number of criteria are being considered for prioritizing the harvesting data needs, including:

— Applicability of harvested material for addressing critical gaps
  - Harvesting to address critical gaps should be prioritized over less essential technical gaps
— Ease of laboratory replication of the degradation scenario
  - Degradation mechanisms that are harder to replicate under simulated aging conditions are of higher priority for harvesting. For example, simultaneous thermal and irradiation conditions are difficult to replicate outside of the plant environment. Alternatively, accelerated aging may not be feasible for a mechanism sensitive to dose rate. These two degradation mechanisms may be best evaluated using harvested materials.
— Unique field aspects of degradation
  - For example, legacy materials (e.g., fabrication methods, composition) that are no longer available, but may play an important role in a potential degradation mechanism, would have a higher priority than harvesting materials that can be obtained from other sources.
— Fleet-wide vs. plant-specific applicability of data
  - There is greater value in developing knowledge to address an issue that may be applicable to a larger number of plants compared to one that may only affect a relatively small number of plants.
— Harvesting cost and complexity
  - Activities with higher costs and complexity are less attractive than similar activities with lower costs and that are simpler to execute.. For example, harvesting unirradiated concrete or electrical cables is less expensive and less complex than harvesting from the reactor internals or RPV.
— Availability of reliable inspection methods for the degradation scenario
  - If mature inspection methods exist and are easy to apply to monitor degradation, harvesting may be less valuable. If inspection methods do not exist, harvesting may be essential to ensure confidence in the assessment of age-related degradation in that particular component.
— Timeliness of the expected research results
  - The ability of a potential harvesting program to provide timely results to support either a technical or regulatory need is important. Having high confidence that results will be timely increases the priority.
— Availability of materials for harvesting
  - The availability of materials to harvest for a particular data need is clearly essential and increases the priority.

The above potential criteria provide a systematic approach for prioritizing harvesting data needs. Different organizations may uniquely weigh these criteria differently, but the criteria are intended to be comprehensive. NRC is interested in engaging with other organizations to further refine these criteria, use them to prioritize data needs for harvesting, and ultimately identify areas of common interest that may provide optimal harvesting opportunities.

6. DATABASE OF SOURCES OF MATERIALS FOR HARVESTING

The NRC is also developing a database that identifies sources of materials for harvesting. This database will include both previously harvested materials and those which may be available for future harvesting. This database will be used to align the high-priority harvesting needs to the available materials. As with the harvesting prioritization effort, the level of detail for the sources of materials database should be appropriate for the factors influencing decision-making. NRC is interested in engaging with other organizations to develop a database that identifies sources of materials for harvesting.

7. CONCLUSIONS

NRC's experience is that harvesting can yield highly representative and valuable knowledge about materials aging. However, these efforts may be expensive and challenging. Having a clearly defined objective and early engagement with other stakeholders, including the decommissioning plant where harvesting will take place, are necessary to ensure project success. As specific harvesting opportunities are identified through this strategic approach, the NRC will develop strategies for pursuing these opportunities. The NRC also welcomes collaboration from other interested research organizations both in developing the proactive harvesting strategy and in pursuing harvesting opportunities of mutual interest.

REFERENCES

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[2] U.S. NUCLEAR REGULATORY COMMISSION, "Ongoing Staff Activities to Assess Regulatory Considerations for Power Reactor Subsequent License Renewal," SECY-14-0016, 2014, https://www.nrc.gov/docs/ML1405/ML14050A306.pdf.

[3] HAWTHORNE, J.R., HISER, A.L., "Experimental Assessments of Gundremmingen RPV Archive Material for Fluence Rate Effects Studies," NUREG/CR-5201 (MEA-2286), U.S. Nuclear Regulatory Commission, October 1988.

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From: Oberson, Greg
Sent: Wed, 22 Feb 2017 16:03:56 -0500
To: Hiser, Matthew
Subject: RE: Input on Harvesting Slides

Looks good to me, thanks for sharing.

Greg

From: Hiser, Matthew
Sent: Wednesday, February 22, 2017 10:08 AM
To: Nove, Carol <Carol.Nove@nrc.gov>; Kirk, Mark <Mark.Kirk@nrc.gov>; Oberson, Greg <Greg.Oberson@nrc.gov>; Focht, Eric <Eric.Focht@nrc.gov>
Subject: Input on Harvesting Slides

Hi Carol, Mark, Greg, and Eric,

We are hosting a workshop with a number of external participants in two weeks to discuss ex-plant materials harvesting. I know I've discussed this with at least a couple of you. I have attached the workshop introduction slides that cover meeting logistics, motivation, approach, expected outcome, and session expectations for your awareness.

I have also attached PP slides for NRC presentations in sessions 2, 3, and 4. These slides have been developed primarily with input from myself, Rob Tregoning and Pat Purtscher. The intent of these slides is to be a discussion starter and provide NRC's perspective on the session topics related to harvesting.

Some of the topics covered in these slides include RPV, NDE, PWSCC, and NAM, so I'd like to share them with each of you for a quick review. Please let me know if you have any questions and provide any comments or feedback at your earliest convenience.

Thanks!
Matt

Matthew Hiser
Materials Engineer
US Nuclear Regulatory Commission | Office of Nuclear Regulatory Research
Division of Engineering | Corrosion and Metallurgy Branch
Phone: 301-415-2454 | Office: TWFN 10D62
Matthew.Hiser@nrc.gov

From: Moyer, Carol
Sent: Tue, 14 Feb 2017 18:29:59 +0000
To: Hull, Amy;Iyengar, Raj
Subject: Re: INQUIRY: Division Topics for April 11 EPRI/NRC Annual Meeting (due Feb 28)

Raj - Thanks for the great start
Amy - Agreed, harvesting should be on the list, too.
Thank you both!
Carol
From: Hull, Amy
Sent: Tuesday, February 14, 2017 11:28 AM
To: Iyengar, Raj; Moyer, Carol
Subject: RE: INQUIRY: Division Topics for April 11 EPRI/NRC Annual Meeting (due Feb 28)
I think Raj has done a great job on this. Also talk about followup from the March 7 NPP materials harvesting workshop.

From: Iyengar, Raj
Sent: Tuesday, February 14, 2017 11:19 AM
To: Moyer, Carol <Carol.Moyer@nrc.gov>
Cc: Hull, Amy <Amy.Hull@nrc.gov>
Subject: RE: INQUIRY: Division Topics for April 11 EPRI/NRC Annual Meeting (due Feb 28)
Carol,
My suggestion is below:
LTO

- Ongoing efforts in cables, vessel internals, and concrete (CMB)
- Co-sponsorship of public workshop on SLR technical topics and publicly-available documentation on research progress (CMB)
- Technical reports on Continued Adequacy of RG1.99 (CIB)
- Path Forward

We do not want give the impression that there are SLR-related technical issues that are not being addressed adequately.
Raj

From: Moyer, Carol
Sent: Monday, February 13, 2017 11:15 PM
To: Iyengar, Raj <Raj.Iyengar@nrc.gov>
Subject: Fw: INQUIRY: Division Topics for April 11 EPRI/NRC Annual Meeting (due Feb 28)
Importance: High
Hi Raj & Amy,
Please see the request from Steve, below, for input to the EPRI meeting agenda. The draft agenda is the first attachment, dated April 11, 2017. Raj, I expect you have a similar request for input from Ilka.
At this very high level, I think we do not need to add much to the agenda for SLR - do you? I wanted to run this proposal by both of you before I discuss it with Steve tomorrow (Tues., 2/14) afternoon. I propose:
Long Term Operation Beyond 60 Years
- Technical issues needing resolution

- Cable aging; testing under load
- Path forward

Laboratory Tour

- Concrete degradation and NDE

I see that neutron absorbers is a topic included in one of the previous agendas. Is there enough recent or near-term activity on this to make it a good fit to the SLR/LTO part of the agenda?

Thanks in advance for your help,

Carol

From: Frankl, Istvan
Sent: Sunday, February 12, 2017 9:06 PM
To: Moyer, Carol
Subject: Fw: INQUIRY: Division Topics for April 11 EPRI/NRC Annual Meeting (due Feb 28)

Carol,

Sorry for the delay in sending you this but could not get to it on Wednesday and had CITRIX issues with Outlook on Friday.

Please review the enclosed request from our TA and schedule meeting with me on Tuesday to discuss. To get background on this, please reach out to Raj on this, if needed.

You also requested meeting with me to discuss the proposed trip to TN for the NEI/NRC Concrete Meeting and the separate follow-on meeting for detailed work on the concrete Roadmap in May. Hopefully we can wrap up the proposal that you should present to Brian within the framework of a short briefing.

Let's cover both subjects.

Thanks,

Steve

From: Berrios, Ilka
Sent: Tuesday, February 7, 2017 10:31 AM
To: Iyengar, Raj; Frankl, Istvan; Jung, Ian; Seber, Dogan
Subject: FW: INQUIRY: Division Topics for April 11 EPRI/NRC Annual Meeting (due Feb 28)

All,

The next EPRI/NRC Annual Meeting is planned for Tuesday April 11 in Charlotte. Please let me know if there are any topics you would like to be discussed during this meeting.

Attachment 1 – provides a potential 2017 schedule based on review of prior meetings.
Attachments 2 - 4 – provide the agendas from the prior three years.

Please provide your input by 02/16/2017. If you don't have any topics, please let me know too.

Thanks,

Ilka

415-2404

From: Difrancesco, Nicholas
Sent: Tuesday, February 07, 2017 9:23 AM
To: Berrios, Ilka <Ilka.Berrios@nrc.gov>; Herrity, Thomas <Thomas.Herrity@nrc.gov>; Armstrong, Kenneth <Kenneth.Armstrong@nrc.gov>; Thomas, Brian <Brian.Thomas@nrc.gov>; Thaggard, Mark <Mark.Thaggard@nrc.gov>; Webber, Kimberly <Kimberly.Webber@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>; Cheok, Michael <Michael.Cheok@nrc.gov>; Santiago, Patricia <Patricia.Santiago@nrc.gov>

Cc: Case, Michael <Michael.Case@nrc.gov>; Hackett, Edwin <Edwin.Hackett@nrc.gov>; Weber, Michael <Michael.Weber@nrc.gov>; Johnson, Kevin <Kevin.Johnson@nrc.gov>; RidsResPmdaMail Resource <RidsResPmdaMail.Resource@nrc.gov>
Subject: INQUIRY: Division Topics for April 11 EPRI/NRC Annual Meeting (due Feb 28)
Folks,
To support the upcoming EPRI/NRC Annual Meeting planned for Tuesday April 11 in Charlotte, please provide proposed division topics for discussion, based on past interactions there would likely be 2 or 3 items per division.

Attachment 1 – provides a potential 2017 schedule based on review of prior meetings.
Attachments 2 - 4 – provide the agendas from the prior three years.

Please target February 28 to support office consolidation and coordination with EPRI.
Let me know if you have any comments, questions, or concerns.
Thanks,
Nick
Technical Assistant
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
301-415-1115

Note to requester: Attachment is immediately following.

From: Tregoning, Robert
Sent: Thu, 30 Aug 2018 20:09:03 +0000
To: Audrain, Margaret
Cc: Hiser, Matthew;Purtscher, Patrick
Subject: RE: JNRA Meeting Sept 2018 Harvesting.pptx
Attachments: JNRA Meeting Sept 2018 Harvesting rlt.pptx

Meg, Matthew, Patrick:

Many thanks for your help with this. The presentation looks good and it will be useful for having a targeted discussion on the topic and hopefully we will see some interest from them in this area. I made a few simple formatting changes to a few slides so they all have similar fonts (see attached).

Could you also provide me a reference for the PNNL report (i.e., title and report number)? I'd specifically like to let them know about this report and let them know that we are planning to have it completed sometime in the fall. I'm going to add this as a bullet to one slide.

Matt:

Can I get you to add another slide which summarizes, at a high level the harvesting workshop and then has a reference to the workshop summary report? Basically just a reminder of dates, attendance, agenda/discussion topics, and then the reference to the report. Since Kazu attended the meeting I don't think there are any issues with giving them the summary. Do you agree?

Thanks again,

Rob

Robert Tregoning
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US Nuclear Regulatory Commission
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11545 Rockville Pike
Rockville, MD 20852-2738
ph: 301-415-2324
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From: Audrain, Margaret
Sent: Thursday, August 30, 2018 2:22 PM
To: Tregoning, Robert <Robert.Tregoning@nrc.gov>
Cc: Hiser, Matthew <Matthew.Hiser@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: JNRA Meeting Sept 2018 Harvesting.pptx

Rob,

Please see attached for the harvesting presentation. I added the harvesting needs slides, as discussed. Feel free to make edits or let me know if you want something changed.

Thanks,

Meg

Harvesting of Aged Materials from Operating and Decommissioning Nuclear Power Plants

M. Audrain, M. Hiser, P. Purtscher, R. Tregoning

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

The views expressed in this presentation are those of the author, not necessarily those of the U.S. NRC.

Motivation

U.S.NRC
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- US utilities are interested in extending operating lifespans from to 60-80 years:
  - Key technical areas for aging management:
    - RPV embrittlement, irradiation-assisted degradation of internals, concrete structures and containment, electrical cables
- Many plant shutdowns worldwide provide opportunities to harvest components during decommissioning
  - Harvesting can provide valuable information on aging mechanisms to increase confidence in aging management
- Limited budgets make cooperation for new research, including harvesting, essential:
  - Important to align interested parties
  - Leverage resources for maximum benefit

NRC Harvesting Experience

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- NRC has participated in several programs:
  - RPV, CRDM penetrations, RCS piping, RPV internals, neutron absorbers, and cables
  - Materials harvested from unfinished, operating and decommissioning plants
  - US and international programs
- NRC experience is there is significant value in using harvested components to confirm data from other research programs

Lessons Learned

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- Technical
  - Provides highly representative aged materials for research
  - Important to gain as much information as possible before committing to specific harvesting project

- Logistical
  - Expensive and time-consuming effort
  - Leveraging resources helps mitigate cost challenges
  - Transportation of irradiated materials is cumbersome and time-consuming

Current Work

U.S.NRC
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- Develop strategic approach to materials harvesting
  - Past efforts have been reactive to individual plants shutting down
- Prioritize data needs best addressed by harvesting, considering:
  - Applicability of harvested material for addressing gaps
  - Importance of harvested materials over laboratory aging
  - Fleet-wide vs plant-specific applicability of data
  - Regulatory considerations
  - Harvesting cost/complexity
- Database for Sources of Materials
  - Compilation of previously harvested materials available at US national labs as well as those available for future harvesting
  - NRC is interested in engaging with other organizations in developing the database

Needs - Metals

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- RPV
  - High fluence & high shift vessel with well-established unirradiated properties (or a means to estimate them)
    - Through thickness section to validate fluence & attenuation models
    - Measure fluence, toughness, & chemistry as a function of through-thickness position
  - Samples from virtually any vessel
    - Of sufficient size to enable measurement of both the Charpy transition curve and master curve transition temperature T_0
    - This testing
      - Enables demonstration of the conservatism of regulatory approaches for transition temperature prediction
      - Provides data supporting evolution from the use of correlative (Charpy-based) to direct measurement (fracture toughness-based) approaches

Needs - Metals

U.S.NRC
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- CASS and Internals
  - High fluence reactor internals
    - >50 dpa 304 SS from high core outlet temp plant
    - Bounding temperature and high fluence for void swelling
  - Thermally aged unirradiated CASS
    - >30 years at ~320° C; Validate accelerated aging data
  - Moderate fluence (1-2 dpa) CASS
    - Bolster technical basis for embrittlement in this fluence range
- Components with known flaws
  - Example: weld overlays over known flaws
    - NDE evaluations or to assess effectiveness of mitigation techniques
- Components with limiting fatigue life
  - Confirm fatigue calculations are accurate by inspecting for flaws

Needs - Electrical

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- Cables
  - Low and medium voltage cables
  - Cables protected with fire retardant coating
- Electrical components
  - 1E MOVs from harsh and mild environments
  - 1E Air operated valves; 4160 1E breakers
  - 1E Molded case breakers 480V, 250V DC, 125 VDC,
  - 1E Relays from mild environment GE – HFA, Agastat timing relays, any from Westinghouse, Potter Brumfield, Stuthers Dunn etc.,
  - Electrical penetrations; Batteries
- Fire research interest
  - Electrical enclosures
    - Distribution : switchgear, MCCs, LCs | Control : Horseshoe, SSCP, ASP, etc.

Needs - Concrete

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- Structures exposed to high radiation
- Post-tensioned structures
- Corrosion of reinforcing steel, tendon, liner, embedment
- Spent fuel pool and transfer canal-boric acid attack on concrete in PWRs
- Alkali Aggregate Reaction
- Large structural sections for testing

Conclusion

U.S.NRC
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Protecting People and the Environment

- Harvesting can yield highly representative and valuable data on materials aging
- A focused approach to choosing harvested materials is necessary to get best outcomes
- NRC is working on a sources of materials database and prioritizing data needs based on relevant criteria to inform decisions on specific harvesting opportunities
- NRC welcomes opportunities for cooperation and leveraging with other interested research organizations

Discussion

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- Has the planned work on harvesting RPV materials and concrete from Hamaoka 1 been completed?
  - Can those results be shared with NRC?
- Does JNRA/CRIEPI have any other harvesting programs in progress or planned?
  - If so, any information that can be shared?
  - If still being planned, is there interest in additional partners?
- Would there be interest in participating if a harvesting project was identified in the US or another country?
  - Should we reach out to JNRA if other harvesting opportunities develop?

From: Tregoning, Robert
Sent: Tue, 4 Sep 2018 13:12:05 +0000
To: Hiser, Matthew;Audrain, Margaret
Cc: Purtscher, Patrick
Subject: RE: JNRA Meeting Sept 2018 Harvesting.pptx

Looks good. Thanks so much for all your help.

Rob

Robert Tregoning
Technical Advisor for Materials
US Nuclear Regulatory Commission
Two White Flint North, M/S T-10 A36
11545 Rockville Pike
Rockville, MD 20852-2738
ph: 301-415-2324
fax: 301-415-6671

From: Hiser, Matthew
Sent: Tuesday, September 04, 2018 8:44 AM
To: Tregoning, Robert <Robert.Tregoning@nrc.gov>; Audrain, Margaret <Margaret.Audrain@nrc.gov>
Cc: Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: RE: JNRA Meeting Sept 2018 Harvesting.pptx

Hi Rob,

Sounds good – I added a new slide 5 covering the harvesting workshop and included a link to the Google Drive with all the presentations and meeting materials, including summary report. It should be no problem to share that with JNRA.

Thanks!
Matt

Matthew Hiser
Materials Engineer
US Nuclear Regulatory Commission | Office of Nuclear Regulatory Research
Division of Engineering | Corrosion and Metallurgy Branch
Phone: 301-415-2454 | Office: TWFN 10D62
Matthew.Hiser@nrc.gov

From: Tregoning, Robert
Sent: Thursday, August 30, 2018 4:09 PM
To: Audrain, Margaret <Margaret.Audrain@nrc.gov>
Cc: Hiser, Matthew <Matthew.Hiser@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: RE: JNRA Meeting Sept 2018 Harvesting.pptx

Meg, Matthew, Patrick:

Many thanks for your help with this. The presentation looks good and it will be useful for having a targeted discussion on the topic and hopefully we will see some interest from them in this area. I made a few simple formatting changes to a few slides so they all have similar fonts (see attached).

Could you also provide me a reference for the PNNL report (i.e., title and report number)? I'd specifically like to let them know about this report and let them know that we are planning to have it completed sometime in the fall. I'm going to add this as a bullet to one slide.

Matt:

Can I get you to add another slide which summarizes, at a high level the harvesting workshop and then has a reference to the workshop summary report? Basically just a reminder of dates, attendance, agenda/discussion topics, and then the reference to the report. Since Kazu attended the meeting I don't think there are any issues with giving them the summary. Do you agree?

Thanks again,

Rob

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Technical Advisor for Materials
US Nuclear Regulatory Commission
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ph: 301-415-2324
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From: Audrain, Margaret
Sent: Thursday, August 30, 2018 2:22 PM
To: Tregoning, Robert <Robert.Tregoning@nrc.gov>
Cc: Hiser, Matthew <Matthew.Hiser@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: JNRA Meeting Sept 2018 Harvesting.pptx

Rob,

Please see attached for the harvesting presentation. I added the harvesting needs slides, as discussed. Feel free to make edits or let me know if you want something changed.

Thanks,

Meg

Note to requester: Attachment is immediately following.

From: Hiser, Matthew
Sent: Tue, 4 Sep 2018 12:44:14 +0000
To: Tregoning, Robert;Audrain, Margaret
Cc: Purtscher, Patrick
Subject: RE: JNRA Meeting Sept 2018 Harvesting.pptx
Attachments: JNRA Meeting Sept 2018 Harvesting rlt mah 9-4-18.pptx

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Matt

Matthew Hiser
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Rob

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Rob,

Please see attached for the harvesting presentation. I added the harvesting needs slides, as discussed. Feel free to make edits or let me know if you want something changed.

Thanks,

Meg

Harvesting of Aged Materials from Operating and Decommissioning Nuclear Power Plants

M. Audrain, M. Hiser, P. Purtscher, R. Tregoning

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The views expressed in this presentation are those of the author, not necessarily those of the U.S. NRC.

Motivation

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- US utilities are interested in extending operating lifespans from to 60-80 years:
  - Key technical areas for aging management:
    - RPV embrittlement, irradiation-assisted degradation of internals, concrete structures and containment, electrical cables
- Many plant shutdowns worldwide provide opportunities to harvest components during decommissioning
  - Harvesting can provide valuable information on aging mechanisms to increase confidence in aging management
- Limited budgets make cooperation for new research, including harvesting, essential:
  - Important to align interested parties
  - Leverage resources for maximum benefit

NRC Harvesting Experience

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- NRC has participated in several programs:
  - RPV, CRDM penetrations, RCS piping, RPV internals, neutron absorbers, and cables
  - Materials harvested from unfinished, operating and decommissioning plants
  - US and international programs
- NRC experience is there is significant value in using harvested components to confirm data from other research programs

Lessons Learned

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- Technical
  - Provides highly representative aged materials for research
  - Important to gain as much information as possible before committing to specific harvesting project

- Logistical
  - Expensive and time-consuming effort
  - Leveraging resources helps mitigate cost challenges
  - Transportation of irradiated materials is cumbersome and time-consuming

Ex-Plant Materials Harvesting Workshop

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- Overview
  - Purpose: discuss benefits and challenges associated with harvesting
  - Held at NRC HQ on March 7-8, 2017
  - Participants included U.S. and international utilities and researchers
- Sessions covered:
  - Motivation, data needs, sources of materials, lessons learned and practical aspects of harvesting, and decision-making and planning
- Summary of discussion:
  - Focused on the importance of clearly identifying the need and purpose for performing a harvesting project.
  - Harvesting is a complex and expensive proposition, but one that can be worthwhile if the need is clearly defined and addressed.
- Slides and summary report can be found here: https://drive.google.com/open?id=0B5DWMLch5YSXcnpZZ0JOS055QUU

Current Work

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- Develop strategic approach to materials harvesting
  - Past efforts have been reactive to individual plants shutting down
  - Developing
- Prioritize data needs best addressed by harvesting, considering:
  - Applicability of harvested material for addressing gaps
  - Importance of harvested materials over laboratory aging
  - Fleet-wide vs plant-specific applicability of data
  - Regulatory considerations
  - Harvesting cost/complexity
- Database for Sources of Materials
  - Compilation of previously harvested materials available at US national labs as well as those available for future harvesting
  - NRC is interested in engaging with other organizations in developing the database

Needs - Metals

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- RPV
  - High fluence & high shift vessel with well-established unirradiated properties (or a means to estimate them)
    - Through thickness section to validate fluence & attenuation models
    - Measure fluence, toughness, & chemistry as a function of through-thickness position
  - Samples from virtually any vessel
    - Of sufficient size to enable measurement of both the Charpy transition curve and master curve transition temperature T_0
    - This testing
      - Enables demonstration of the conservatism of regulatory approaches for transition temperature prediction
      - Provides data supporting evolution from the use of correlative (Charpy-based) to direct measurement (fracture toughness-based) approaches

Needs - Metals

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- CASS and Internals
  - High fluence reactor internals
    - >50 dpa 304 SS from high core outlet temp plant
    - Bounding temperature and high fluence for void swelling
  - Thermally aged unirradiated CASS
    - >30 years at ~320° C; Validate accelerated aging data
  - Moderate fluence (1-2 dpa) CASS
    - Bolster technical basis for embrittlement in this fluence range
- Components with known flaws
  - Example: weld overlays over known flaws
    - NDE evaluations or to assess effectiveness of mitigation techniques
- Components with limiting fatigue life
  - Confirm fatigue calculations are accurate by inspecting for flaws

Needs - Electrical

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- Cables
  - Low and medium voltage cables
  - Cables protected with fire retardant coating
- Electrical components
  - 1E MOVs from harsh and mild environments
  - 1E Air operated valves; 4160 1E breakers
  - 1E Molded case breakers 480V, 250V DC, 125 VDC,
  - 1E Relays from mild environment GE – HFA, Agastat timing relays, any from Westinghouse, Potter Brumfield, Stuthers Dunn etc.,
  - Electrical penetrations; Batteries
- Fire research interest
  - Electrical enclosures
    - Distribution : switchgear, MCCs, LCs | Control : Horseshoe, SSCP, ASP, etc.

Needs - Concrete

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- Structures exposed to high radiation
- Post-tensioned structures
- Corrosion of reinforcing steel, tendon, liner, embedment
- Spent fuel pool and transfer canal-boric acid attack on concrete in PWRs
- Alkali Aggregate Reaction
- Large structural sections for testing

Conclusion

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- Harvesting can yield highly representative and valuable data on materials aging
- A focused approach to choosing harvested materials is necessary to get best outcomes
- NRC is working on a sources of materials database and prioritizing data needs based on relevant criteria to inform decisions on specific harvesting opportunities
- NRC welcomes opportunities for cooperation and leveraging with other interested research organizations

Discussion

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- Has the planned work on harvesting RPV materials and concrete from Hamaoka 1 been completed?
  - Can those results be shared with NRC?
- Does NRA/CRIEPI have any other harvesting programs in progress or planned?
  - If so, any information that can be shared?
  - If still being planned, is there interest in additional partners?
- Would there be interest in participating if a harvesting project was identified in the US or another country?
  - Should we reach out to NRA if other harvesting opportunities develop?

From: Hiser, Matthew
Sent: Fri, 1 Jun 2018 19:14:50 +0000
To: Moyer, Carol
Cc: Purtscher, Patrick;Audrain, Margaret;Tregoning, Robert
Subject: RE: LTMD (SLR) Research Update

Hi Carol,

Nothing really major. Here's the latest ongoing:

- We met with the electrical and concrete folks a couple weeks ago to share what we've been doing in the metals area to prioritize technical needs for harvesting and ask them to do something similar.
- Pat is trying to finish up the PNNL report (address NRR's comments) in near future.
- We're nearly finished with getting information on previously harvested materials at national labs, etc. Just today we got input from Battelle in Columbus, OH, which has a number of pipes (both large and small) that were harvested and used in earlier research. The last big one will be Meg visiting PNNL late this month or next month (can't remember).

Thanks!
Matt

From: Moyer, Carol
Sent: Friday, June 01, 2018 3:01 PM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>
Subject: RE: LTMD (SLR) Research Update

Matt,

Can you add any late news about the Harvesting effort?

-Carol

From: Hiser, Matthew
Sent: Friday, June 01, 2018 2:36 PM
To: Moyer, Carol <Carol.Moyer@nrc.gov>
Cc: Rao, Appajosula <Appajosula.Rao@nrc.gov>
Subject: RE: LTMD (SLR) Research Update

Your description is exactly right ☺ For us, unlike the fuels folks, Halden doesn't really have very valuable unique technical capabilities. The unique value to us from Halden was leveraging… which has been our message for IAD/materials to higher level managers.

Thanks!
Matt

From: Moyer, Carol
Sent: Friday, June 01, 2018 2:32 PM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>
Cc: Rao, Appajosula <Appajosula.Rao@nrc.gov>
Subject: RE: LTMD (SLR) Research Update

Matt,

Thanks very much for this recap. It is helpful for my near-term needs.

The main thing about which I was unsure was which tests, if any, were being done in-pile at Halden, and therefore would be the most impacted and most difficult to replicate elsewhere. Irradiations would be delayed, if moved, but could be accomplished at other facilities. Based on your email's attachments, we were planning to use the Halden in-pile CGR capabilities for welds, and in-pile creep/SR for baffle bolts. But it is only the welds that are high-priority work, and the in-pile feature is not critical to this work.

Does that sound right? Please correct me if I have mis-characterized the situation.

Thanks again,
Carol

From: Hiser, Matthew
Sent: Friday, June 01, 2018 1:53 PM
To: Moyer, Carol <Carol.Moyer@nrc.gov>; Rao, Appajosula <Appajosula.Rao@nrc.gov>
Cc: Frankl, Istvan <Istvan.Frankl@nrc.gov>; Tregoning, Robert <Robert.Tregoning@nrc.gov>
Subject: RE: LTMD (SLR) Research Update

Hi Carol,

We have provided the attached documents to Brian and Chris (and others higher up) regarding our mitigation plan for a Halden shutdown. This has been a fast-moving activity over the past 3 weeks since we received word that Halden would likely decommission.

Essentially the most important IAD activity impacted by Halden is the further irradiation of stainless steels welds for IASCC CGR and FT (the first bullet in your list of IAD work). We will plan to work with EPRI to determine an alternate facility to perform this work, which we both consider high priority. Our rough estimate is a 2-4 year delay and >$1M cost increase to perform this work elsewhere.

For the 3 dpa CASS work, my understanding is those materials were irradiated at Halden, but are now at ANL, so there is no further dependency on Halden (is that right Sri?).

The other update on IAD related to void swelling is that the baffle bolts from Indian Point and Ginna that are now at Westinghouse will be in the DOE library likely within the next two months. We've received some temperature and fluence information on those bolts that seems to indicate they might be interesting to look at for void swelling. We also may be interested to look at them for baffle bolt degradation research as well (pending alignment within RES and NRR).

Let me know if you have any questions or need more info. I'll be stopping work around 3:15 today. While I'll be in external training next week, I'll be checking email at least once a day.

Thanks!
Matt

From: Moyer, Carol
Sent: Friday, June 01, 2018 1:00 PM
To: Rao, Appajosula <Appajosula.Rao@nrc.gov>; Hiser, Matthew <Matthew.Hiser@nrc.gov>
Subject: LTMD (SLR) Research Update

Hello, Sri and Matt,

I will be briefing Brian next week on the status of Long-Term Materials Degradation research (that is, research related to subsequent license renewal), which includes IAD. Brian Harris had asked for some input and updates last month, but he was told that nothing really had changed in the IAD portion of the program.

Now that the Halden shut-down is all but certain, our near- and medium-term plans for irradiated materials testing will have to be adjusted. I must ask you both to take another look at my summary document (attached), and also the slide set that Steve Frankl used for the EPRI materials meeting last week (attached). I have inserted notes about expected programmatic risk due to the evolving Halden situation. But if you can give me more specific guidance on how our plans will change – do less, do the same work but with some delays, do something different, ? – I would very much appreciate it.

I am in the office today, so you can call me if you would like to discuss this. Thanks in advance!

Carol

Carol Moyer
Sr. Materials Engineer
RES/DE/CMB
301-415-2153
carol.moyer@nrc.gov

From: Pires, Jose
Sent: Mon, 7 May 2018 20:52:31 +0000
To: Sircar, Madhumita;Hiser, Matthew;Purtscher, Patrick;Tregoning, Robert;Audrain, Margaret;Koshy, Thomas;Murdock, Darrell;Philip, Jacob
Subject: RE: Materials Harvesting

Same with me. I will accommodate as convenient to the others.

José

From: Sircar, Madhumita
Sent: Monday, May 07, 2018 4:51 PM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>; Tregoning, Robert <Robert.Tregoning@nrc.gov>; Audrain, Margaret <Margaret.Audrain@nrc.gov>; Pires, Jose <Jose.Pires@nrc.gov>; Koshy, Thomas <Thomas.Koshy@nrc.gov>; Murdock, Darrell <Darrell.Murdock@nrc.gov>; Philip, Jacob <Jacob.Philip@nrc.gov>
Subject: RE: Materials Harvesting

I am available on 16th or 18th. Also available in the week of 21st.

Mita

From: Hiser, Matthew
Sent: Monday, May 07, 2018 4:45 PM
To: Sircar, Madhumita <Madhumita.Sircar@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>; Tregoning, Robert <Robert.Tregoning@nrc.gov>; Audrain, Margaret <Margaret.Audrain@nrc.gov>; Pires, Jose <Jose.Pires@nrc.gov>; Koshy, Thomas <Thomas.Koshy@nrc.gov>; Murdock, Darrell <Darrell.Murdock@nrc.gov>; Philip, Jacob <Jacob.Philip@nrc.gov>
Subject: RE: Materials Harvesting

OK, thanks Mita and Jose! Are there any days next week that are good – Wednesday or Friday maybe?

From: Sircar, Madhumita
Sent: Monday, May 07, 2018 4:14 PM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>; Tregoning, Robert <Robert.Tregoning@nrc.gov>; Audrain, Margaret <Margaret.Audrain@nrc.gov>; Pires, Jose <Jose.Pires@nrc.gov>; Koshy, Thomas <Thomas.Koshy@nrc.gov>; Murdock, Darrell <Darrell.Murdock@nrc.gov>; Philip, Jacob <Jacob.Philip@nrc.gov>
Subject: RE: Materials Harvesting

Matt,
Concrete folks will be out for the entire day for a NEI-EPRI concrete workshop on May 17th.
Thanks,
Mita

-----Original Appointment-----
From: Hiser, Matthew
Sent: Monday, May 07, 2018 3:56 PM
To: Purtscher, Patrick; Tregoning, Robert; Audrain, Margaret; Sircar, Madhumita; Pires, Jose; Koshy, Thomas; Murdock, Darrell; Philip, Jacob
Subject: Materials Harvesting
When: Thursday, May 17, 2018 9:00 AM-10:00 AM (UTC-05:00) Eastern Time (US & Canada).
Where: HQ-TWFN-10A73-8p

We'd like to meet with electrical and concrete research staff to discuss the latest status of the materials harvesting activities under Task 2 of UNR NRR-2017-006.

The four topics we'd like to update you on / discuss in this meeting are:

1. CMB staff development of prioritization criteria for harvesting needs and lessons learned from exercising them for metals
2. CMB staff effort to development inventory of previously harvested materials already available at lab facilities
3. Latest status of harvesting plans for electrical and concrete components
4. Pulling relevant information from license renewal documents for decommissioning plants

From: Pires, Jose
Sent: Mon, 7 May 2018 20:09:09 +0000
To: Hiser, Matthew;Purtscher, Patrick;Tregoning, Robert;Audrain, Margaret;Sircar, Madhumita;Koshy, Thomas;Murdock, Darrell;Philip, Jacob
Subject: RE: Materials Harvesting

Matt,

Mita, Jake and I have a day-long meeting with NRR, EPRI and NEI on that day to go over concrete issues for long-term operations. This week is also not good, especially for me, because I will in Canada for a harvesting project involving Gentilly-2, a severely ASR-affected plant that is now decommissioned.

If there is another time to meet, it would be great. Thanks,

José

Jose A. Pires, PhD, PE
Sr. Technical Advisor for Civil Structural Engineering
Division of Engineering
Office of Nuclear Regulatory Research
Ph: 301-415-2156

-----Original Appointment-----
From: Hiser, Matthew
Sent: Monday, May 07, 2018 3:56 PM
To: Purtscher, Patrick; Tregoning, Robert; Audrain, Margaret; Sircar, Madhumita; Pires, Jose; Koshy, Thomas; Murdock, Darrell; Philip, Jacob
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3. Latest status of harvesting plans for electrical and concrete components

4. Pulling relevant information from license renewal documents for decommissioning plants

From: Hiser, Matthew
Sent: Fri, 1 Jun 2018 19:22:44 +0000
To: Purtscher, Patrick;Tregoning, Robert;Audrain, Margaret;Sircar, Madhumita;Pires, Jose;Koshy, Thomas;Murdock, Darrell;Philip, Jacob
Cc: Miller, Kenneth A;Christensen, Jason
Subject: RE: Materials Harvesting

Hi everyone,

I wanted to follow up with the electrical and concrete folks to see how things are progressing on the action items we discussed. I think a goal of developing the prioritized list of needs by the end of June would be good to help keep momentum. Does that seem doable?

Please feel free to contact me if you have any questions.

Thanks!
Matt

_____

From: Hiser, Matthew
Sent: Wednesday, May 16, 2018 10:36 AM
To: Purtscher, Patrick <Patrick.Purtscher@nrc.gov>; Tregoning, Robert <Robert.Tregoning@nrc.gov>; Audrain, Margaret <Margaret.Audrain@nrc.gov>; Sircar, Madhumita <Madhumita.Sircar@nrc.gov>; Pires, Jose <Jose.Pires@nrc.gov>; Koshy, Thomas <Thomas.Koshy@nrc.gov>; Murdock, Darrell <Darrell.Murdock@nrc.gov>; Philip, Jacob <Jacob.Philip@nrc.gov>
Cc: Miller, Kenneth A <KennethA.Miller@nrc.gov>; Christensen, Jason <Jason.Christensen@nrc.gov>
Subject: RE: Materials Harvesting

<< File: Harvesting Needs Prioritization 5-16-18.xlsx >> << File: IML materials_update.xlsx >> << File: NRC Technical Data Needs for Harvesting.pptx >>

Thanks everyone for attending the meeting this morning. I appreciate the update on activities for electrical and concrete and have attached the documents that were printed out this morning.

Action Items for Metals, Concrete, and Electrical

1. Use prioritization criteria to prioritize data needs for harvesting in each area.
2. Catalog any previously harvested materials that may be available at labs.
3. Identify relevant information from license renewal documents for decommissioning plants

Thanks!
Matt

-----Original Appointment-----
From: Hiser, Matthew
Sent: Monday, May 07, 2018 3:56 PM
To: Hiser, Matthew; Purtscher, Patrick; Tregoning, Robert; Audrain, Margaret; Sircar, Madhumita; Pires, Jose; Koshy, Thomas; Murdock, Darrell; Philip, Jacob
Cc: Miller, Kenneth A; Christensen, Jason
Subject: Materials Harvesting
When: Wednesday, May 16, 2018 9:00 AM-10:00 AM (UTC-05:00) Eastern Time (US & Canada).
Where: T10D40

Rescheduling for hopefully a better time for everyone.

We'd like to meet with electrical and concrete research staff to discuss the latest status of the materials harvesting activities under Task 2 of UNR NRR-2017-006.

The four topics we'd like to update you on / discuss in this meeting are:

1. CMB staff development of prioritization criteria for harvesting needs and lessons learned from exercising them for metals
2. CMB staff effort to development inventory of previously harvested materials already available at lab facilities
3. Latest status of harvesting plans for electrical and concrete components
4. Pulling relevant information from license renewal documents for decommissioning plants

From: Sircar, Madhumita
Sent: Fri, 14 Sep 2018 12:03:44 +0000
To: Hiser, Matthew
Cc: Pires, Jose;Seber, Dogan
Subject: RE: Materials Harvesting

Matt,
Yes, Jose and I agreed to keep irradiated concrete, ASR, and post-tensioning systems and delete the other items.
Thanks,
Mita

-----Original Message-----
From: Hiser, Matthew
Sent: Friday, September 14, 2018 7:52 AM
To: Sircar, Madhumita <Madhumita.Sircar@nrc.gov>
Cc: Pires, Jose <Jose.Pires@nrc.gov>; Seber, Dogan <Dogan.Seber@nrc.gov>
Subject: RE: Materials Harvesting

Thank you Mita! I appreciate you guys providing this input, which should be quite useful.

I noticed you guys filled in the first three rows on irradiated concrete, ASR, and post-tensioning systems, but not the other three rows. Does this mean you didn't see the others as high enough priority to rank? If so, I'll just delete them in what we provide as input to the final deliverable on harvesting prioritization.

Thanks!
Matt

-----Original Message-----
From: Sircar, Madhumita
Sent: Thursday, September 13, 2018 3:39 PM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>
Cc: Pires, Jose <Jose.Pires@nrc.gov>; Seber, Dogan <Dogan.Seber@nrc.gov>
Subject: FW: Materials Harvesting

Matt,
Please find attached our input on harvesting needs prioritization.
Thanks,
Mita

-----Original Message-----
From: Pires, Jose
Sent: Wednesday, September 12, 2018 5:17 PM
To: Sircar, Madhumita <Madhumita.Sircar@nrc.gov>; Seber, Dogan <Dogan.Seber@nrc.gov>
Subject: RE: Materials Harvesting

Mita,

Sorry for the delay. I entered a line for ASR and added something on the first column of the irradiation.

José

-----Original Message-----
From: Sircar, Madhumita
Sent: Monday, September 10, 2018 4:05 PM
To: Seber, Dogan <Dogan.Seber@nrc.gov>; Pires, Jose <Jose.Pires@nrc.gov>
Subject: FW: Materials Harvesting

Jose,
As we discussed last week, I have provided input on harvesting needs prioritization for (i) Structures Exposed to High Radiation and (ii) Post-tensioned Structures. Could you please provide input on AAR and review the input I provided on the two topics.
I propose to delete the other topics and keep these 3 topics only. As I understand this form will be used to communicate with NRR and tee-up the discussion with NRR. CMB has a UNR from NRR.

Dogan,
Once Jose and I complete our input, l will send it to you for review.

Matt requested to get it by 9/14.

Thanks,
Mita

-----Original Message-----
From: Hiser, Matthew
Sent: Friday, August 03, 2018 3:55 PM
To: Miller, Kenneth A <KennethA.Miller@nrc.gov>; Sircar, Madhumita <Madhumita.Sircar@nrc.gov>
Cc: Purtscher, Patrick <Patrick.Purtscher@nrc.gov>; Audrain, Margaret <Margaret.Audrain@nrc.gov>
Subject: FW: Materials Harvesting

Hi Kenn and Mita,

I just wanted to follow up from this meeting/email back in May on harvesting priorities. I have attached a template of the prioritization of harvesting needs in the metals area. Can you follow that template to provide input for the electrical and concrete technical areas?

Please let me (or Meg or Pat on cc) know if you have any questions.

Thanks!
Matt

-----Original Message-----
From: Hiser, Matthew
Sent: Wednesday, May 16, 2018 10:36 AM
To: Purtscher, Patrick <Patrick.Purtscher@nrc.gov>; Tregoning, Robert <Robert.Tregoning@nrc.gov>; Audrain, Margaret <Margaret.Audrain@nrc.gov>; Sircar, Madhumita <Madhumita.Sircar@nrc.gov>; Pires, Jose <Jose.Pires@nrc.gov>; Koshy, Thomas <Thomas.Koshy@nrc.gov>; Murdock, Darrell <Darrell.Murdock@nrc.gov>; Philip, Jacob <Jacob.Philip@nrc.gov>
Cc: Miller, Kenneth A <KennethA.Miller@nrc.gov>; Christensen, Jason <Jason.Christensen@nrc.gov>
Subject: RE: Materials Harvesting

Thanks everyone for attending the meeting this morning. I appreciate the update on activities for electrical and concrete and have attached the documents that were printed out this morning.

Action Items for Metals, Concrete, and Electrical
1. Use prioritization criteria to prioritize data needs for harvesting in each area.

2. Catalog any previously harvested materials that may be available at labs.
3. Identify relevant information from license renewal documents for decommissioning plants

Thanks!
Matt

-----Original Appointment-----
From: Hiser, Matthew
Sent: Monday, May 07, 2018 3:56 PM
To: Hiser, Matthew; Purtscher, Patrick; Tregoning, Robert; Audrain, Margaret; Sircar, Madhumita; Pires, Jose; Koshy, Thomas; Murdock, Darrell; Philip, Jacob
Cc: Miller, Kenneth A; Christensen, Jason
Subject: Materials Harvesting
When: Wednesday, May 16, 2018 9:00 AM-10:00 AM (UTC-05:00) Eastern Time (US & Canada).
Where: T10D40

Rescheduling for hopefully a better time for everyone.

We'd like to meet with electrical and concrete research staff to discuss the latest status of the materials harvesting activities under Task 2 of UNR NRR-2017-006.

The four topics we'd like to update you on / discuss in this meeting are:

1. CMB staff development of prioritization criteria for harvesting needs and lessons learned from exercising them for metals
2. CMB staff effort to development inventory of previously harvested materials already available at lab facilities
3. Latest status of harvesting plans for electrical and concrete components
4. Pulling relevant information from license renewal documents for decommissioning plants

From: Philip, Jacob
Sent: Mon, 7 May 2018 20:59:29 +0000
To: Hiser, Matthew
Cc: Seber, Dogan
Subject: RE: Materials Harvesting

I will not be in 5/18

From: Hiser, Matthew
Sent: Monday, May 07, 2018 4:45 PM
To: Sircar, Madhumita <Madhumita.Sircar@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>; Tregoning, Robert <Robert.Tregoning@nrc.gov>; Audrain, Margaret <Margaret.Audrain@nrc.gov>; Pires, Jose <Jose.Pires@nrc.gov>; Koshy, Thomas <Thomas.Koshy@nrc.gov>; Murdock, Darrell <Darrell.Murdock@nrc.gov>; Philip, Jacob <Jacob.Philip@nrc.gov>
Subject: RE: Materials Harvesting

OK, thanks Mita and Jose! Are there any days next week that are good – Wednesday or Friday maybe?

From: Sircar, Madhumita
Sent: Monday, May 07, 2018 4:14 PM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>; Tregoning, Robert <Robert.Tregoning@nrc.gov>; Audrain, Margaret <Margaret.Audrain@nrc.gov>; Pires, Jose <Jose.Pires@nrc.gov>; Koshy, Thomas <Thomas.Koshy@nrc.gov>; Murdock, Darrell <Darrell.Murdock@nrc.gov>; Philip, Jacob <Jacob.Philip@nrc.gov>
Subject: RE: Materials Harvesting

Matt,
Concrete folks will be out for the entire day for a NEI-EPRI concrete workshop on May 17th.
Thanks,
Mita

-----Original Appointment-----
From: Hiser, Matthew
Sent: Monday, May 07, 2018 3:56 PM
To: Purtscher, Patrick; Tregoning, Robert; Audrain, Margaret; Sircar, Madhumita; Pires, Jose;

Koshy, Thomas; Murdock, Darrell; Philip, Jacob
Subject: Materials Harvesting
When: Thursday, May 17, 2018 9:00 AM-10:00 AM (UTC-05:00) Eastern Time (US & Canada).
Where: HQ-TWFN-10A73-8p

We'd like to meet with electrical and concrete research staff to discuss the latest status of the materials harvesting activities under Task 2 of UNR NRR-2017-006.

The four topics we'd like to update you on / discuss in this meeting are:

1. CMB staff development of prioritization criteria for harvesting needs and lessons learned from exercising them for metals
2. CMB staff effort to development inventory of previously harvested materials already available at lab facilities
3. Latest status of harvesting plans for electrical and concrete components
4. Pulling relevant information from license renewal documents for decommissioning plants

Note to requester: There are two attachments to this email, both which are immediately following, and have been provided in previous releases. The attachments are: "JNRA Meeting Sept 2018.pptx" and "4.4 CRIEPI research activities_r2 for providing participants.pdf".

From: Purtscher, Patrick
Sent: Wed, 29 Aug 2018 13:42:29 +0000
To: Audrain, Margaret;Hiser, Matthew
Subject: RE: JNRA Meeting Sept 2018.pptx

I just had one small change. Maybe we could refer back to the presentation that the Japanese made at the Workshop last year?

Pat

From: Audrain, Margaret
Sent: Tuesday, August 28, 2018 1:54 PM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: JNRA Meeting Sept 2018.pptx

Matt and Pat,

Please take a look at the attached presentation for Rob's harvesting meeting. In particular, let me know if there's any additional information you think we should ask Rob to discuss in the meeting (last slide). If possible, please have this to me by COB Thursday so I can get it to Rob before I go on [redacted] (b)(6)

Thanks,

Meg

CRIEPI research activities with harvested materials

Material Research Lab.

Nuclear Power Plant Maintenance Research Team

Taku Arai, Sadao Higuchi

Ex-Plant Materials Harvesting Workshop

March 7-8, 2017 USNRC HQ, Rockville, MD, USA

CRIEPI
Central Research Institute of Electric Power Industry

CRIEPI projects

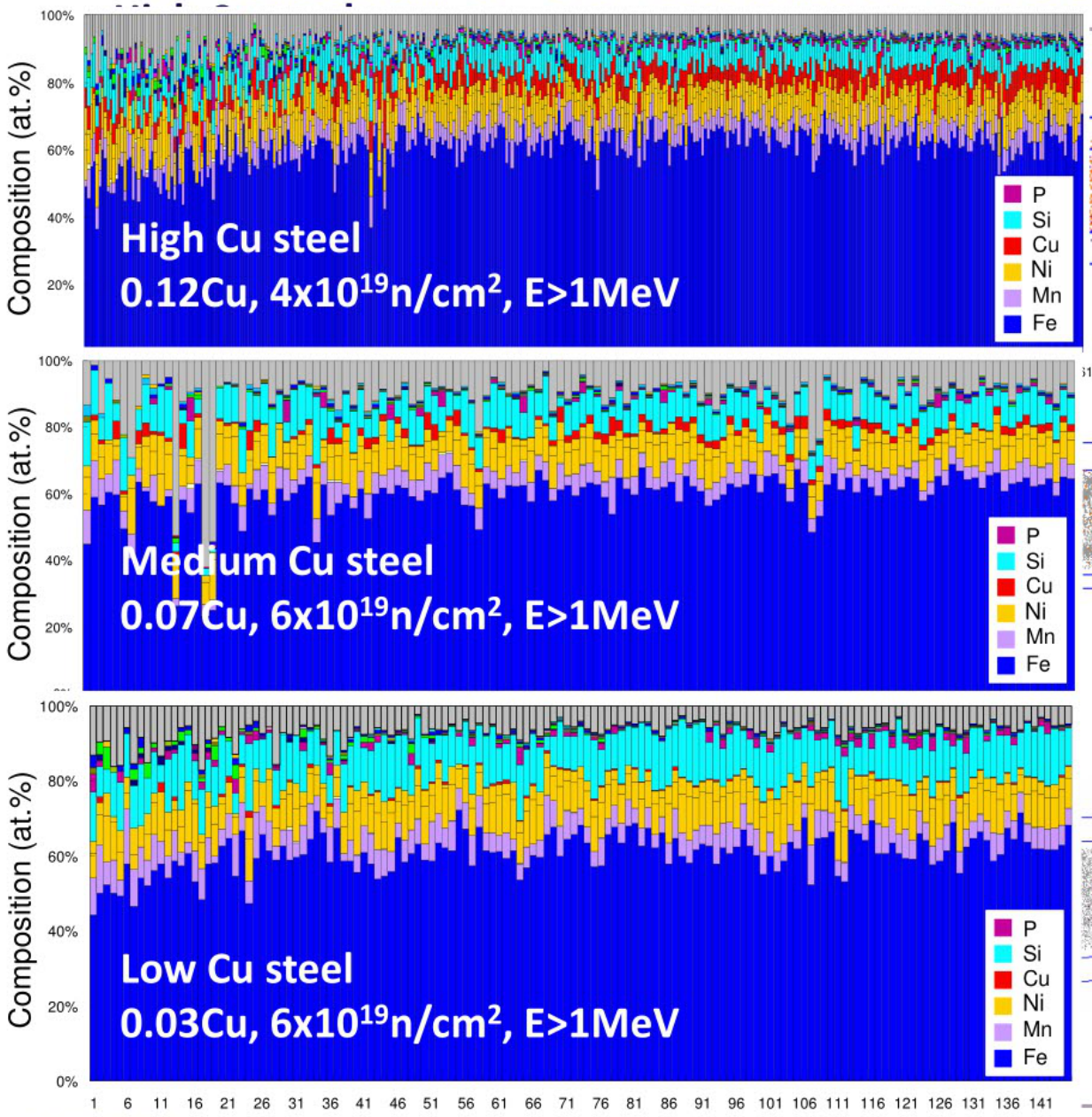
- RPV surveillance database
  - All the Japanese utilities
- Greifswald(VVER/440) RPV material
  - Collaboration with HZDR
- 304L, 304 and 316 stainless steels from decommissioned core internals
  - Collaboration with EPRI
- National research project
  - Irradiation effects on RPV and Core Internals
  - Collaboration with LWRS(ORNL)

RPV SURVEILLANCE MATERIALS

Japanese RPV surveillance database

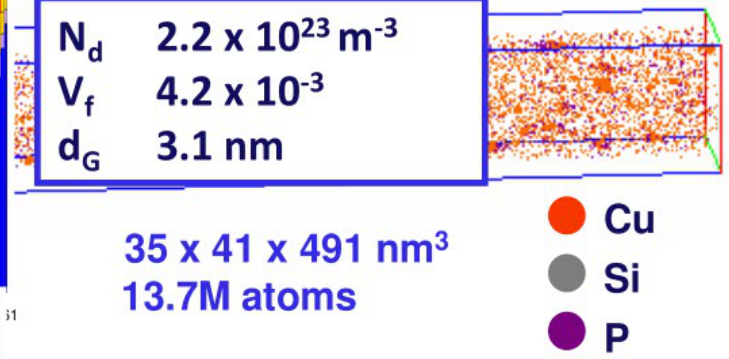
- Microstructural characterization of the RPV surveillance materials has been continuously performed by CRIEPI since 2007.
  - Mainly Atom Probe Tomography (APT)
- More than 100 conditions with different materials and different fluences have been compiled to date.
  - Good correlation between microstructural changes and mechanical changes has been observed.

Nature of solute atom clusters



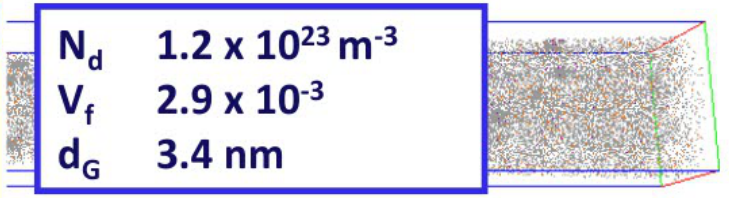
Cu-Ni-Si-Mn cluster

N_d	2.2×10^{23} m^{-3}
V_f	4.2×10^{-3}
d_G	3.1 nm



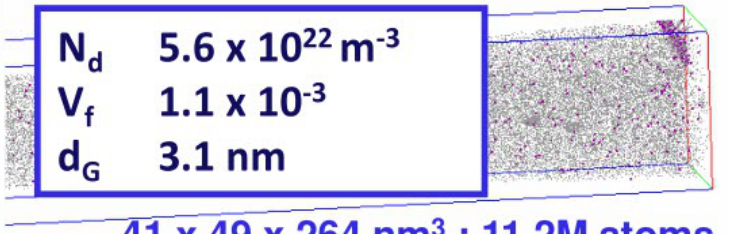
35 x 41 x 491 nm^3
13.7M atoms

N_d	1.2×10^{23} m^{-3}
V_f	2.9×10^{-3}
d_G	3.4 nm



33 x 38 x 284 nm^3 : 8.1M atoms

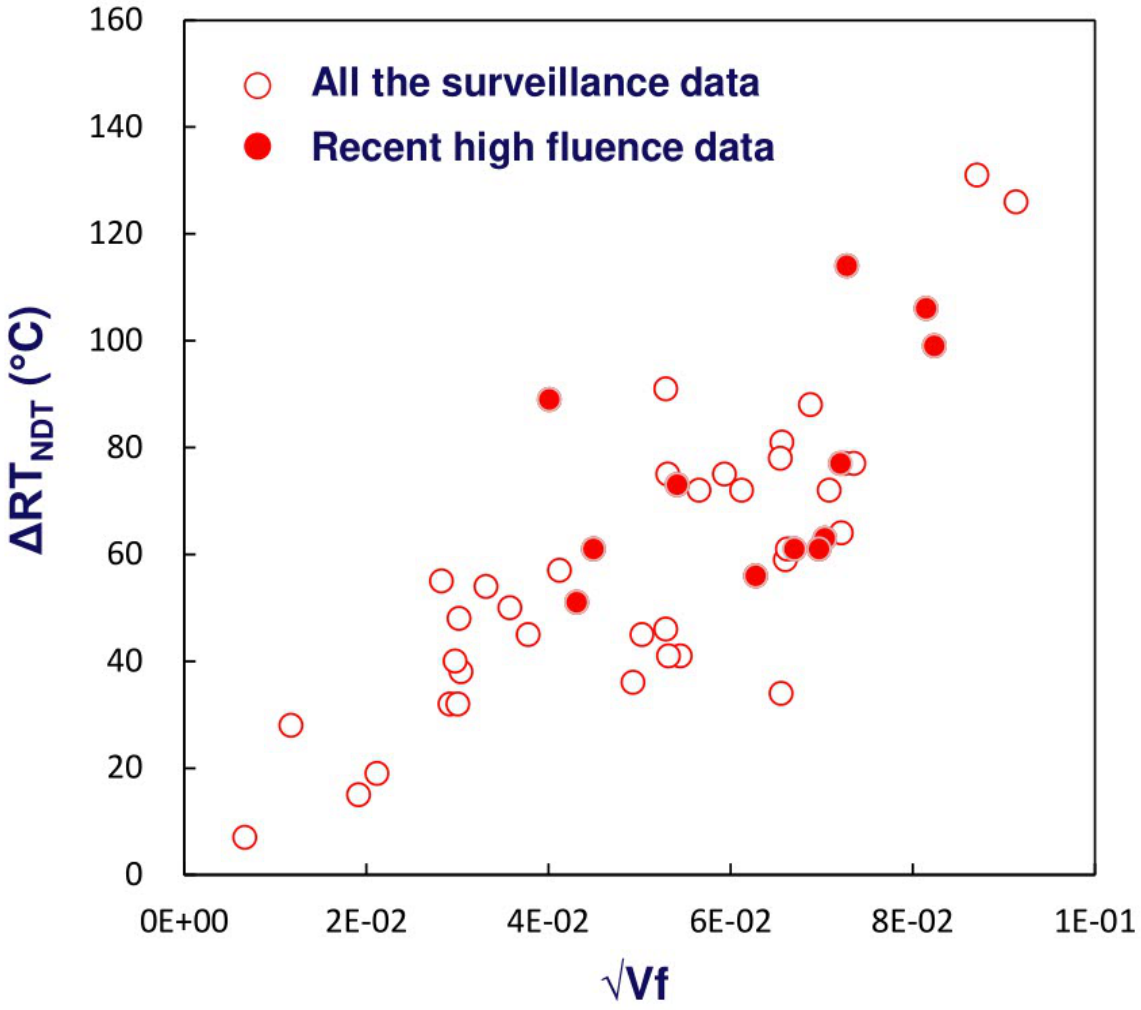
N_d	5.6×10^{22} m^{-3}
V_f	1.1×10^{-3}
d_G	3.1 nm



41 x 49 x 264 nm^3 : 11.2M atoms

Ni-Si-Mn cluster

ΔRT_{NDT} vs V_f



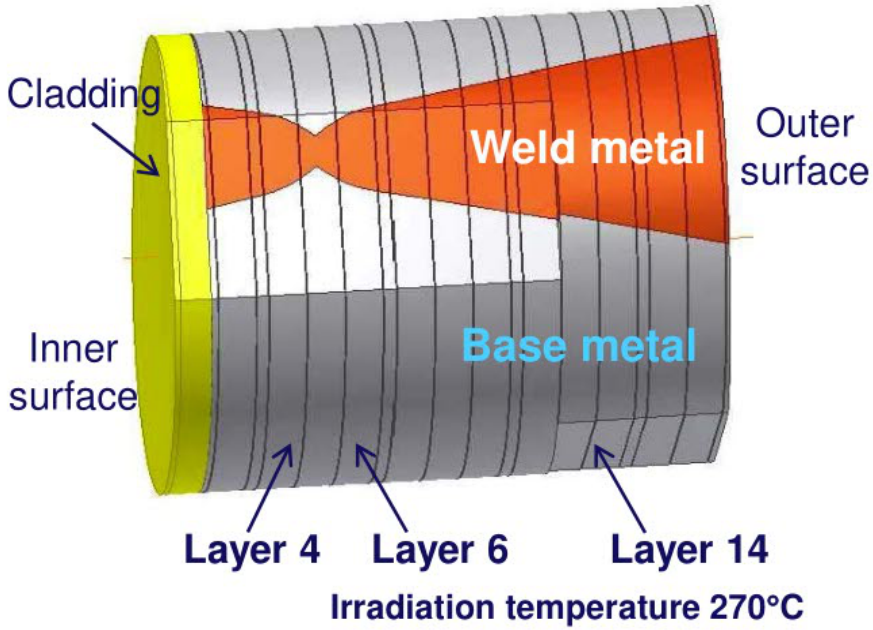
- The correlation between ΔRT_{NDT} and V_f for the recent high fluence data shown in solid red symbols is consistent with that for lower fluence surveillance data.

Greifswald RPV materials

RPV MATERIALS HARVESTED FROM DECOMMISSIONED PLANT

Greifswald Unit 4 material

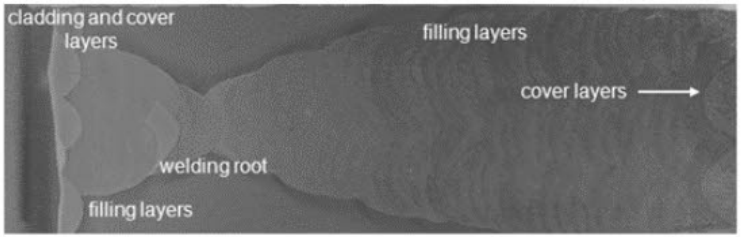
- **SANS (HZDR), APT (CRIEPI) and Hv (HZDR & CRIEPI) were performed to characterize the weld and base metals of Greifswald Unit 4 RPV.**

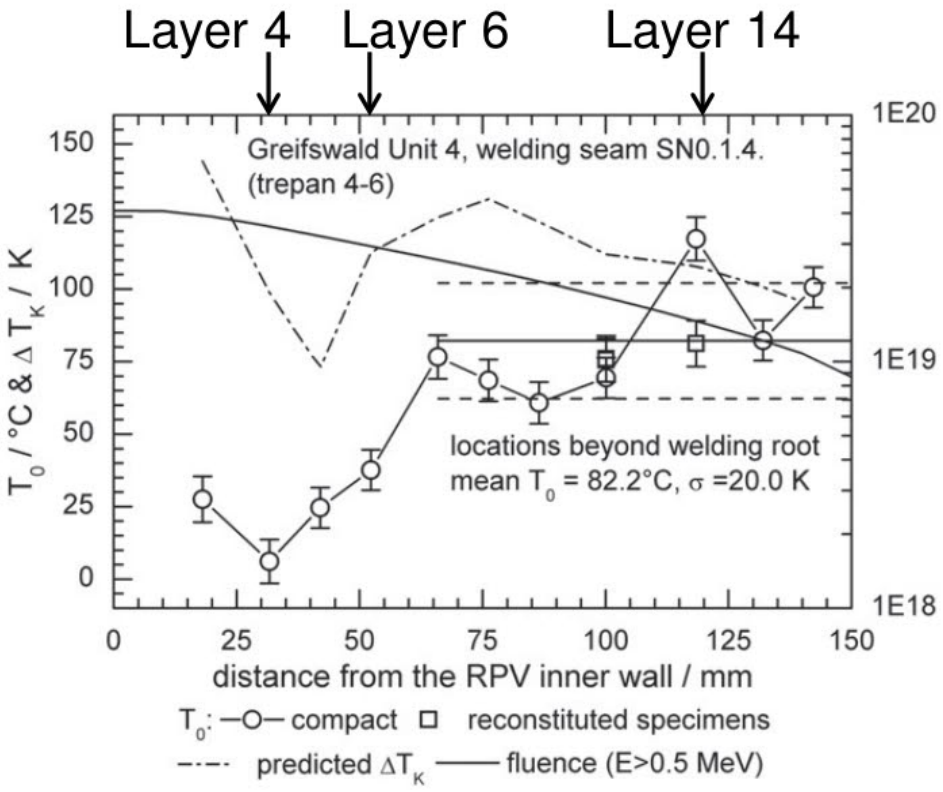


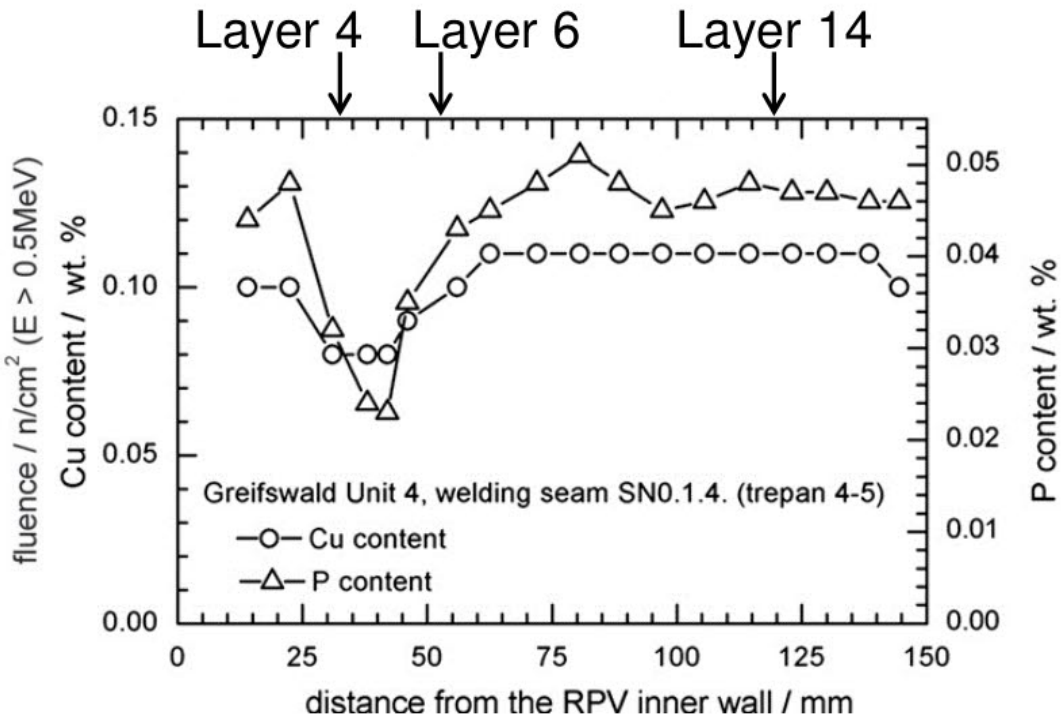
Material	Neutron fluence (10^{19} n/cm^2, E>1MeV)	Neutron flux (10^{11} n/cm^2/s, E>1MeV)
Weld layer 4	2.0	0.72
Weld layer 6	1.5	0.55
Weld layer 14	0.6	0.22
Base layer 4	2.6	0.94

Material	Cu	P	Ni	Mn	C	Si	Cr	Mo	V
Weld	0.12	0.029	0.12	0.98	0.08	0.33	1.31	0.45	0.15
Base	0.1	0.012	0.16	0.47	0.17	0.74	2.52	0.57	0.25

Distributions of mechanical property and chemical composition

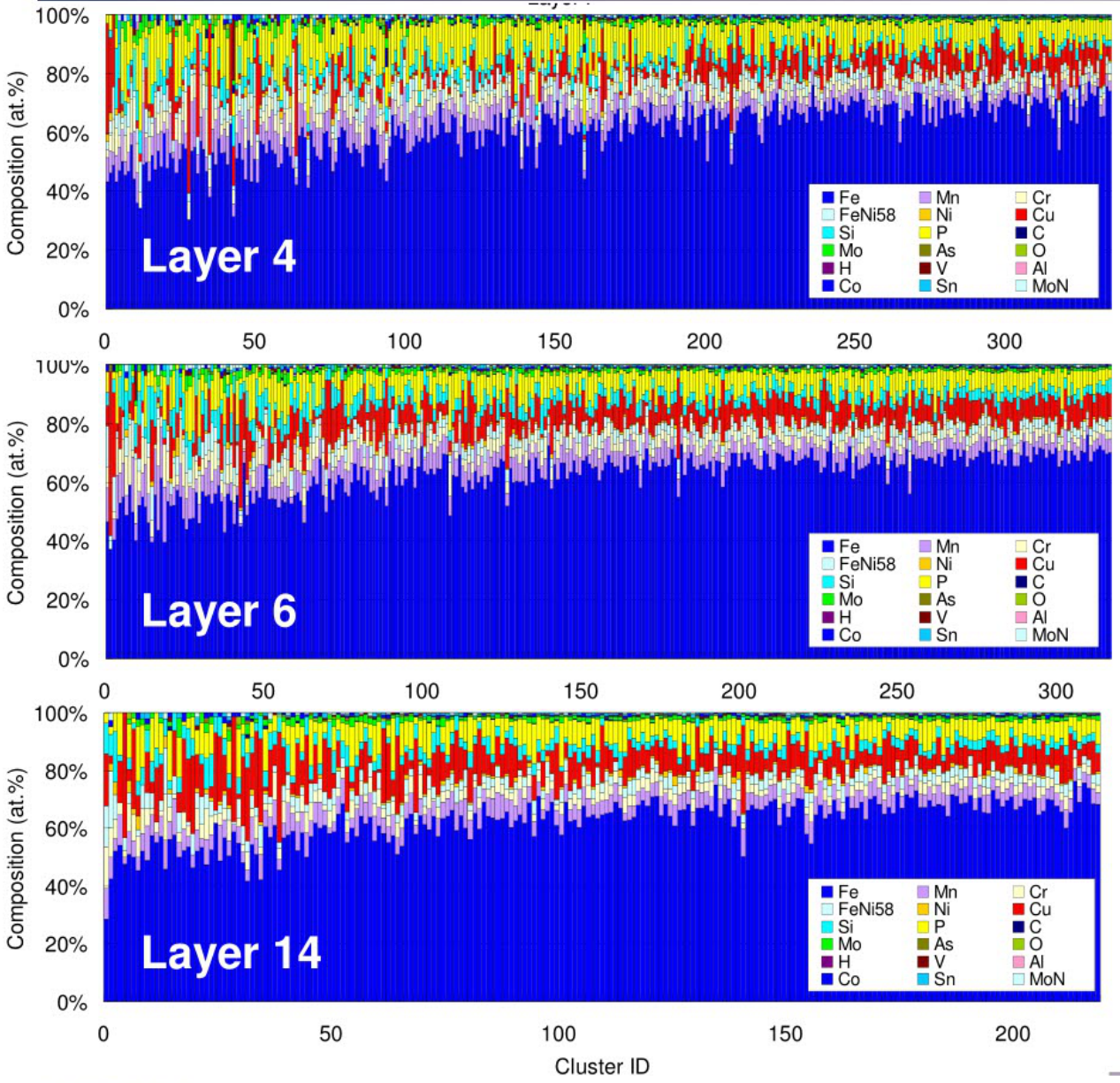






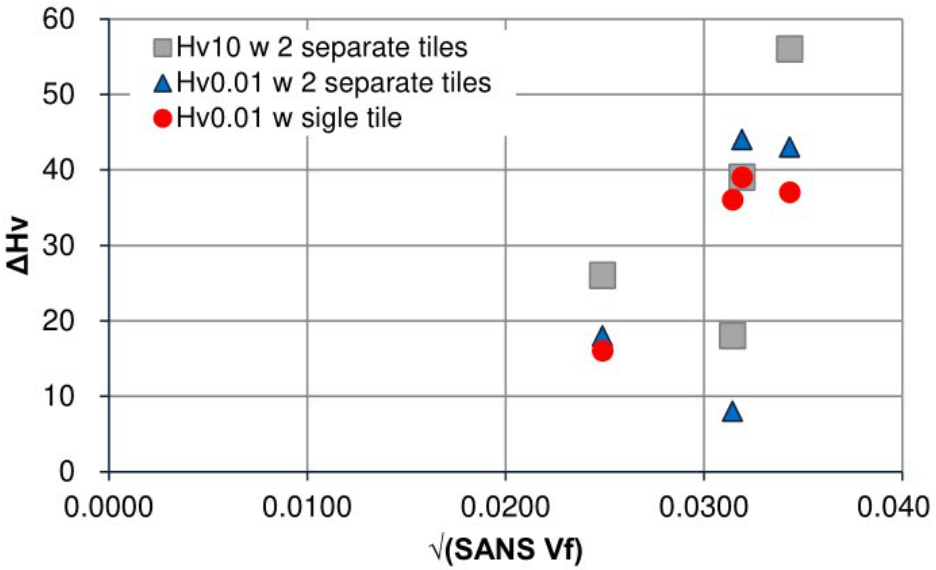
Ref. Viehrig, H.-W.; Altstadt, E.; Houska, M.; Valo, M.: Fracture mechanics characterization of the beltline welding seam of the decommissioned WWER-440 reactor pressure vessels of nuclear power plant Greifswald Unit 4. International Journal of Pressure Vessels and Piping 89(2012)

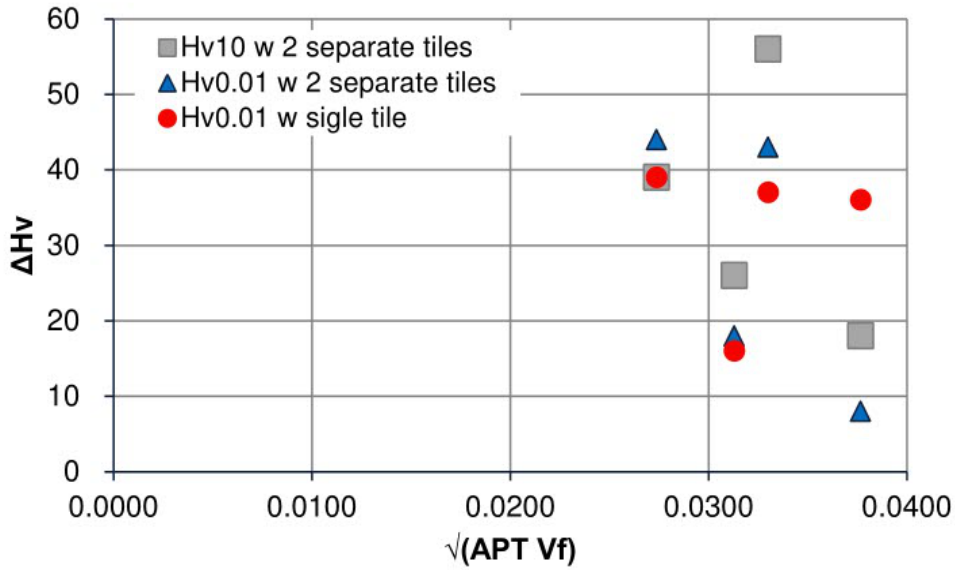
APT results of weld metals



- P content (yellow) is very high in the three materials compared to the Japanese steels.
- Cu content (red) is very low in small clusters of layer 4, while all the clusters contain Cu atoms in layer 6 and 14.

Comparison between SANS, APT and Hv





- **Comparison between the SANS Vf and ΔHv0.01 by single tile method shows relatively good correlation.**
  - **Combination of single tile, NI hardness distribution measurement and PIA is a powerful tool to avoid material variability.**
- **Sampling APT needles from the area of hardness measurement may give us information with less scatter.**

STAINLESS STEELS HARVESTED FROM DECOMMISSIONED CORE INTERNALS

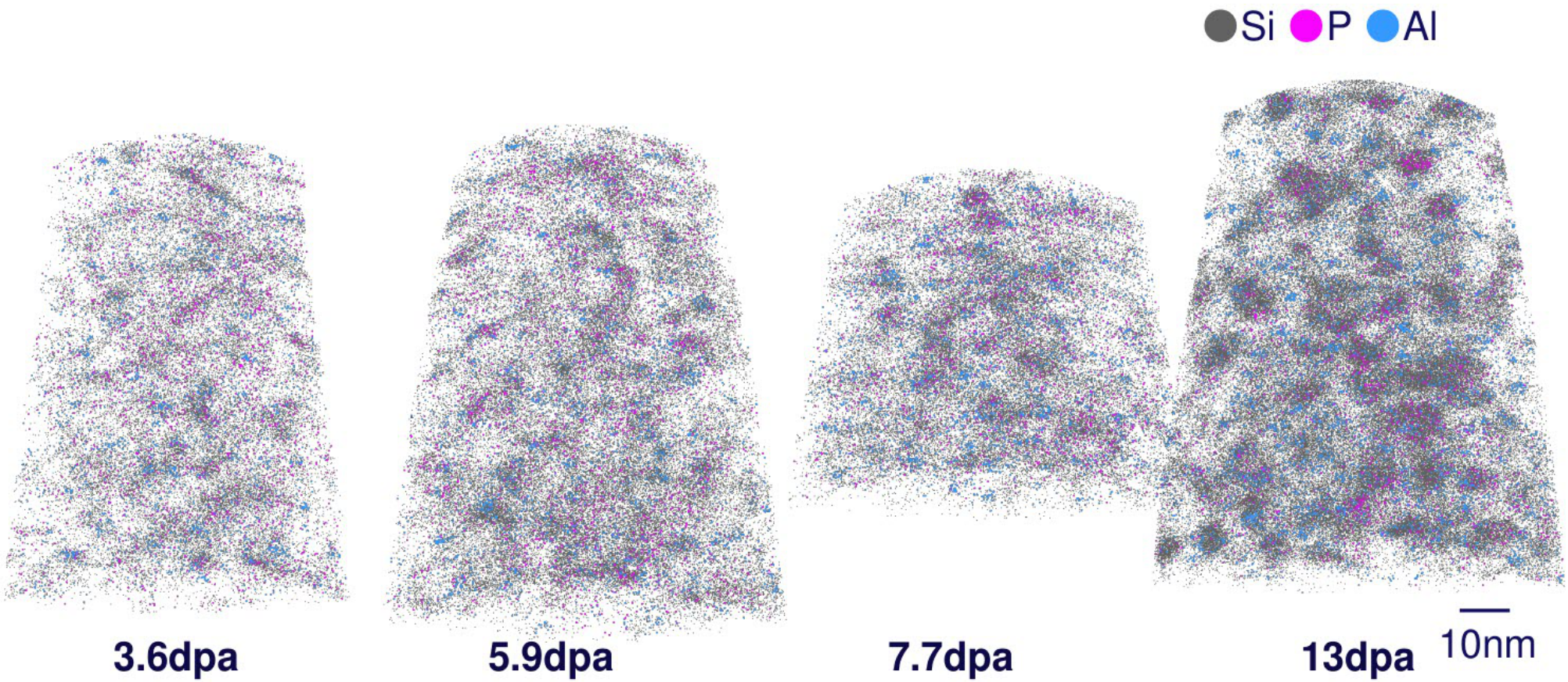
APT Characterization of 304L SS

- Grain interior analysis of 304L SS by APT

ID	Material	Source	Neutron Fluence (n/cm^2, E > 1 MeV)	dpa
A	304L	CR	$2.5X10^{21}$	3.6
B	304	TG	$3.3X10^{21}$	4.7
C	304	TG	$3.8X10^{21}$	5.5
D	304L	CR	$4.2X10^{21}$	5.9
E	304L	CR	$5.4X10^{21}$	7.7
F	304L	CR	$9.1X10^{21}$	13
G	316L	CR	$4.7X10^{21}$	6.7

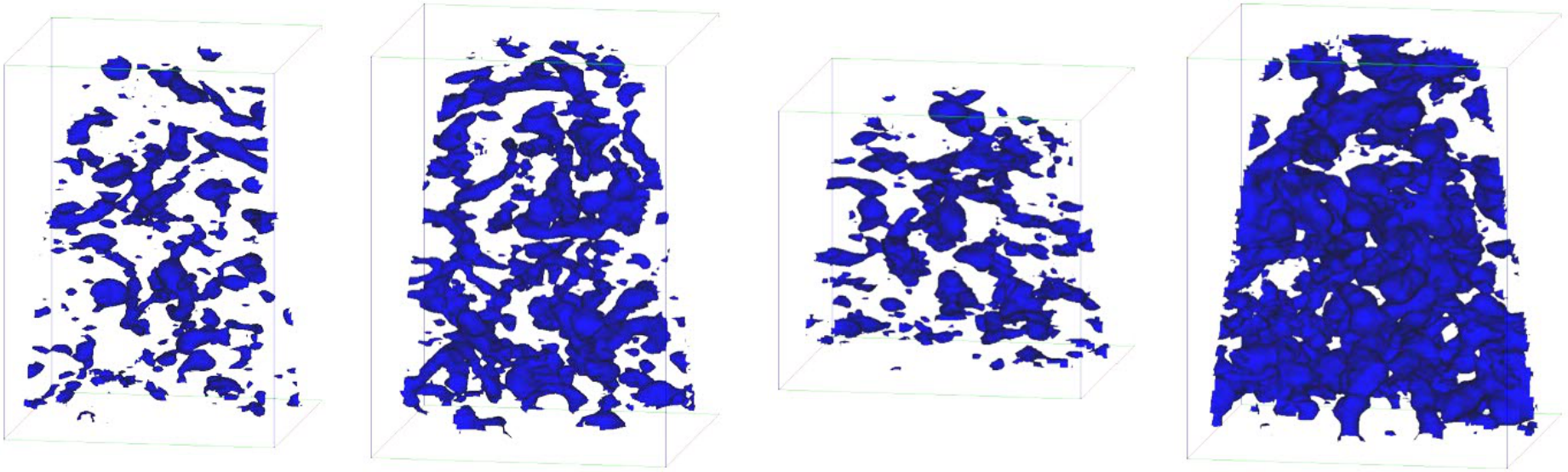
CR: Control rod, TG: Top guide

Comparison of 304L SS microstructures



- Both Ni/Si and Al clusters are well developed at 13 dpa that at lower doses.
- Note that Si and Al bulk compositions is higher in the 304L heat irradiated to 13 dpa.

Iso-surface of 2 at% Si in 304L SS



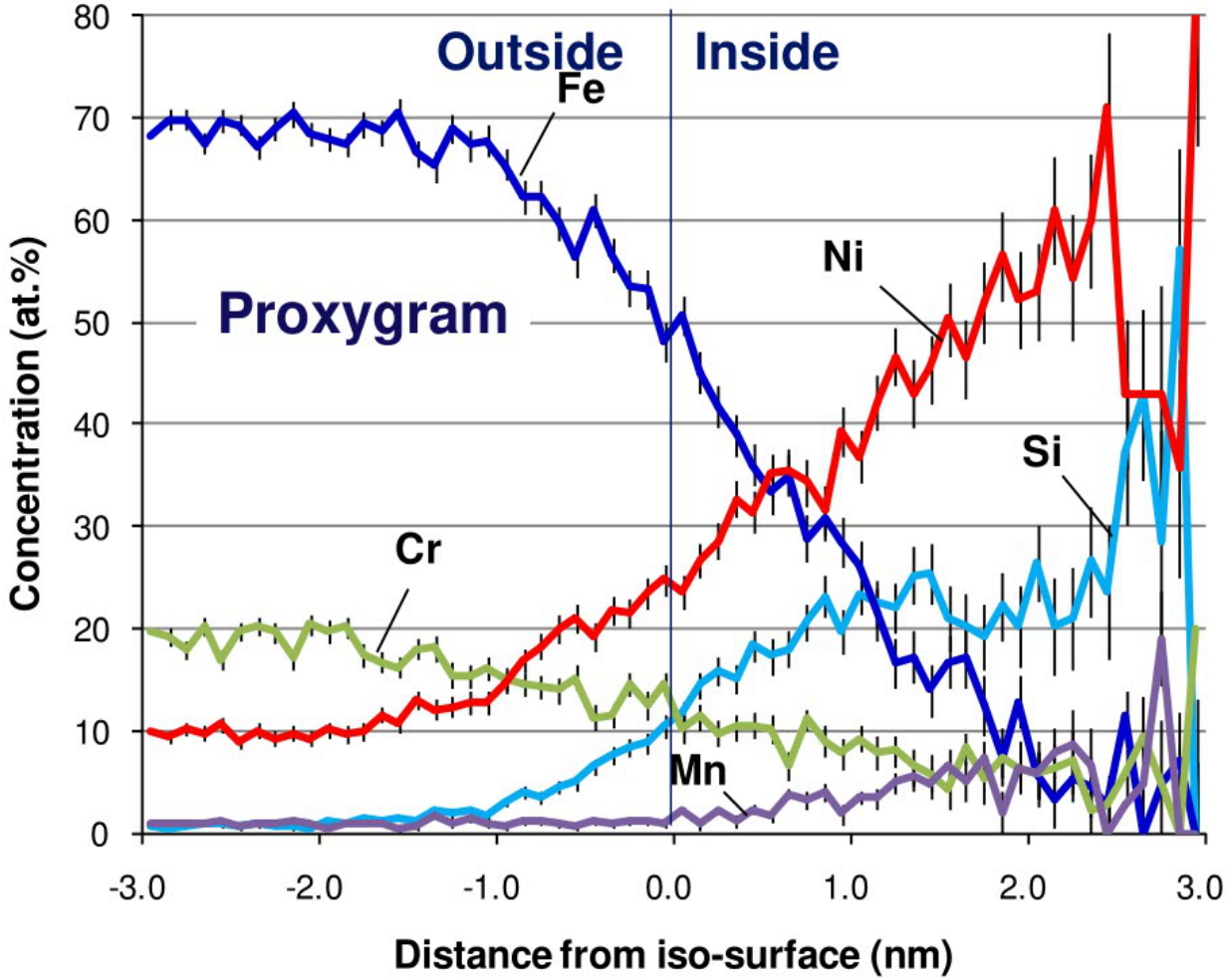
3.6dpa 5.9dpa 7.7dpa 13dpa

Damage (dpa)	3.6	5.9	7.7	13
Volume fraction	3.4%	7.1%	5.8%	19%

- Large increase in volume fraction is observed at 13 dpa.
- The shape of bounded regions is not spherical nor separated.

Chemical composition of Ni/Si feature in 304L

13dpa

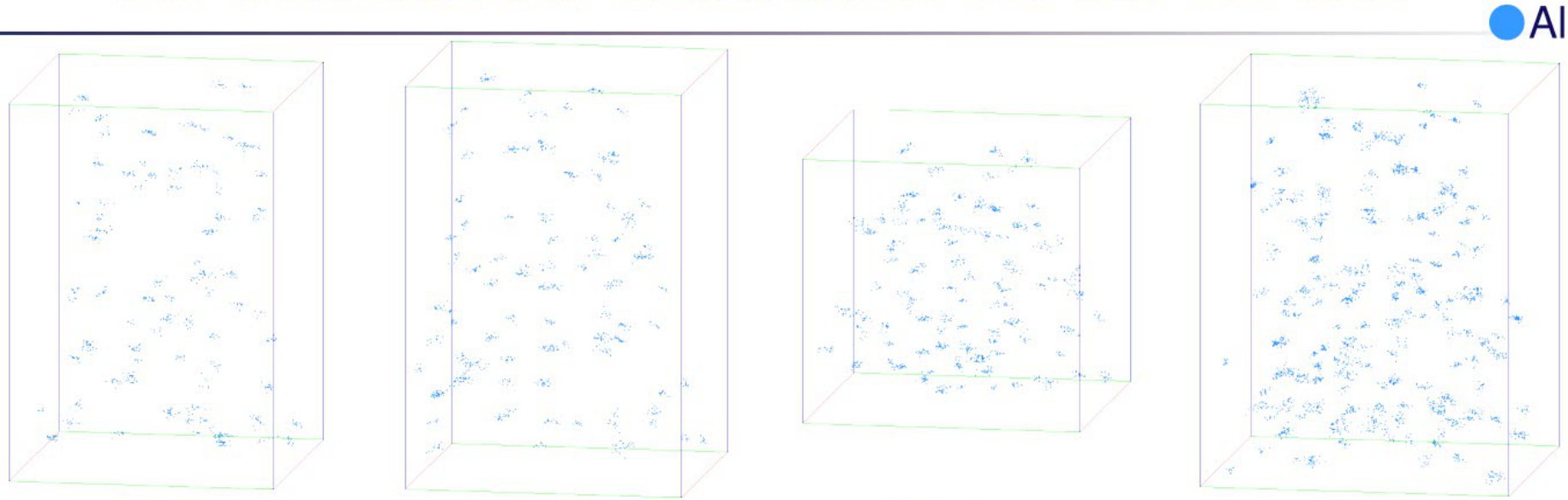


10at% Si isosurface

20~25 at.% Si, 50~60 at.% Ni, <10 at.% Fe&Cr near the center.

40 at.% Si, 40 at.% Ni, 10 at.% Mn <10 at.% Fe&Cr at the center.

Al enriched clusters in 304L SS



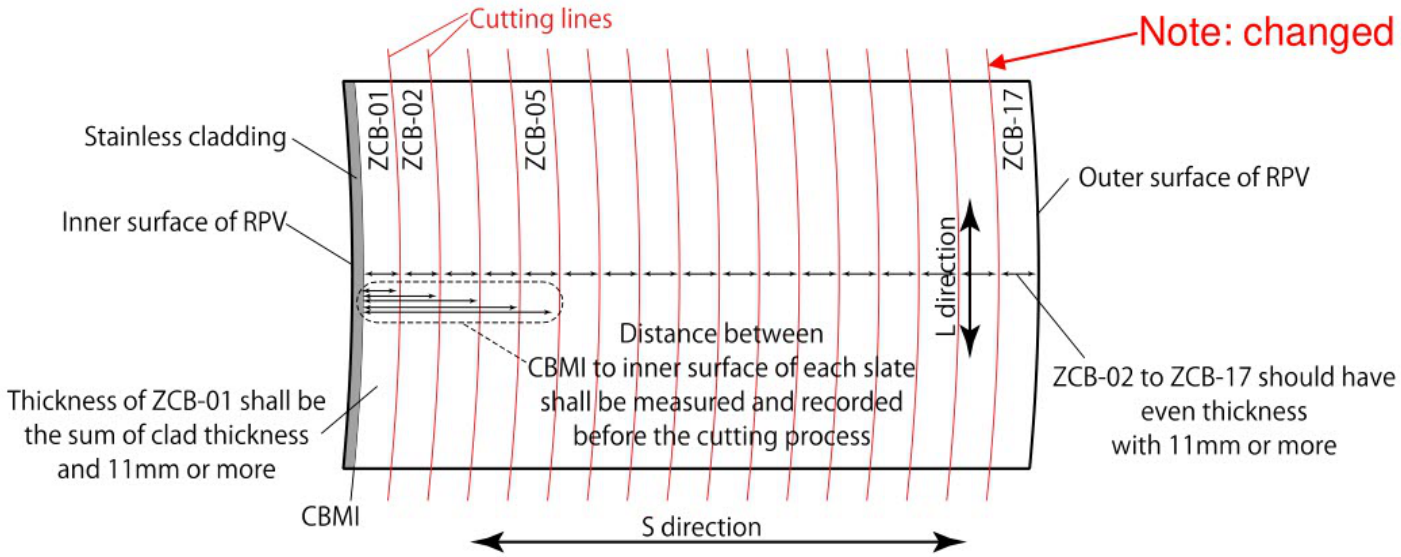
Damage (dpa)	3.6	5.9	7.7	13
Number density (m^{-3})	4.1×10^{23}	3.6×10^{23}	5.8×10^{23}	5.8×10^{23}

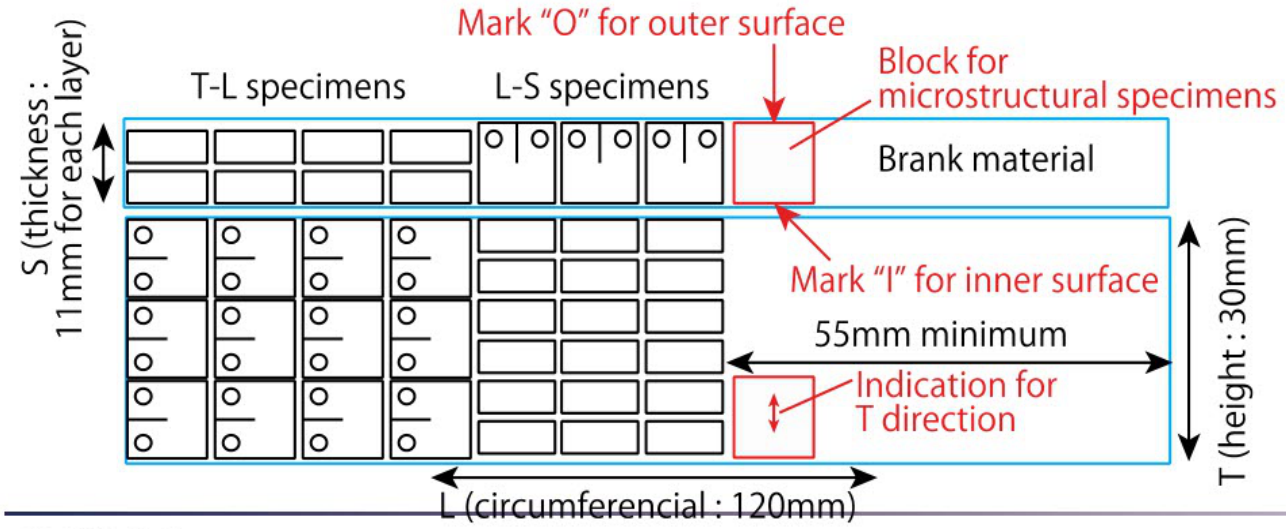
- Cluster diameter is >3nm.
- Enrichment factors of Al and Cu ***impurities*** are 50~100 and 4~5, respectively, although the amount of Al and Cu is small.
- Number density does not change very much with dose.

National Research Project (2015 to 2018)

- Collaboration with ORNL (LWRS)
- Harvested RPV steel from Zion
  - Evaluation of through-wall attenuation of Reactor Pressure Vessel embrittlement.
  - Mini-CT master curve fracture toughness, hardness, APT
- US PWR Ginna BFB material
  - Characterization of microstructure of irradiated stainless steels.
  - APT analysis

Cutting scheme for Zion unit 1





24 specimens
X
2 orientations
X
17 layers
↓
816 specimens

Summary

- For RPV surveillance materials, comparisons between the surveillance coupons and the actual vessel materials are important to demonstrate the adequacy of surveillance program.

- Materials harvested from actual vessels show the actual state of RPV materials.
  - Demonstration of large safety margin is expected

- No surveillance materials are available for core internal materials.
  - Expanding knowledge about irradiation effects on microstructure

Harvesting of Aged Materials from Operating and Decommissioning Nuclear Power Plants

M. Audrain, M. Hiser, P.Purtscher, R. Tregoning

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

The views expressed in this presentation are those of the author, not necessarily those of the U.S. NRC.

Motivation

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- Interest in extending lifespan to 60-80 years
  - Need to understand aging mechanisms
  - Key areas: RPV embrittlement, IASCC of internals, concrete structures and containment degradation and electrical cables
- Announced plant shut downs worldwide – opportunities to harvest in situ components
- Limited budgets have restricted new research, including harvesting
  - Important to align interested parties
  - Leverage resources for maximum benefit

NRC Harvesting Experience

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- NRC has participated in several programs:
  - RPV, CRDM penetrations, RCS piping, RPV internals, neutron absorbers, and cables
  - Materials harvested from unfinished, operating and decommissioning plants
  - US and international programs
- Determined significant value in using harvesting components to confirm data from other research programs

Lessons Learned

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- Technical
  - Provides highly representative ages materials for research
  - Important to gain as much information as possible before committing to specific harvesting project
- Logistical
  - Expensive and time-consuming effort
  - Leveraging resources helps mitigate cost challenges
  - Transportation of irradiated materials is cumbersome and time-consuming

Current Work

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- Develop strategic approach to materials harvesting
  - Past efforts have been reactive to individual plants shutting down
- Prioritize data needs best addressed by harvesting, considering:
  - Applicability of harvested material for addressing gaps
  - Importance of harvested materials over laboratory aging
  - Fleet-wide vs plant-specific applicability of data
  - Regulatory considerations
  - Harvesting cost/complexity
- Database for Sources of Materials
  - Compilation of available materials at US national labs
  - Eventually include materials previously harvested and available for future harvesting
  - NRC is interested in engaging with other organizations in developing the database

Conclusion

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- Harvesting can yield highly representative and valuable data on materials aging
- A focused approach to choosing harvested materials is necessary to get best outcomes
- NRC is working on a Sources of Materials Database and a Data Needs Prioritization scheme
- NRC welcomes opportunities for cooperation and leveraging with other interested research organizations

Discussion

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- What (if any) activities are currently being undertaken in Japan for materials harvesting?
- Does Japan have an interest in harvesting? If so, what areas are considered most important?
- Would there be interest in leveraging resources if a harvesting project was identified?

Note to requester: Attachments are immediately following.

From: Hiser, Matthew
Sent: Thu, 30 Aug 2018 12:39:50 +0000
To: Purtscher, Patrick;Audrain, Margaret
Subject: RE: JNRA Meeting Sept 2018.pptx
Attachments: JNRA Meeting Sept 2018 Harvesting.pptx, Harvesting Efforts NRAJ Bilateral 7-20-16.pptx

---

From: Hiser, Matthew
Sent: Wednesday, August 29, 2018 10:24 AM
To: Purtscher, Patrick <Patrick.Purtscher@nrc.gov>; Audrain, Margaret <Margaret.Audrain@nrc.gov>
Subject: RE: JNRA Meeting Sept 2018.pptx

Hi Meg and Pat,

I made some more extensive edits and changes (mostly same information but reorganized / reworded in many cases) in the attached. I also redid the last slide per Pat's suggestion to reflect what Japan shared at the workshop last year. Feel free to edit my edits ☺

I also attached some slides I found in my folders from 2 years ago when we last met with the JNRA for reference / awareness (I didn't even remember those!).

Thanks!
Matt

From: Purtscher, Patrick
Sent: Wednesday, August 29, 2018 9:42 AM
To: Audrain, Margaret <Margaret.Audrain@nrc.gov>; Hiser, Matthew <Matthew.Hiser@nrc.gov>
Subject: RE: JNRA Meeting Sept 2018.pptx

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Pat

From: Audrain, Margaret
Sent: Tuesday, August 28, 2018 1:54 PM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: JNRA Meeting Sept 2018.pptx

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(b)(6)

Thanks,

Meg

Strategic Approach for Ex-Plant Materials Harvesting

Matthew Hiser

Amy Hull

Patrick Purtscher

Robert Tregoning

U.S. NRC

NRC-NRAJ Bilateral Technical Information Exchange Meeting
Nuclear Regulatory Commission Headquarters
August 8-9, 2016

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Purpose

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- Create a framework for a strategic approach to harvesting ex-plant materials to support regulatory needs associated with subsequent license renewal (SLR)
  - Ex-plant materials offer unique environmental exposure that cannot be entirely replicated by laboratory testing with fresh materials

- Align high priority data needs identified in SLR activities with harvesting opportunities from decommissioning plants

Background

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- To date, harvesting opportunities have been limited due to few decommissioning plants
  - Zion in U.S., Zorita in Spain
- However, several U.S. plants have already shut down or are planning to do so in the near future
  - Kewaunee, San Onofre, Crystal River, Vermont Yankee, Oyster Creek, Fort Calhoun, Clinton, Quad Cities, Diablo Canyon
- This provides a unique opportunity to plan harvesting to address the highest priority technical and regulatory issues

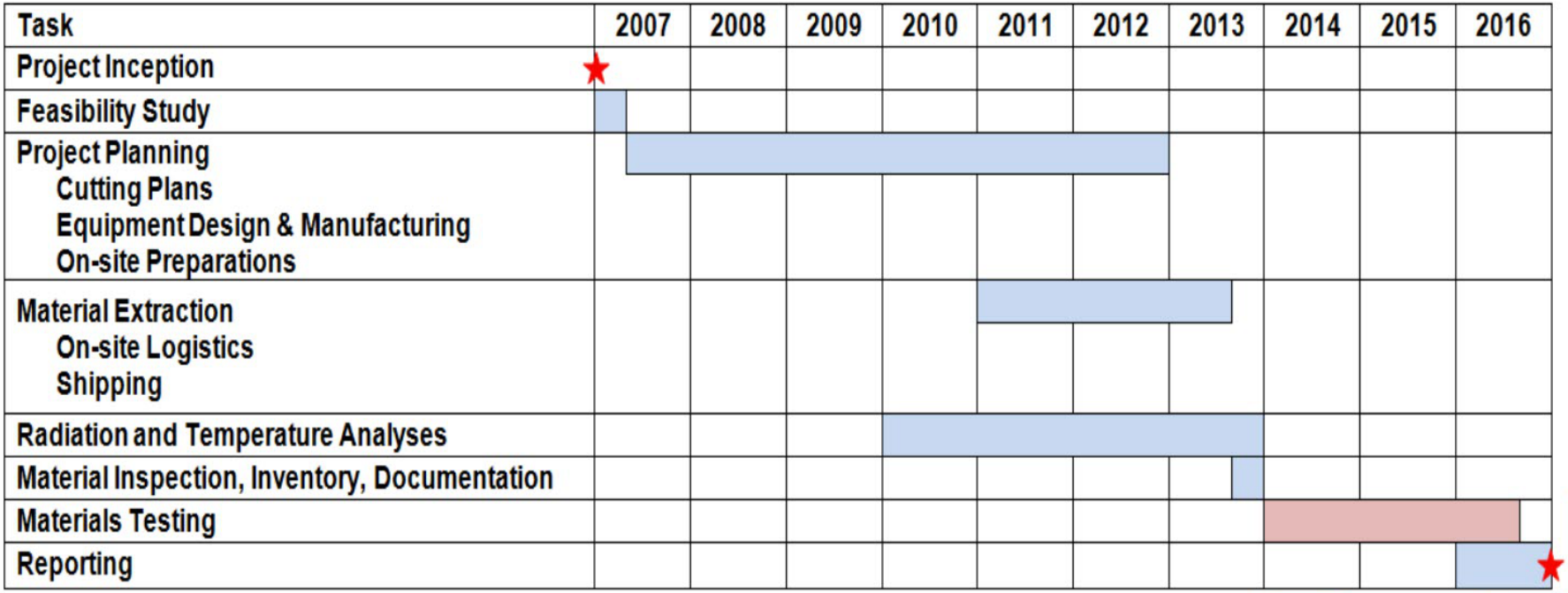
Harvesting Experience

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- Past harvesting efforts have generally involved reactive decision-making
  - Limited opportunities to acquire ex-plant materials
  - Limited strategic planning for harvesting
- Harvesting projects with NRC involvement:
  - Reactors internal materials from Zorita
  - Concrete from Zorita
  - Neutron absorber material from Zion
  - Cables from Zion and Crystal River

Zorita Internals Research Project Timeline

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment



Approach: Assessment of Technical Issues and Available Materials for Harvesting

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- Utilize various sources of technical information with respect to anticipated degradation in NPPs out to 80 years of operation
  - NRC, DOE, EPRI, IAEA
- Identify high-priority data needs that could be addressed through harvesting ex-plant materials
  - Focus on identifying characteristics of important systems, structures, and components (SSCs) for harvesting
- Gather information on ex-plant material expected to be available based on identified needs
  - May be from both operating and decommissioning reactors

Implementation

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- What might the output of this activity look like?
  - For example, the review may show there is value in acquiring CASS material around 15% delta ferrite with various dose ranges (<0.08 dpa, 1–3 dpa, and >5 dpa)
- Once that need is identified, this activity would identify what SSCs might be the best candidates for harvesting
  - For example, perhaps lower support columns would be identified as the ideal SSC to address the CASS data need
- As decommissioning plants announce their plans, there is a clear list of SSCs and their characteristics (metallurgy, temperature, fluence, etc.) that would be desired to address the data need

Current NRC Activities

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- NRC is working with Pacific Northwest National Lab (PNNL) to identify technical issues that may be best addressed by ex-plant harvesting
  - Focused on unique value of harvesting to understand material properties in difficult to replicate environments
- NRC also seeking interest from other stakeholders to better understand availability of materials for harvesting
  - Considering a public workshop in fall 2016
  - Stakeholders include EPRI, DOE, U.S. industry, international partners

Discussion Topics

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- Japanese approach to ex-plant material harvesting
- Information on available harvesting opportunities from Japanese reactors
  - Is it known which plants will not restart?
- Opportunities for coordination / cooperation on ex-plant harvesting

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Backup Slides

Neutron Absorbers from Zion

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- **Materials Harvested**:
  - Select Boral® NAM panels from Regions 1 and 2 of the Zion SFP
- **Scope**:
  - Visual and microstructural examinations (incl. areal density)
  - Corrosion testing
- **Purpose**:
  - Identify degradation mechanisms and estimate degradation rate
  - Confirm results of in-situ areal density measurements
  - Provide confirmatory data to support regulatory decision-making
- **Timeline**:
  - Initial discussions in 2014, harvesting in 2015, testing in 2015-2016
- **Coordination**:
  - EPRI, ZionSolutions, SRNL

Zorita Internals Research Project (ZIRP)

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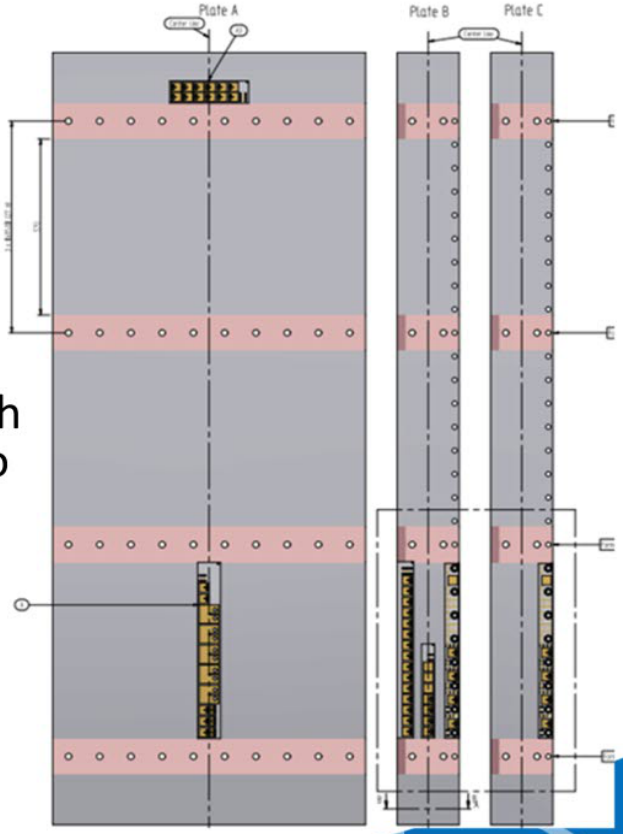
- **Materials Harvested**:
  - Baffle plate and core barrel weld materials
- **Scope**:
  - Mechanical testing (tensile, CGR, FT)
  - Microstructural characterization (void swelling)
- **Purpose**:
  - High-fluence (up to 50 dpa) IAD effects with representative LWR exposure conditions to
  - Support regulatory decision-making associated with SLR
- **Timeline**:
  - Initial discussions in 2006, harvesting in 2013, testing ongoing through 2016
- **Coordination**:
  - EPRI, international consortium, Studsvik, Halden



Concrete from Zorita (Plan)

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- **Materials Harvested**:
  - Concrete from structures that are in close proximity to RPV
- **Scope**:
  - Mechanical testing (compressive, tensile, modulus of elasticity)
  - Microstructural characterization
  - Physical change
- **Purpose**:
  - High fluence in combination with temperature and humidity that are representative of LWR environmental effects on structural and shielding performance
  - Supports regulatory decision-making associated with SLR
- **Timeline**:
  - Initial discussions in 2014, harvesting in 2015, testing 2016-2018
- **Coordination**:
  - NRC , ENRESA and CSN

Cables: Zion and Crystal River

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- **Materials Harvested**:
  - Low and Medium Voltage Cables
- **Scope**:
  - Condition monitoring to assess cable performance under normal operating conditions (accelerated aging) and accident conditions
- **Purpose**:
  - Cable degradation due to normal operating environment and accident conditions
  - Supports regulatory decision-making associated with SLR
- **Timeline**:
  - Initial discussions in 2012; Cable samples harvested from Zion in 2013
  - Plan is to harvest additional samples from Crystal River and Zion in 2015
  - Testing expected to be completed in 2017
- **Coordination**:
  - ORNL, Zion Solutions, NIST, EPRI

Harvesting of Aged Materials from Operating and Decommissioning Nuclear Power Plants

M. Audrain, M. Hiser, P. Purtscher, R. Tregoning

U.S.NRC
United States Nuclear Regulatory Commission
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The views expressed in this presentation are those of the author, not necessarily those of the U.S. NRC.

Motivation

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- US utilities are interested in extending operating lifespans from to 60-80 years:
  - Key technical areas for aging management:
    - RPV embrittlement, irradiation-assisted degradation of internals, concrete structures and containment, electrical cables
- Many plant shutdowns worldwide provide opportunities to harvest components during decommissioning
  - Harvesting can provide valuable information on aging mechanisms to increase confidence in aging management
- Limited budgets make cooperation for new research, including harvesting, essential:
  - Important to align interested parties
  - Leverage resources for maximum benefit

NRC Harvesting Experience

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- NRC has participated in several programs:
  - RPV, CRDM penetrations, RCS piping, RPV internals, neutron absorbers, and cables
  - Materials harvested from unfinished, operating and decommissioning plants
  - US and international programs
- NRC experience is there is significant value in using harvested components to confirm data from other research programs

Lessons Learned

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- Technical
  - Provides highly representative aged materials for research
  - Important to gain as much information as possible before committing to specific harvesting project

- Logistical
  - Expensive and time-consuming effort
  - Leveraging resources helps mitigate cost challenges
  - Transportation of irradiated materials is cumbersome and time-consuming

Current Work

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- Develop strategic approach to materials harvesting
  - Past efforts have been reactive to individual plants shutting down
- Prioritize data needs best addressed by harvesting, considering:
  - Applicability of harvested material for addressing gaps
  - Importance of harvested materials over laboratory aging
  - Fleet-wide vs plant-specific applicability of data
  - Regulatory considerations
  - Harvesting cost/complexity
- Database for Sources of Materials
  - Compilation of previously harvested materials available at US national labs as well as those available for future harvesting
  - NRC is interested in engaging with other organizations in developing the database

Needs - Metals

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- RPV
  - High fluence & high shift vessel with well-established unirradiated properties (or a means to estimate them)
    - Through thickness section to validate fluence & attenuation models
    - Measure fluence, toughness, & chemistry as a function of through-thickness position
  - Samples from virtually any vessel
    - Of sufficient size to enable measurement of both the Charpy transition curve and master curve transition temperature T_0
    - This testing
      - Enables demonstration of the conservatism of regulatory approaches for transition temperature prediction
      - Provides data supporting evolution from the use of correlative (Charpy-based) to direct measurement (fracture toughness-based) approaches

Needs - Metals

U.S.NRC
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- CASS and Internals
  - High fluence reactor internals
    - >50 dpa 304 SS from high core outlet temp plant
    - Bounding temperature and high fluence for void swelling
  - Thermally aged unirradiated CASS
    - >30 years at ~320° C; Validate accelerated aging data
  - Moderate fluence (1-2 dpa) CASS
    - Bolster technical basis for embrittlement in this fluence range
- Components with known flaws
  - Example: weld overlays over known flaws
    - NDE evaluations or to assess effectiveness of mitigation techniques
- Components with limiting fatigue life
  - Confirm fatigue calculations are accurate by inspecting for flaws

Needs - Electrical

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- Cables
  - Low and medium voltage cables
  - Cables protected with fire retardant coating
- Electrical components
  - 1E MOVs from harsh and mild environments
  - 1E Air operated valves; 4160 1E breakers
  - 1E Molded case breakers 480V, 250V DC, 125 VDC,
  - 1E Relays from mild environment GE – HFA, Agastat timing relays, any from Westinghouse, Potter Brumfield, Stuthers Dunn etc.,
  - Electrical penetrations; Batteries
- Fire research interest
  - Electrical enclosures
    - Distribution : switchgear, MCCs, LCs | Control : Horseshoe, SSCP, ASP, etc.

Needs - Concrete

U.S.NRC
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- Structures exposed to high radiation
- Post-tensioned structures
- Corrosion of reinforcing steel, tendon, liner, embedment
- Spent fuel pool and transfer canal-boric acid attack on concrete in PWRs
- Alkali Aggregate Reaction
- Large structural sections for testing

Conclusion

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- Harvesting can yield highly representative and valuable data on materials aging
- A focused approach to choosing harvested materials is necessary to get best outcomes
- NRC is working on a sources of materials database and prioritizing data needs based on relevant criteria to inform decisions on specific harvesting opportunities
- NRC welcomes opportunities for cooperation and leveraging with other interested research organizations

Discussion

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- Has the planned work on harvesting RPV materials and concrete from Hamaoka 1 been completed?
  - Can those results be shared with NRC?
- Does JNRA/CRIEPI have any other harvesting programs in progress or planned?
  - If so, any information that can be shared?
  - If still being planned, is there interest in additional partners?
- Would there be interest in participating if a harvesting project was identified in the US or another country?
  - Should we reach out to JNRA if other harvesting opportunities develop?

From: Hiser, Matthew
Sent: Thu, 30 Aug 2018 17:01:01 +0000
To: Purtscher, Patrick;Audrain, Margaret
Subject: RE: JNRA Meeting Sept 2018.pptx
Attachments: NRC Technical Data Needs for Harvesting.pptx

Note to requester: Attachment is immediately following.

Hi Meg,

Here's the slides on data needs by area that were presented at the 2017 workshop.

Thanks!
Matt

Matthew Hiser
Materials Engineer
US Nuclear Regulatory Commission | Office of Nuclear Regulatory Research
Division of Engineering | Corrosion and Metallurgy Branch
Phone: 301-415-2454 | Office: TWFN 10D62
Matthew.Hiser@nrc.gov

From: Hiser, Matthew
Sent: Thursday, August 30, 2018 8:40 AM
To: Purtscher, Patrick <Patrick.Purtscher@nrc.gov>; Audrain, Margaret <Margaret.Audrain@nrc.gov>
Subject: RE: JNRA Meeting Sept 2018.pptx

From: Hiser, Matthew
Sent: Wednesday, August 29, 2018 10:24 AM
To: Purtscher, Patrick <Patrick.Purtscher@nrc.gov>; Audrain, Margaret <Margaret.Audrain@nrc.gov>
Subject: RE: JNRA Meeting Sept 2018.pptx

Hi Meg and Pat,

I made some more extensive edits and changes (mostly same information but reorganized / reworded in many cases) in the attached. I also redid the last slide per Pat's suggestion to reflect what Japan shared at the workshop last year. Feel free to edit my edits ☺

I also attached some slides I found in my folders from 2 years ago when we last met with the JNRA for reference / awareness (I didn't even remember those!).

Thanks!
Matt

From: Purtscher, Patrick
Sent: Wednesday, August 29, 2018 9:42 AM

To: Audrain, Margaret <Margaret.Audrain@nrc.gov>; Hiser, Matthew <Matthew.Hiser@nrc.gov>
Subject: RE: JNRA Meeting Sept 2018.pptx

I just had one small change. Maybe we could refer back to the presentation that the Japanese made at the Workshop last year?

Pat

From: Audrain, Margaret
Sent: Tuesday, August 28, 2018 1:54 PM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: JNRA Meeting Sept 2018.pptx

Matt and Pat,

Please take a look at the attached presentation for Rob's harvesting meeting. In particular, let me know if there's any additional information you think we should ask Rob to discuss in the meeting (last slide). If possible, please have this to me by COB Thursday so I can get it to Rob before I go on [redacted] (b)(6)

Thanks,

Meg

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NRC High-Priority Data Needs for Harvesting

NRC Staff

March 7, 2017

Metals

- RPV
  - High fluence & high shift vessel with well-established unirradiated properties (or a means to estimate them)
    - Through thickness section to validate fluence & attenuation models
    - Measure fluence, toughness, & chemistry as a function of through-thickness position
  - Samples from virtually any vessel
    - Of sufficient size to enable measurement of both the Charpy transition curve and master curve transition temperature T_0
    - This testing
      - Enables demonstration of the conservatism of regulatory approaches for transition temperature prediction
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Metals

- CASS and Internals
  - High fluence reactor internals
    - >50 dpa 304 SS from high core outlet temp plant
    - Bounding temperature and high fluence for void swelling
  - Thermally aged unirradiated CASS
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  - Moderate fluence (1-2 dpa) CASS
    - Bolster technical basis for embrittlement in this fluence range
- Components with known flaws
  - Example: weld overlays over known flaws
    - NDE evaluations or to assess effectiveness of mitigation techniques
- Components with limiting fatigue life
  - Confirm fatigue calculations are accurate by inspecting for flaws

Electrical

- Cables
  - Low and medium voltage cables
  - Cables protected with fire retardant coating
- Electrical components
  - 1E MOVs from harsh and mild environments
  - 1E Air operated valves; 4160 1E breakers
  - 1E Molded case breakers 480V, 250V DC, 125 VDC,
  - 1E Relays from mild environment GE – HFA, Agastat timing relays, any from Westinghouse, Potter Brumfield, Stuthers Dunn etc.,
  - Electrical penetrations; Batteries
- Fire research interest
  - Electrical enclosures
    - Distribution : switchgear, MCCs, LCs | Control : Horseshoe, SSCP, ASP, etc.

Concrete

- Structures exposed to high radiation
- Post-tensioned structures
- Corrosion of reinforcing steel, tendon, liner, embedment
- Spent fuel pool and transfer canal-boric acid attack on concrete in PWRs
- Alkali Aggregate Reaction
- Large structural sections for testing

Note to requester: All the .png attachments listed in the email header are the images on the last page of this email record, including social media images.

From: Hiser, Matthew
Sent: Wed, 4 Oct 2017 18:34:08 +0000
To: Hull, Amy
Cc: Tregoning, Robert
Subject: RE: Matt, pls advise: also harvesting poster....: I recommend we go forward with NRR presenting our work.....: PLiM Conference
Attachments: image001.png, image002.png, image003.png, image004.png, image005.png, image006.png

Hi Rob and Amy,

My expectation was George or Allen would take it with them. Chris Regan signed off on the 390 this morning and I sent it to Graphics for printing which they said should be done by tomorrow.

Thanks!
Matt

_____

From: Hull, Amy
Sent: Wednesday, October 4, 2017 1:48 PM
To: Hiser, Matthew
Cc: Tregoning, Robert
Subject: Matt, pls advise: also harvesting poster....: I recommend we go forward with NRR presenting our work.....: PLiM Conference

Matt, can you weigh in here please…

From: Tregoning, Robert
Sent: Wednesday, October 04, 2017 1:46 PM
To: Hull, Amy <Amy.Hull@nrc.gov>
Subject: RE: also harvesting poster....: I recommend we go forward with NRR presenting our work.....: PLiM Conference

Good point; I forgot about that. Do we need to man it during the conference? How is it getting over to the conference, hand carrying or shipping?

Robert Tregoning
Technical Advisor for Materials
US Nuclear Regulatory Commission
Two White Flint North, M/S T-10 A36
11545 Rockville Pike
Rockville, MD 20852-2738
ph: 301-415-2324
fax: 301-415-6671

From: Hull, Amy
Sent: Wednesday, October 04, 2017 1:45 PM
To: Tregoning, Robert <Robert.Tregoning@nrc.gov<mailto:Robert.Tregoning@nrc.gov>>
Subject: also harvesting poster....: I recommend we go forward with NRR presenting our work.....: PLiM Conference

Rob, note the following….

From: Hiser, Matthew
Sent: Wednesday, October 04, 2017 12:06 PM

To: Hull, Amy <Amy.Hull@nrc.gov<mailto:Amy.Hull@nrc.gov>>
Subject: RE: I recommend we go forward with NRR presenting our work.....: PLiM Conference

Hi Amy,

No, in fact it was just concurred on by Chris Regan and I was about to send an email to Graphics to get the poster printed.

Thanks!
Matt

Matthew Hiser
Materials Engineer
US Nuclear Regulatory Commission | Office of Nuclear Regulatory Research
Division of Engineering | Corrosion and Metallurgy Branch
Phone: 301-415-2454 | Office: TWFN 10D62
Matthew.Hiser@nrc.gov<mailto:Matthew.Hiser@nrc.gov>

From: Hull, Amy
Sent: Wednesday, October 04, 2017 12:05 PM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov<mailto:Matthew.Hiser@nrc.gov>>
Subject: FW: I recommend we go forward with NRR presenting our work.....: PLiM Conference

Did you withdraw?

Harvesting of Aged Materials from Operating and Decommissioning Nuclear Power Plants
M. Hisera, P. Purtschera, P. Ramuhallib, A. B. Hulla, R. Tregoninga, and C. E. Moyera

From: Hiser, Allen
Sent: Wednesday, October 04, 2017 11:51 AM

From: Tregoning, Robert
Sent: Wednesday, October 04, 2017 1:41 PM
To: Hiser, Allen <Allen.Hiser@nrc.gov<mailto:Allen.Hiser@nrc.gov>>
Cc: Moyer, Carol <Carol.Moyer@nrc.gov<mailto:Carol.Moyer@nrc.gov>>; Frankl, Istvan <Istvan.Frankl@nrc.gov<mailto:Istvan.Frankl@nrc.gov>>; Hull, Amy <Amy.Hull@nrc.gov<mailto:Amy.Hull@nrc.gov>>
Subject: RE: I recommend we go forward with NRR presenting our work.....: PLiM Conference

Allen:

This is the only RES paper for PLiM. Once you have the paper and slides, I would expect that only a brief meeting will be necessary on this to make sure that we are in alignment on key messages and we can answer any questions that you have. The other thing that we'd like you at PLiM is represent us at a side-bar meeting on IFRAM. We will therefore need to get you up-to-speed on the efforts of IFRAM, the players at the side bar, and the objectives that we are trying to accomplish during that meeting. This effort may require more time to get you up to speed. I estimate that we will need between 1 – 2 hours to cover both topics, depending on the questions that you have and the level of discussion depth.

Your schedule is challenging. Can you identify a few windows between now and 10/12 when we can meet to discuss both PLiM and the IFRAM side-bar meeting?

Cheers,

Rob

Robert Tregoning
Technical Advisor for Materials
US Nuclear Regulatory Commission
Two White Flint North, M/S T-10 A36
11545 Rockville Pike
Rockville, MD 20852-2738
ph: 301-415-2324
fax: 301-415-6671

From: Hiser, Allen
Sent: Wednesday, October 04, 2017 11:51 AM
To: Thomas, Brian <Brian.Thomas@nrc.gov<mailto:Brian.Thomas@nrc.gov>>
Cc: Moyer, Carol <Carol.Moyer@nrc.gov<mailto:Carol.Moyer@nrc.gov>>; Frankl, Istvan <Istvan.Frankl@nrc.gov<mailto:Istvan.Frankl@nrc.gov>>; Hull, Amy <Amy.Hull@nrc.gov<mailto:Amy.Hull@nrc.gov>>; Iyengar, Raj <Raj.Iyengar@nrc.gov<mailto:Raj.Iyengar@nrc.gov>>; Tregoning, Robert <Robert.Tregoning@nrc.gov<mailto:Robert.Tregoning@nrc.gov>>; Regan, Christopher <Christopher.Regan@nrc.gov<mailto:Christopher.Regan@nrc.gov>>
Subject: RE: I recommend we go forward with NRR presenting our work.....: PLiM Conference

Dear Brian,

I just want to clarify that the only paper for PLiM is this one:

Regulatory Research on the Aging Management of Structures, Systems and Components in Nuclear Power Plants Supporting License Renewal
C.E. MOYER, A.B. HULL, M. Sircar, J. Philip, J. E. Pires, D. D. Murdock, T. KoshI

Also, my last day in the office is October 12, so hopefully I will be able to have time that day or earlier to discuss the presentation material with the originators.

Allen

From: Thomas, Brian
Sent: Friday, September 29, 2017 1:35 PM
To: Hiser, Allen <Allen.Hiser@nrc.gov<mailto:Allen.Hiser@nrc.gov>>
Cc: Moyer, Carol <Carol.Moyer@nrc.gov<mailto:Carol.Moyer@nrc.gov>>; Frankl, Istvan <Istvan.Frankl@nrc.gov<mailto:Istvan.Frankl@nrc.gov>>; Hull, Amy <Amy.Hull@nrc.gov<mailto:Amy.Hull@nrc.gov>>; Iyengar, Raj <Raj.Iyengar@nrc.gov<mailto:Raj.Iyengar@nrc.gov>>; Tregoning, Robert <Robert.Tregoning@nrc.gov<mailto:Robert.Tregoning@nrc.gov>>; Freeman, Eric <Eric.Freeman@nrc.gov<mailto:Eric.Freeman@nrc.gov>>; Wilson, George <George.Wilson@nrc.gov<mailto:George.Wilson@nrc.gov>>; Regan, Christopher <Christopher.Regan@nrc.gov<mailto:Christopher.Regan@nrc.gov>>
Subject: RE: I recommend we go forward with NRR presenting our work.....: PLiM Conference

Allen,

As promised, I have checked-in with Steve Frankl and Amy Hull, and we agree that since we (a number of folks have contributed) have made significant progress in preparing the research presentation, we would be happy to accept your offer. We are in the 'home stretch' for completing the work, and it should be ready, in draft, within the next week. Once we get all the material, we can consider what aspects of it you can deliver based on the agenda and how the research sessions align or not align with your sessions.

Let's talk about how we see things unfolding.

Thanks. Have a good weekend!

Brian

From: Hull, Amy
Sent: Friday, September 29, 2017 10:15 AM
To: Thomas, Brian <Brian.Thomas@nrc.gov<mailto:Brian.Thomas@nrc.gov>>
Cc: Moyer, Carol <Carol.Moyer@nrc.gov<mailto:Carol.Moyer@nrc.gov>>; Frankl, Istvan <Istvan.Frankl@nrc.gov<mailto:Istvan.Frankl@nrc.gov>>
Subject: I recommend we go forward with NRR presenting our work.....: PLiM Conference

Brian,

Carol is (b)(6) I have been working on both presentations and they are both in pretty good shape and soon coming to you to sign off on. I recommend that we let NRR make the presentations for RES; many people in RES/DE already have much time invested in writing the papers, and preparing both the oral and poster presentations. We are in the 'home stretch' of this work, and it would be unfortunate to withdraw our presentations.

Harvesting of Aged Materials from Operating and Decommissioning Nuclear Power Plants
M. Hisera, P. Purtschera, P. Ramuhallib, A. B. Hulla, R. Tregoninga, and C. E. Moyera

Regulatory Research on the Aging Management of Structures, Systems and Components in Nuclear Power Plants Supporting License Renewal

C.E. MOYER, A.B. HULL, M. Sircar, J. Philip, J. E. Pires, D. D. Murdock, T. KoshI

Thanks,
Amy

From: Thomas, Brian
Sent: Friday, September 29, 2017 9:09 AM
To: Hiser, Allen <Allen.Hiser@nrc.gov<mailto:Allen.Hiser@nrc.gov>>; Freeman, Eric <Eric.Freeman@nrc.gov<mailto:Eric.Freeman@nrc.gov>>; Wilson, George <George.Wilson@nrc.gov<mailto:George.Wilson@nrc.gov>>
Cc: Frankl, Istvan <Istvan.Frankl@nrc.gov<mailto:Istvan.Frankl@nrc.gov>>; Moyer, Carol <Carol.Moyer@nrc.gov<mailto:Carol.Moyer@nrc.gov>>; Regan, Christopher <Christopher.Regan@nrc.gov<mailto:Christopher.Regan@nrc.gov>>; Hull, Amy <Amy.Hull@nrc.gov<mailto:Amy.Hull@nrc.gov>>; Tregoning, Robert <Robert.Tregoning@nrc.gov<mailto:Robert.Tregoning@nrc.gov>>; Iyengar, Raj <Raj.Iyengar@nrc.gov<mailto:Raj.Iyengar@nrc.gov>>
Subject: RE: PLiM Conference

Allen,

Thank you for the offer. The idea crossed my mind. If you can do that it would go a long way towards satisfying expectations our international partners. I will check in with Steve and Carol and get back with you on your offer.

Brian

From: Hiser, Allen
Sent: Friday, September 29, 2017 8:57 AM
To: Thomas, Brian <Brian.Thomas@nrc.gov<mailto:Brian.Thomas@nrc.gov>>; Freeman, Eric <Eric.Freeman@nrc.gov<mailto:Eric.Freeman@nrc.gov>>; Wilson, George

<George.Wilson@nrc.gov<mailto:George.Wilson@nrc.gov>>
Cc: Frankl, Istvan <Istvan.Frankl@nrc.gov<mailto:Istvan.Frankl@nrc.gov>>; Moyer, Carol
<Carol.Moyer@nrc.gov<mailto:Carol.Moyer@nrc.gov>>; Vera, Graciela
<Graciela.Vera@nrc.gov<mailto:Graciela.Vera@nrc.gov>>; Cole, Cassandra
<Cassandra.Cole@nrc.gov<mailto:Cassandra.Cole@nrc.gov>>; Regan, Christopher
<Christopher.Regan@nrc.gov<mailto:Christopher.Regan@nrc.gov>>; Hull, Amy
<Amy.Hull@nrc.gov<mailto:Amy.Hull@nrc.gov>>; Tregoning, Robert
<Robert.Tregoning@nrc.gov<mailto:Robert.Tregoning@nrc.gov>>; Iyengar, Raj
<Raj.Iyengar@nrc.gov<mailto:Raj.Iyengar@nrc.gov>>
Subject: RE: PLiM Conference

Brian,

What is the status of the RES presentation & paper?

If needed, I can make the presentation for RES.

Allen

From: Thomas, Brian
Sent: Friday, September 29, 2017 8:55 AM
To: Freeman, Eric <Eric.Freeman@nrc.gov<mailto:Eric.Freeman@nrc.gov>>; Wilson, George
<George.Wilson@nrc.gov<mailto:George.Wilson@nrc.gov>>; Hiser, Allen
<Allen.Hiser@nrc.gov<mailto:Allen.Hiser@nrc.gov>>
Cc: Frankl, Istvan <Istvan.Frankl@nrc.gov<mailto:Istvan.Frankl@nrc.gov>>; Moyer, Carol
<Carol.Moyer@nrc.gov<mailto:Carol.Moyer@nrc.gov>>; Vera, Graciela
<Graciela.Vera@nrc.gov<mailto:Graciela.Vera@nrc.gov>>; Cole, Cassandra
<Cassandra.Cole@nrc.gov<mailto:Cassandra.Cole@nrc.gov>>; Regan, Christopher
<Christopher.Regan@nrc.gov<mailto:Christopher.Regan@nrc.gov>>; Hull, Amy
<Amy.Hull@nrc.gov<mailto:Amy.Hull@nrc.gov>>; Tregoning, Robert
<Robert.Tregoning@nrc.gov<mailto:Robert.Tregoning@nrc.gov>>; Iyengar, Raj
<Raj.Iyengar@nrc.gov<mailto:Raj.Iyengar@nrc.gov>>
Subject: PLiM Conference

Eric, George, Allen,

After further discussion of this matter with Mike Weber, RES has decided to not participate in the PLiM Conference this year. Notwithstanding that George has been invited as Keynote speaker, and the RES travel was previously (initially) approved, Mike has expressed concerns that we are even planning on sending additional staff to the conference given all our higher priority program activities. He also thinks, and I agree, that we address research to support SLR through a number of different venues in our interactions with the international community. Our plans were well intended, however, given our priorities coupled with our drive to be more efficient and effective in the conduct of research we will not participate in this year's PLiM Conference.

Please stop all activities to prepare for the research part of the conference. Thanks to all the staff who provided your support in preparation for RES to be presented in the conference.

Brian

From: Hiser, Allen
Sent: Monday, September 25, 2017 5:18 AM
To: Freeman, Eric <Eric.Freeman@nrc.gov<mailto:Eric.Freeman@nrc.gov>>
Cc: Wilson, George <George.Wilson@nrc.gov<mailto:George.Wilson@nrc.gov>>; Thomas, Brian
<Brian.Thomas@nrc.gov<mailto:Brian.Thomas@nrc.gov>>

Subject: Fwd: [External_Sender] CN-246_PLiM conference - pending designation

Eric,

Any assistance is appreciated.

Thanks,
Allen

-------- Original Message --------
From: "KHAELSS, Martina" <M.Khaelss@iaea.org<mailto:M.Khaelss@iaea.org>>
Date: Mon, September 25, 2017 9:33 AM +0200
To: bruce.hallbert@inl.gov<mailto:bruce.hallbert@inl.gov>, "Hiser, Allen" <Allen.Hiser@nrc.gov<mailto:Allen.Hiser@nrc.gov>>, leonardk@ornl.gov<mailto:leonardk@ornl.gov>, ronaldo.szilard@inl.gov<mailto:ronaldo.szilard@inl.gov>, "Thomas, Brian" <Brian.Thomas@nrc.gov<mailto:Brian.Thomas@nrc.gov>>, john.wagner@inl.gov<mailto:john.wagner@inl.gov>, "Wilson, George" <George.Wilson@nrc.gov<mailto:George.Wilson@nrc.gov>>
Subject: [External_Sender] CN-246_PLiM conference - pending designation
RE: Fourth International Conference on Nuclear Power Plant Life Management (PLiM), 23-27 October 2017, Lyon, France

Dear Madam/Sir,
You are registered for above conference but we are still awaiting approval from your authorities.
Thus, we have not yet been able to send you the final confirmation, logistical details & login to the local web site providing access to hotel, meal, gala dinner, tour bookings.
Above will be provided as soon as your official designation has been received.
Kind regards

Ms Martina KHAELSS | Conference Service Assistant |
Conference Services Section | Division of Conference and Document Services| Department of Management |
International Atomic Energy Agency | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |
Email:m.khaelss@iaea.org | T: (+43-1) 2600-21315 | M: [redacted] (b)(6) | F: (+43-1) 2600-7-21315 |

[cid:image001.png@01D33D17.285A3920]<http://www.iaea.org/>

Follow us on www.iaea.org<http://www.iaea.org/> [cid:image002.png@01D1C55A.5FE7F2A0]
<http://www.facebook.com/iaeaorg> [cid:image003.png@01D1C55A.5FE7F2A0]
<http://www.youtube.com/user/IAEAvideo> [cid:image004.png@01D1C55A.5FE7F2A0]
<http://twitter.com/iaeaorg> [cid:image005.png@01D1C55A.5FE7F2A0]
<http://www.flickr.com/photos/iaea_imagebank/> [cid:image006.png@01D1C55A.5FE7F2A0]
<http://www.linkedin.com/company/iaea>

PLiM conference web site<http://www-pub.iaea.org/iaeameetings/50811/Fourth-International-Conference-on-Nuclear-Power-Plant-Life-Management>

From: Moyer, Carol
Sent: Wed, 21 Mar 2018 17:25:50 +0000
To: Purtscher, Patrick
Cc: Hull, Amy
Subject: Re: MDLR comments on PNLL's Guidelines for Harvesting Materials for SLR

Thank you, Pat. And yes, I think that may well be a record level of attention!
-Carol

Note to requester: The text only of this March 21, 2018 Email string, from P. Purtscher to the end of this email record, was provided in full in the 5th interim release.

From: Purtscher, Patrick
Sent: Wednesday, March 21, 2018 12:52 PM
To: Moyer, Carol; Hull, Amy
Subject: FW: MDLR comments on PNLL's Guidelines for Harvesting Materials for SLR

Here are DMLR comments. Eight people provided comments, do you think that is some kind of record? I don't remember any RES document that got that kind of review while I was in NRR.
Pat

From: Brady, Bennett
Sent: Tuesday, March 20, 2018 5:19 PM
To: Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Cc: Oesterle, Eric <Eric.Oesterle@nrc.gov>
Subject: MDLR comments on PNLL's Guidelines for Harvesting Materials for SLR

Pat
Following your request, I asked eight of our technical review staff to review and provide comments on PNNL's technical letter report on harvesting materials. Attached are general comments on the report and specific comments that I have compiled in redline/strikeout version of the report itself. Some of the comments are repetitious of comments made by other reviews. I have tried to group similar comments together. When you have had a chance to review them, please see me if you have any questions. I will try to answer your questions or get you to the right reviewer.
In spite of the rather negative comments on this report, we continue to believe that the Materials Harvesting Project will be in valuable in the future as the NRC deals with aging plants and needs an organized approach for selecting materials for harvesting withe the increased availability of sources.
Bennett

Bennett M. Brady
Senior Project Manager
Division of License Renewal
Office of Nuclear Reactor Regulation
O 11 – D8
301-415-2981

From: Hiser, Matthew
Sent: Fri, 3 Mar 2017 21:10:37 +0000
To: Cheruvenki, Ganesh
Subject: RE: Meeting Forward Notification: Materials Harvesting Workshop

Hi Ganesh,

Here is the webinar info:

https://attendee.gotowebinar.com/register/6076202901971284226

Thanks!
Matt

-----Original Appointment-----
From: Microsoft Outlook **On Behalf Of** Poehler, Jeffrey
Sent: Friday, March 03, 2017 3:59 PM
To: Hiser, Matthew
Subject: Meeting Forward Notification: Materials Harvesting Workshop
When: Tuesday, March 07, 2017 8:00 AM-5:00 PM (UTC-05:00) Eastern Time (US & Canada).
Where: HQ-3WFN-1C03-32p

Your meeting was forwarded

Poehler, Jeffrey has forwarded your meeting request to additional recipients.

Meeting
Materials Harvesting Workshop
Meeting Time
Tuesday, March 7, 2017 8:00 AM-5:00 PM.
Recipients
Cheruvenki, Ganesh

All times listed are in the following time zone: (UTC-05:00) Eastern Time (US & Canada)

From: Hiser, Matthew
Sent: Wed, 24 Aug 2016 14:10:33 +0000
To: Vera, Graciela
Subject: RE: Meeting with Kathy and Dave

Yep ☺

From: Vera, Graciela
Sent: Wednesday, August 24, 2016 10:10 AM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>
Subject: RE: Meeting with Kathy and Dave

One hour?

From: Hiser, Matthew
Sent: Wednesday, August 24, 2016 10:06 AM
To: Vera, Graciela <Graciela.Vera@nrc.gov>
Subject: Meeting with Kathy and Dave

Hi Gracie,

Could you schedule a meeting with Kathy and Dave on “Ex-plant Harvesting Workshop Plans” for next Thursday, Sept. 1 in the afternoon?

Please include the following attendees along with myself:

Brock, Kathryn
Rudland, David
Frankl, Istvan
Tregoning, Robert
Purtscher, Patrick

Thanks!
Matt

Matthew Hiser
Materials Engineer
US Nuclear Regulatory Commission | Office of Nuclear Regulatory Research
Division of Engineering | Corrosion and Metallurgy Branch
Phone: 301-415-2454 | Office: TWFN 10D62
Matthew.Hiser@nrc.gov

From: Obodoako, Aloysius
Sent: Tue, 29 Mar 2016 15:06:30 -0400
To: Hiser, Matthew
Subject: RE: Meeting with PNNL on Harvesting

Sure. I'll email them and ask.

From: Hiser, Matthew
Sent: Tuesday, March 29, 2016 3:05 PM
To: Obodoako, Aloysius <Aloysius.Obodoako@nrc.gov>
Subject: RE: Meeting with PNNL on Harvesting

Hi Aloysius!

(b)(6) [redacted]

I can support the meeting on Thursday, although it may be beneficial to try to reschedule for a time when you can be there as well. Maybe we should see if PNNL can do a little later on Thursday or maybe Friday?

Thanks!
Matt

From: Obodoako, Aloysius
Sent: Tuesday, March 29, 2016 2:23 PM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>
Subject: Meeting with PNNL on Harvesting

Hey Matt,

(b)(6) [redacted]

(b)(6) [redacted] As such, I won't be able to make the scheduled meeting with PNNL. Are you able to support the meeting without me? I should be back in the office later that afternoon.

Aloysius Obodoako, P.E.
Materials Engineer
U.S. Nuclear Regulatory Commission
RES/DE/CMB
Office location: TWFN-10B31
Office phone: (301)-415-2889
Email: Aloysius.Obodoako@nrc.gov

From: Hiser, Matthew
Sent: Thu, 12 Oct 2017 18:06:29 +0000
To: Vera, Graciela
Subject: RE: ML17285A484
Attachments: NRC PLiM slides on Harvesting final.pptx

Note to requester: Attachment is immediately following.

Thank you Gracie! Can you swap the PP in ADAMS out with this one (attached)?

Matthew Hiser
Materials Engineer
US Nuclear Regulatory Commission | Office of Nuclear Regulatory Research
Division of Engineering | Corrosion and Metallurgy Branch
Phone: 301-415-2454 | Office: TWFN 10D62
Matthew.Hiser@nrc.gov

From: Vera, Graciela
Sent: Thursday, October 12, 2017 12:11 PM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>
Subject: ML17285A484

Done. You need to sign on the form before giving to Chris.

Thanks

View ADAMS Properties ML17285A484
Open ADAMS Document (NRC PLiM slides on Harvesting final.pptx)

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Harvesting of Aged Materials from Operating and Decommissioning Nuclear Power Plants

M. Hiser[a], P. Purtscher[a], P. Ramuhalli[b], A. B. Hull[a], R. Tregoning[a]
[a]U.S. Nuclear Regulatory Commission (NRC), Washington, D.C., USA
[b]Pacific Northwest National Laboratory (PNNL), Richland, WA, USA

Outline

- Background and Motivation
- NRC Harvesting Experience
- Recent NRC Activities
  - Criteria for Prioritizing Data Needs
  - Database for Sources of Materials
- Path Forward

Background and Motivation

- Recent trends in global nuclear industry:
  - Interest in extending nuclear power plant (NPP) lifespans
  - Numerous NPPs, both in U.S. and internationally, have announced plans to or already have shut down
- Limited budgets have restricted the resources available to support new research, including harvesting programs
  - Aligning interests and leveraging with other organizations is important to maximize value

NRC Harvesting Experience

- NRC has participated in numerous harvesting programs over the years:
  - RPV, CRDM penetrations, RCS piping, RPV internals, neutron absorbers, and cables
  - From unfinished, operating ,and decommissioning plants in U.S. and internationally
- Significant value in using harvested components to confirm data from other research programs

Technical Lessons Learned

- Harvesting can provide highly representative aged materials for research
  - May be only practical source of representative aged materials
  - May be able to use limited harvested materials to validate larger accelerated aging data set
- Important to gain as much information as possible in advance before committing to specific harvesting project

Logistical Lessons Learned

- Harvesting is an expensive, time-consuming effort
- Leveraging resources with other research organizations helps mitigate cost challenges
- Transporting irradiated materials, particularly internationally, is cumbersome and time-consuming

Lifting operation for irradiated materials transport cask

Recent NRC Activities

- Strategic approach to materials harvesting
  - Due to limited opportunities, past harvesting efforts have generally been reactive to individual plants shutting down
- Prioritize the data needs best addressed by harvesting
- Workshop held in March 2017 at NRC HQ to discuss all aspects of harvesting with other interested stakeholders

Potential Criteria for Harvesting Prioritization

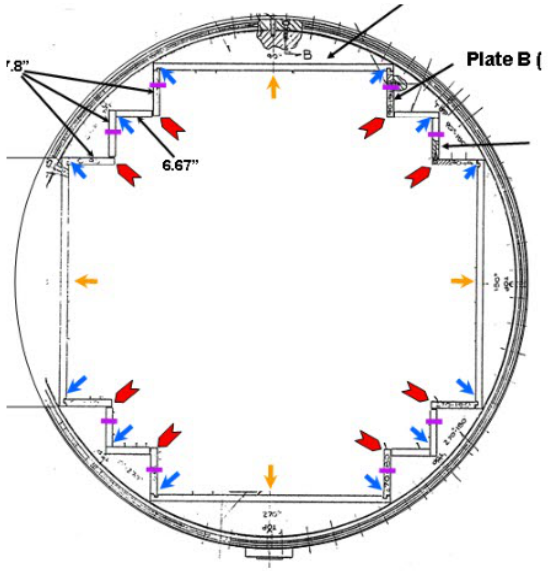
- Applicability of harvested material for addressing critical gaps
- Ease of laboratory replication of the degradation scenario
- Unique field aspects of degradation
- Fleet-wide vs. plant-specific applicability of data

Potential Criteria for Harvesting Prioritization

- Harvesting cost and complexity
- Availability of reliable in-service inspection (ISI) techniques for the material / component
- Availability of materials for harvesting
- Timeliness of the expected research results relative to the objective

Database for Sources of Materials

- NRC is pursuing the development of a database for sources of materials for harvesting
- Allow for aligning of high-priority data needs to the available sources of materials
- NRC is interested in engaging with other organizations in developing the database



Example of reactor internals harvesting plan

Conclusion and Path Forward

- Harvesting can yield highly representative and valuable data on materials aging
- Data Needs Prioritization and Sources of Materials Database
- As specific harvesting opportunities are identified, NRC welcomes opportunities for cooperation and leveraging with other interested research organizations

From: Hiser, Matthew
Sent: Thu, 16 Nov 2017 18:20:48 +0000
To: Vera, Graciela
Subject: RE: ML17285A484

Note to requester: Attachment is immediately following.

Hi Gracie,

Can you make the document at ML17285A484 in ADAMS publicly available? Per the 665 (attached), it should have gone public on October 23.

Thanks!
Matt

Matthew Hiser
Materials Engineer
US Nuclear Regulatory Commission | Office of Nuclear Regulatory Research
Division of Engineering | Corrosion and Metallurgy Branch
Phone: 301-415-2454 | Office: TWFN 10D62
Matthew.Hiser@nrc.gov

From: Vera, Graciela
Sent: Thursday, October 12, 2017 2:11 PM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>
Subject: RE: ML17285A484

Done. Thanks

Graciela Vera
Administrative Assistant
Division of Engineering
Office of Nuclear Regulatory Research
Washington, D.C. 20555
TWFN10-A00

From: Hiser, Matthew
Sent: Thursday, October 12, 2017 2:06 PM
To: Vera, Graciela <Graciela.Vera@nrc.gov>
Subject: RE: ML17285A484

Thank you Gracie! Can you swap the PP in ADAMS out with this one (attached)?

Matthew Hiser
Materials Engineer
US Nuclear Regulatory Commission | Office of Nuclear Regulatory Research
Division of Engineering | Corrosion and Metallurgy Branch
Phone: 301-415-2454 | Office: TWFN 10D62
Matthew.Hiser@nrc.gov

From: Vera, Graciela
Sent: Thursday, October 12, 2017 12:11 PM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>
Subject: ML17285A484

Done. You need to sign on the form before giving to Chris.

Thanks

View ADAMS Properties ML17285A484
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NRC FORM 665
(07-2016)

U.S. NUCLEAR REGULATORY COMMISSION

ADAMS DOCUMENT SUBMISSION

Instructions for completing NRC Form 665 - "Cheat Sheet" (ML15313A310)

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Matthew Hiser	Matthew Hiser	(301) 415-2454	T-10A36	MAH3	10/12/2017

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Note to requester: Attachment is immediately following.

From: Hiser, Matthew
Sent: Wed, 20 Jul 2016 16:59:46 +0000
To: Tregoning, Robert;Hull, Amy;Purtscher, Patrick
Subject: RE: NRAJ Bilateral Meeting Presentation on Harvesting
Attachments: Harvesting Efforts NRAJ Bilateral 7-20-16.pptx

Thanks Rob! I have added a slide at the end for discussion topics, but kept 5 and 7 in. I can breeze through those fairly quickly.

Amy and Pat, do either of you have any input? If not, I will go ahead and run these by Steve…

Thanks!
Matt

Matthew Hiser
Materials Engineer
US Nuclear Regulatory Commission | Office of Nuclear Regulatory Research
Division of Engineering | Corrosion and Metallurgy Branch
Phone: 301-415-2454 | Office: TWFN 10D62
Matthew.Hiser@nrc.gov

From: Tregoning, Robert
Sent: Friday, July 15, 2016 1:19 PM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>; Hull, Amy <Amy.Hull@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: RE: NRAJ Bilateral Meeting Presentation on Harvesting

Matt:

Just got a chance to look at this. Given that you've only got ½ hour, your 8 slides are probably the max. I would take more than 10 minutes to provide an overview of the activity. If you need to save time, slides 5 and 7 could be eliminated. You could provide them in the slide package but just gloss right over them in the presentation.

Obviously, Japan has a large number of plants that are shut-down. It's still not clear which of these plants will restart. Therefore, there may be a lot of harvesting opportunities there.

The main purpose of this discussion is to see if NRAJ has any activities (or planned activities) to identify harvesting opportunities. If so, it would be good to understand there approach. It would also be good to see if they know which plants are most likely to not restart.

With this in mind it would be good to have a slide or two with a list of questions or discussion topics on this issue to discuss with the Japanese. While we only have ½ hour, we may be flexible to extend the meeting if we need more discussion time on any topic.

Does this make sense?

Ro

Robert Tregoning
Technical Advisor for Materials
US Nuclear Regulatory Commission
Two White Flint North, M/S T-10 A36
11545 Rockville Pike
Rockville, MD 20852-2738
ph: 301-415-2324
Blackberry: (b)(6)
fax: 301-415-6671

From: Hiser, Matthew
Sent: Tuesday, July 12, 2016 5:13 PM
To: Hull, Amy <Amy.Hull@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>; Tregoning, Robert <Robert.Tregoning@nrc.gov>
Subject: NRAJ Bilateral Meeting Presentation on Harvesting

Hi Amy, Pat, and Rob,

I've pulled together a few slides for discussion of the harvesting program at the NRAJ meeting next month.

Please take a look and provide any comments or edits.

Thanks!
Matt

Strategic Approach for Ex-Plant Materials Harvesting

Matthew Hiser

Amy Hull

Patrick Purtscher

Robert Tregoning

U.S. NRC

NRC-NRAJ Bilateral Technical Information Exchange Meeting
Nuclear Regulatory Commission Headquarters
August 8-9, 2016

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Purpose

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- Create a framework for a strategic approach to harvesting ex-plant materials to support regulatory needs associated with subsequent license renewal (SLR)
  - Ex-plant materials offer unique environmental exposure that cannot be entirely replicated by laboratory testing with fresh materials

- Align high priority data needs identified in SLR activities with harvesting opportunities from decommissioning plants

Background

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- To date, harvesting opportunities have been limited due to few decommissioning plants
  - Zion in U.S., Zorita in Spain
- However, several U.S. plants have already shut down or are planning to do so in the near future
  - Kewaunee, San Onofre, Crystal River, Vermont Yankee, Oyster Creek, Fort Calhoun, Clinton, Quad Cities, Diablo Canyon
- This provides a unique opportunity to plan harvesting to address the highest priority technical and regulatory issues

Harvesting Experience

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- Past harvesting efforts have generally involved reactive decision-making
  - Limited opportunities to acquire ex-plant materials
  - Limited strategic planning for harvesting
- Harvesting projects with NRC involvement:
  - Reactors internal materials from Zorita
  - Concrete from Zorita
  - Neutron absorber material from Zion
  - Cables from Zion and Crystal River

Zorita Internals Research Project Timeline

U.S.NRC
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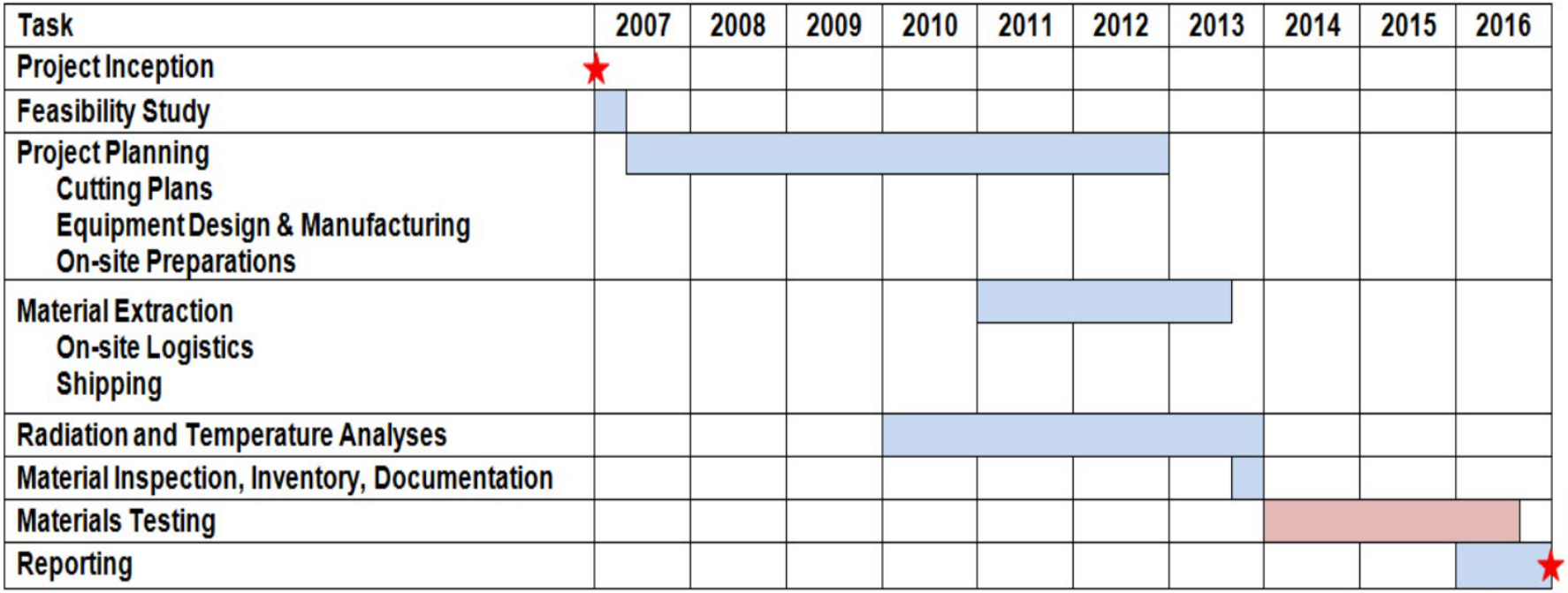

Approach: Assessment of Technical Issues and Available Materials for Harvesting

U.S.NRC
United States Nuclear Regulatory Commission
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- Utilize various sources of technical information with respect to anticipated degradation in NPPs out to 80 years of operation
  - NRC, DOE, EPRI, IAEA
- Identify high-priority data needs that could be addressed through harvesting ex-plant materials
  - Focus on identifying characteristics of important systems, structures, and components (SSCs) for harvesting
- Gather information on ex-plant material expected to be available based on identified needs
  - May be from both operating and decommissioning reactors

Implementation

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- What might the output of this activity look like?
  - For example, the review may show there is value in acquiring CASS material around 15% delta ferrite with various dose ranges (<0.08 dpa, 1–3 dpa, and >5 dpa)
- Once that need is identified, this activity would identify what SSCs might be the best candidates for harvesting
  - For example, perhaps lower support columns would be identified as the ideal SSC to address the CASS data need
- As decommissioning plants announce their plans, there is a clear list of SSCs and their characteristics (metallurgy, temperature, fluence, etc.) that would be desired to address the data need

Current NRC Activities

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- NRC is working with Pacific Northwest National Lab (PNNL) to identify technical issues that may be best addressed by ex-plant harvesting
  - Focused on unique value of harvesting to understand material properties in difficult to replicate environments
- NRC also seeking interest from other stakeholders to better understand availability of materials for harvesting
  - Considering a public workshop in fall 2016
  - Stakeholders include EPRI, DOE, U.S. industry, international partners

Discussion Topics

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- Japanese approach to ex-plant material harvesting
- Information on available harvesting opportunities from Japanese reactors
  - Is it known which plants will not restart?
- Opportunities for coordination / cooperation on ex-plant harvesting

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Backup Slides

Neutron Absorbers from Zion

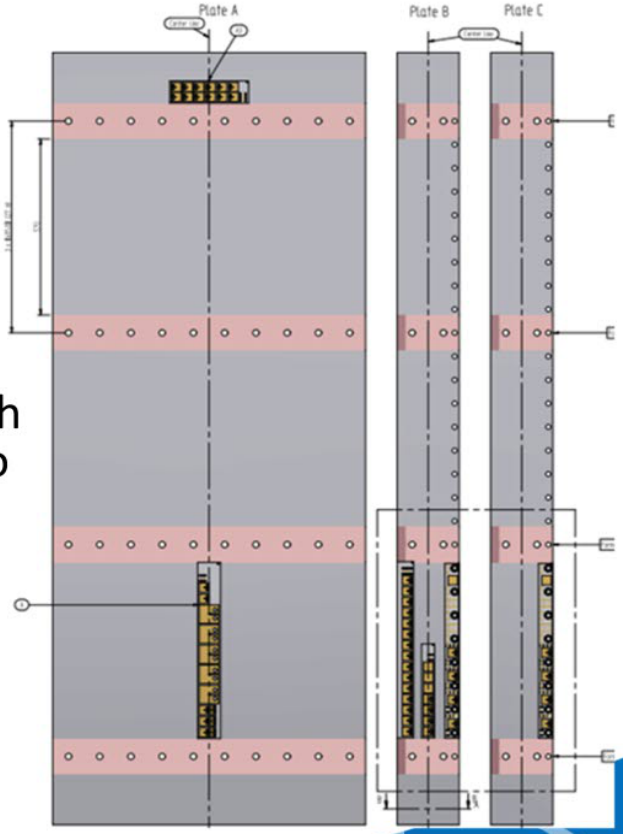
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Materials Harvested**:
  - Select Boral® NAM panels from Regions 1 and 2 of the Zion SFP
- **Scope**:
  - Visual and microstructural examinations (incl. areal density)
  - Corrosion testing
- **Purpose**:
  - Identify degradation mechanisms and estimate degradation rate
  - Confirm results of in-situ areal density measurements
  - Provide confirmatory data to support regulatory decision-making
- **Timeline**:
  - Initial discussions in 2014, harvesting in 2015, testing in 2015-2016
- **Coordination**:
  - EPRI, ZionSolutions, SRNL

Zorita Internals Research Project (ZIRP)

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Materials Harvested**:
  - Baffle plate and core barrel weld materials
- **Scope**:
  - Mechanical testing (tensile, CGR, FT)
  - Microstructural characterization (void swelling)
- **Purpose**:
  - High-fluence (up to 50 dpa) IAD effects with representative LWR exposure conditions to
  - Support regulatory decision-making associated with SLR
- **Timeline**:
  - Initial discussions in 2006, harvesting in 2013, testing ongoing through 2016
- **Coordination**:
  - EPRI, international consortium, Studsvik, Halden



Concrete from Zorita (Plan)

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- **Materials Harvested**:
  - Concrete from structures that are in close proximity to RPV
- **Scope**:
  - Mechanical testing (compressive, tensile, modulus of elasticity)
  - Microstructural characterization
  - Physical change
- **Purpose**:
  - High fluence in combination with temperature and humidity that are representative of LWR environmental effects on structural and shielding performance
  - Supports regulatory decision-making associated with SLR
- **Timeline**:
  - Initial discussions in 2014, harvesting in 2015, testing 2016-2018
- **Coordination**:
  - NRC , ENRESA and CSN

Cables: Zion and Crystal River

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Materials Harvested**:
  - Low and Medium Voltage Cables
- **Scope**:
  - Condition monitoring to assess cable performance under normal operating conditions (accelerated aging) and accident conditions
- **Purpose**:
  - Cable degradation due to normal operating environment and accident conditions
  - Supports regulatory decision-making associated with SLR
- **Timeline**:
  - Initial discussions in 2012; Cable samples harvested from Zion in 2013
  - Plan is to harvest additional samples from Crystal River and Zion in 2015
  - Testing expected to be completed in 2017
- **Coordination**:
  - ORNL, Zion Solutions, NIST, EPRI

From: Hiser, Matthew
Sent: Thu, 14 Jul 2016 02:20:30 +0000
To: Hull, Amy;Purtscher, Patrick;Tregoning, Robert
Subject: RE: NRAJ Bilateral Meeting Presentation on Harvesting

Hi Amy,

I did - just forwarded pradeep's meeting notice to you for next week...

Thanks!
Matt

From: Hull, Amy
Sent: Wednesday, July 13, 2016 8:25 AM
To: Hiser, Matthew; Purtscher, Patrick; Tregoning, Robert
Subject: RE: NRAJ Bilateral Meeting Presentation on Harvesting

OK, thanks Matt. I wiill do – did you hear anything back from Pradeep?

From: Hiser, Matthew
Sent: Tuesday, July 12, 2016 5:13 PM
To: Hull, Amy <Amy.Hull@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>; Tregoning, Robert <Robert.Tregoning@nrc.gov>
Subject: NRAJ Bilateral Meeting Presentation on Harvesting

Hi Amy, Pat, and Rob,

I've pulled together a few slides for discussion of the harvesting program at the NRAJ meeting next month.

Please take a look and provide any comments or edits.

Thanks!
Matt

From: Frankl, Istvan
Sent: Tue, 26 Jul 2016 18:03:14 -0400
To: Hiser, Matthew
Subject: RE: NRAJ Bilateral Meeting Presentation on Harvesting

Thanks, Matt.

Nice slides. I especially like the reach out for Japanese ex-plant materials.

Please prepare Form 390 package for management review and approval.

Steve

From: Hiser, Matthew
Sent: Tuesday, July 26, 2016 10:01 AM
To: Frankl, Istvan <Istvan.Frankl@nrc.gov>
Subject: FW: NRAJ Bilateral Meeting Presentation on Harvesting

Hi Steve,

I have put together slides on the harvesting for the NRAJ bilateral meeting next month and would like to share them for your review. These have been reviewed by Rob, Pat and Amy (see email chain below).

Thanks!
Matt

From: Hiser, Matthew
Sent: Wednesday, July 20, 2016 1:00 PM
To: Tregoning, Robert <Robert.Tregoning@nrc.gov>; Hull, Amy <Amy.Hull@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: RE: NRAJ Bilateral Meeting Presentation on Harvesting

Thanks Rob! I have added a slide at the end for discussion topics, but kept 5 and 7 in. I can breeze through those fairly quickly.

Amy and Pat, do either of you have any input? If not, I will go ahead and run these by Steve…

Thanks!
Matt

Matthew Hiser
Materials Engineer
US Nuclear Regulatory Commission | Office of Nuclear Regulatory Research
Division of Engineering | Corrosion and Metallurgy Branch
Phone: 301-415-2454 | Office: TWFN 10D62
Matthew.Hiser@nrc.gov

From: Tregoning, Robert
Sent: Friday, July 15, 2016 1:19 PM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>; Hull, Amy <Amy.Hull@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: RE: NRAJ Bilateral Meeting Presentation on Harvesting

Matt:

Just got a chance to look at this. Given that you've only got ½ hour, your 8 slides are probably the max. I would take more than 10 minutes to provide an overview of the activity. If you need to save time, slides 5 and 7 could be eliminated. You could provide them in the slide package but just gloss right over them in the presentation.

Obviously, Japan has a large number of plants that are shut-down. It's still not clear which of these plants will restart. Therefore, there may be a lot of harvesting opportunities there.

The main purpose of this discussion is to see if NRAJ has any activities (or planned activities) to identify harvesting opportunities. If so, it would be good to understand there approach. It would also be good to see if they know which plants are most likely to not restart.

With this in mind it would be good to have a slide or two with a list of questions or discussion topics on this issue to discuss with the Japanese. While we only have ½ hour, we may be flexible to extend the meeting if we need more discussion time on any topic.

Does this make sense?

Ro

Robert Tregoning
Technical Advisor for Materials
US Nuclear Regulatory Commission
Two White Flint North, M/S T-10 A36
11545 Rockville Pike
Rockville, MD 20852-2738
ph: 301-415-2324
(b)(6) Blackberry: [redacted]
fax: 301-415-6671

From: Hiser, Matthew
Sent: Tuesday, July 12, 2016 5:13 PM
To: Hull, Amy <Amy.Hull@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>; Tregoning, Robert <Robert.Tregoning@nrc.gov>
Subject: NRAJ Bilateral Meeting Presentation on Harvesting

Hi Amy, Pat, and Rob,

I've pulled together a few slides for discussion of the harvesting program at the NRAJ meeting next month.

Please take a look and provide any comments or edits.

Thanks!
Matt

From: Moyer, Carol
Sent: Thu, 24 May 2018 20:58:18 +0000
To: Tregoning, Robert
Subject: RE: NRC/EPRI Management Meeting

thanks

From: Tregoning, Robert
Sent: Thursday, May 24, 2018 4:43 PM
To: Moyer, Carol <Carol.Moyer@nrc.gov>
Subject: FW: NRC/EPRI Management Meeting

FYI

Robert Tregoning
Technical Advisor for Materials
US Nuclear Regulatory Commission
Two White Flint North, M/S T-10 A36
11545 Rockville Pike
Rockville, MD 20852-2738
ph: 301-415-2324
fax: 301-415-6671

From: Tregoning, Robert
Sent: Thursday, May 24, 2018 8:23 AM
To: Thomas, Brian <Brian.Thomas@nrc.gov>; Regan, Christopher <Christopher.Regan@nrc.gov>
Cc: Frankl, Istvan <Istvan.Frankl@nrc.gov>; Iyengar, Raj <Raj.Iyengar@nrc.gov>; Oberson, Greg <Greg.Oberson@nrc.gov>
Subject: NRC/EPRI Management Meeting

Brian/Chris:

I had a discussion yesterday during the NRC/Industry material information meeting with Anne Demma of EPRI who was asking about the meeting next week and if we had any topics of interest for discussion. She wants to brief Kurt Edsinger in advance of the meeting. I told her that I would get back to her (today if possible). Last week we agreed that we would like to discuss 4 topics in the “opportunities to collaborate” related to materials in the DE portion of the meeting.

1. IAD
2. Harvesting
3. AM
4. xFEM

I think we were also planning to have some discussion with EPRI on ANLWR materials collaboration under the DSA ANLWR topic. Do you want me to send Anne the brief bullets and the “asks” that we put together for you last week on each CMB topic? She can then pass them along to Kurt to ensure that we’re in alignment prior to the meeting. I have the information that

we put together on IAD, harvesting, and AM. I can coordinate with Raj to make sure that I have the information for AM and ANLWR in advance of sending the email to Anne.

Just let me know how you would like me to proceed.

Cheers,

Rob

Robert Tregoning
Technical Advisor for Materials
US Nuclear Regulatory Commission
Two White Flint North, M/S T-10 A36
11545 Rockville Pike
Rockville, MD 20852-2738
ph: 301-415-2324
fax: 301-415-6671

From: QTE Resource
Sent: Wed, 31 Jan 2018 14:37:26 +0000
To: Moyer, Carol;QTE Resource
Cc: RICMST Resource;Frankl, Istvan;Hiser, Matthew
Subject: RE: NRC Form 1102, RIC PROPOSED DIGITAL PRESENTATION SUBMISSION FORM

Good morning, Ms. Moyer.

Why has this form been submitted to QTE? We received your poster yesterday on harvesting. But I'm not clear why we received this form 1102.

Can you advise?
Thanks,
Keith
Keith Azariah-Kribbs
NRC QTE and the NRCI Publications Program
U.S. NRC
(301) 415-0955

-----Original Message-----
From: Moyer, Carol
Sent: Wednesday, January 31, 2018 8:56 AM
To: QTE Resource <QTE.Resource@nrc.gov>
Cc: RICMST Resource <RICMST.Resource@nrc.gov>; Frankl, Istvan <Istvan.Frankl@nrc.gov>; Hiser, Matthew <Matthew.Hiser@nrc.gov>
Subject: NRC Form 1102, RIC PROPOSED DIGITAL PRESENTATION SUBMISSION FORM

NRC Form 1102, RIC PROPOSED DIGITAL PRESENTATION SUBMISSION FORM

The attached file is the filled-out form. Please open it to review the data.

This Form has received approval from Branch and Division management.

Please call if you have questions.

Thank you,

_____
Carol E. Moyer
Sr. Materials Engineer
U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
MS: T-10A36
Washington, DC 20555-0001
carol.moyer@nrc.gov
301-415-2153

From: RICMST Resource
Sent: Thursday, February 1, 2018 7:46 AM
To: Moyer, Carol
Cc: Frankl, Istvan; Hiser, Matthew; Warren, Brenett
Subject: RE: NRC Form 1102, RIC PROPOSED DIGITAL PRESENTATION SUBMISSION FORM

Hi Carol,

No, I'm going to copy the information into the consolidated/combined report with Titles and Descriptions.

Thanks Carol.

Bren

-----Original Message-----
From: Moyer, Carol
Sent: Thursday, February 01, 2018 7:41 AM
To: QTE Resource <QTE.Resource@nrc.gov>
Cc: RICMST Resource <RICMST.Resource@nrc.gov>; Frankl, Istvan <Istvan.Frankl@nrc.gov>; Hiser, Matthew <Matthew.Hiser@nrc.gov>; Warren, Brenett <Brenett.Warren@nrc.gov>
Subject: RE: NRC Form 1102, RIC PROPOSED DIGITAL PRESENTATION SUBMISSION FORM

Keith - Thanks for your review. I concur with your edits.

RICMST / Bren - Please use this "clean" version of the Harvesting (poster #8) description. Do you need me to re-submit this on a Form 1102, or is this Word text sufficient?

Carol

Carol Moyer
Sr. Materials Engineer
RES/DE/CMB
carol.moyer@nrc.gov
301-415-2153

-----Original Message-----
From: QTE Resource
Sent: Wednesday, January 31, 2018 9:40 PM
To: Moyer, Carol <Carol.Moyer@nrc.gov>; QTE Resource <QTE.Resource@nrc.gov>
Cc: RICMST Resource <RICMST.Resource@nrc.gov>; Frankl, Istvan <Istvan.Frankl@nrc.gov>; Hiser, Matthew <Matthew.Hiser@nrc.gov>
Subject: RE: NRC Form 1102, RIC PROPOSED DIGITAL PRESENTATION SUBMISSION FORM

Good evening, Ms. Moyer.

Well, that was a pretty clean job. My edits are mostly minimal.

Find attached the files for your project, NRC Form 1102, RIC PROPOSED DIGITAL PRESENTATION SUBMISSION FORM.

Since the text in the form does not permit tracking changes, I edited your text in a Word file. You'll see three Word files attached here: a _clean file, a _clean with comments file, and a _compare file.

Please use the _clean file going forward. The _clean_with_comments file includes additional comments you should review before you move forward. The _compare file includes all tracked changes and comments for your inspection.

If the text in the _clean Word file is satisfactory, and if you have modifed the document as needed with regards to the comments in the _clean with comments file, then just copy and paste the title and text from the Word file into your form and you're set to go.

Please consider this email as QTE concurrence with your project. Please let us know if you have any questions or concerns.

Thanks,
Keith
Keith Azariah-Kribbs
NRC QTE and the NRCI Publications Program U.S. NRC
(301) 415-0955

-----Original Message-----
From: Moyer, Carol
Sent: Wednesday, January 31, 2018 8:56 AM
To: QTE Resource <QTE.Resource@nrc.gov>
Cc: RICMST Resource <RICMST.Resource@nrc.gov>; Frankl, Istvan <Istvan.Frankl@nrc.gov>; Hiser, Matthew <Matthew.Hiser@nrc.gov>
Subject: NRC Form 1102, RIC PROPOSED DIGITAL PRESENTATION SUBMISSION FORM

NRC Form 1102, RIC PROPOSED DIGITAL PRESENTATION SUBMISSION FORM

The attached file is the filled-out form. Please open it to review the data.

This Form has received approval from Branch and Division management.

Please call if you have questions.

Thank you,

_____
Carol E. Moyer
Sr. Materials Engineer
U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
MS: T-10A36
Washington, DC 20555-0001
carol.moyer@nrc.gov
301-415-2153

From: Hiser, Matthew
Sent: Wed, 13 May 2015 14:05:43 +0000
To: Hull, Amy
Subject: RE: NRC/Industry June Materials Meeting

Sure!

From: Hull, Amy
Sent: Wednesday, May 13, 2015 9:11 AM
To: Hiser, Matthew
Subject: FW: NRC/Industry June Materials Meeting

Want to coauthor on ex-plant materials database development?

From: Tregoning, Robert
Sent: Wednesday, May 13, 2015 8:49 AM
To: Focht, Eric; Benson, Michael; Oberson, Greg; Hull, Amy
Subject: NRC/Industry June Materials Meeting

All:

We're planning on covering the following topics during the June meeting (6/2 – 6/4)

1. WRS round robin– Benson/?
2. Expert Panel CGR disposition curves – Oberson/Crooker
3. PWSCC initiation research – Focht/Crooker
4. Ex-plant material database development – Hull

The first three topics are meant to be joint talks with us and industry, while Amy's topic will just be an NRC talk. Can you please provide me with the following information by the end of this week (if possible)?

a. Title of talk
b. Presenters – both NRC presenter (or contractor) and industry if joint
c. Time needed for talk (we've nominally allocated 30 minutes per talk but it can be more or less as needed).

Let me know if you have any questions. Thanks for your help.

Rob

Robert Tregoning
Technical Advisor for Materials
US Nuclear Regulatory Commission
21 Church Street, M/S CS-5A24
Rockville, MD 20850
ph: 301-251-7662
Blackberry: [redacted] (b)(6)
fax: 301-251-7425

From: Audrain, Margaret
Sent: Fri, 24 Aug 2018 19:59:42 +0000
To: Tregoning, Robert;Hiser, Matthew;Purtscher, Patrick
Cc: Frankl, Istvan
Subject: RE: NRC/JNRA meeting during week of 9/17

No problem, I'll put something together next week.

-------- Original Message --------
From: "Tregoning, Robert" <Robert.Tregoning@nrc.gov>
Date: Fri, August 24, 2018 3:49 PM -0400
To: "Audrain, Margaret" <Margaret.Audrain@nrc.gov>, "Hiser, Matthew" <Matthew.Hiser@nrc.gov>, "Purtscher, Patrick" <Patrick.Purtscher@nrc.gov>
CC: "Frankl, Istvan" <Istvan.Frankl@nrc.gov>
Subject: RE: NRC/JNRA meeting during week of 9/17

All:

Sorry about the typo in the last email. The sentence reading "…I'd also like you to consider the following questions related to RPV…" integrity should obviously read "…I'd also like you to consider the following questions related to material harvesting…"

This is what happens when you cut and paste without doing proper QA ☺

RT

Robert Tregoning
Technical Advisor for Materials
US Nuclear Regulatory Commission
Two White Flint North, M/S T-10 A36
11545 Rockville Pike
Rockville, MD 20852-2738
ph: 301-415-2324
fax: 301-415-6671

From: Tregoning, Robert
Sent: Friday, August 24, 2018 3:43 PM
To: Audrain, Margaret <Margaret.Audrain@nrc.gov>; Hiser, Matthew <Matthew.Hiser@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Cc: Frankl, Istvan <Istvan.Frankl@nrc.gov>
Subject: NRC/JNRA meeting during week of 9/17
Importance: High

Meg/Matt/Pat:

Chris Regan and I are traveling to Japan in mid-September to meet with JNRA as part of our biannual materials research exchange. One of the agenda topics is material harvesting. In

preparation for the meeting, I am hoping that you can provide me with slides that summarize the state of our research activities and near-term plans. I'm hoping that much, if not all of this information will come from recycled talks and not require much additional burden on your end.

I'd also like you to consider the following questions related to RPV integrity:

1. What information would you like to get from JNRA?
2. What actions (e.g., future information, commitments, data sharing) would you like to see arise from this meeting?

You could include your questions for 1 and 2 as part of your presentation or you could simply send them to me in advance of the meeting.

I'm requesting that you provide me with this information by COB on 9/7. This will give me a week before the trip to make sure that we're aligned on the topic. I think it would be good if one of you coordinates all the input and I'm recommending Meg (since I'm going to hit Matt up on IAD) ☺, but please just let me know you guys decide as lead for this request.

Thanks so much for your help on this. Please let me know if you have further questions as well.

Cheers,

Rob

Robert Tregoning
Technical Advisor for Materials
US Nuclear Regulatory Commission
Two White Flint North, M/S T-10 A36
11545 Rockville Pike
Rockville, MD 20852-2738
ph: 301-415-2324
fax: 301-415-6671

From: Hiser, Matthew
Sent: Mon, 9 Jul 2018 12:54:44 +0000
To: Moyer, Carol
Subject: RE: NRC News Summary for Monday, July 09, 2018

Thanks Carol! Pat and I have been in contact with the Oyster Creek decommissioning PM and the R! public affairs officer, but I hadn't seen a news summary of the meeting.

Thanks!
Matt

From: Moyer, Carol
Sent: Monday, July 09, 2018 8:34 AM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>
Subject: FW: NRC News Summary for Monday, July 09, 2018

Matt,

FYI, in the attached news summaries, there is a mention of potential for harvesting at Oyster Creek. See p. 2 in the Summary; pp. 5-6 in the Clips.

-Carol

From: Bulletin Intelligence [mailto:NRC@BulletinIntelligence.com]
Sent: Monday, July 09, 2018 7:14 AM
To: NRC@BulletinIntelligence.com
Subject: [External_Sender] NRC News Summary for Monday, July 09, 2018

This morning's Nuclear Regulatory Commission News Summary and Clips are attached.

Website: You can also read today's briefing, including searchable archive of past editions, at http://NRC.BulletinIntelligence.com.

Full-text Links: Clicking the hypertext links in our write-ups will take you to the newspapers' original full-text articles.

Interactive Table of Contents: Clicking a page number on the table of contents page will take you directly to that story.

Contact Information: Please contact us any time at 703-483-6100 or NRC@BulletinIntelligence.com. Use of this email address will automatically result in your

message being delivered to everyone at Bulletin Intelligence involved with your service, including senior management. Thank you.

From: Tregoning, Robert
Sent: Wed, 11 Oct 2017 07:16:01 -0600
To: Hiser, Matthew
Cc: Moyer, Carol;Hull, Amy;Purtscher, Patrick
Subject: RE: NRC PLiM slides on Harvesting rlt).pptx

Matt:

Think slides look fine; pending additional comments from others on this email, I'm okay with moving to Steve/Brian for review.

Cheers,

Rob

Robert Tregoning
Technical Advisor for Materials
US Nuclear Regulatory Commission
Two White Flint North, M/S T-10 A36
11545 Rockville Pike
Rockville, MD 20852-2738
ph: 301-415-2324
fax: 301-415-6671

From: Hiser, Matthew
Sent: Wednesday, October 11, 2017 9:13 AM
To: Tregoning, Robert <Robert.Tregoning@nrc.gov>
Cc: Moyer, Carol <Carol.Moyer@nrc.gov>; Hull, Amy <Amy.Hull@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: RE: NRC PLiM slides on Harvesting rlt).pptx

Hi Rob,

Thank you for reviewing and for your input. I greatly reduced the sub bullets and sub sub bullets as you suggested (moving info to the notes) and the slides are much cleaner now.

I also added a couple figures to improve the visual interest.

Thanks!
Matt

From: Tregoning, Robert
Sent: Wednesday, October 11, 2017 6:59 AM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>
Cc: Moyer, Carol <Carol.Moyer@nrc.gov>; Hull, Amy <Amy.Hull@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: NRC PLiM slides on Harvesting rlt).pptx

Matt:

I have only a few comments (attached). I think the key messages are on point. My only real quibble is stylistic. The slides are basically a ton of words. It would be nice to have some representative graphics or illustrations of some of the points just to break up the words. However, I know it can take time to develop/find good representative graphics and given our limited window, I don't know if you want to tackle this or not. At a minimum, I recommend eliminating many of the sub-bullets and sub-sub-bullets from the slides themselves and moving them to the talking points. This will help Allen out as well.

Good job with this on such short notice!

Rob

Robert Tregoning
Technical Advisor for Materials
US Nuclear Regulatory Commission
Two White Flint North, M/S T-10 A36
11545 Rockville Pike
Rockville, MD 20852-2738
ph: 301-415-2324
fax: 301-415-6671

Note to requester: Attachment is immediately following. The presentation is at it was provided to the FOIA staff (re: page numbers on the bottom of the slides).

From: Hiser, Matthew
Sent: Wed, 11 Oct 2017 13:13:06 +0000
To: Tregoning, Robert
Cc: Moyer, Carol;Hull, Amy;Purtscher, Patrick
Subject: RE: NRC PLiM slides on Harvesting rlt).pptx
Attachments: NRC PLiM slides on Harvesting rlt mah.pptx

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I also added a couple figures to improve the visual interest.

Thanks!
Matt

From: Tregoning, Robert
Sent: Wednesday, October 11, 2017 6:59 AM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>
Cc: Moyer, Carol <Carol.Moyer@nrc.gov>; Hull, Amy <Amy.Hull@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: NRC PLiM slides on Harvesting rlt).pptx

Matt:

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Rob

Robert Tregoning
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US Nuclear Regulatory Commission
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U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Harvesting of Aged Materials from Operating and Decommissioning Nuclear Power Plants

M. Hiser[a], P. Purtscher[a], P. Ramuhalli[b], A. B. Hull[a], R. Tregoning[a]
[a]U.S. Nuclear Regulatory Commission (NRC), Washington, D.C., USA
[b]Pacific Northwest National Laboratory (PNNL), Richland, WA, USA

Outline

- Background and Motivation
- NRC Harvesting Experience
- Recent NRC Activities
  - Criteria for Prioritizing Data Needs
  - Database for Sources of Materials
- Path Forward

Background and Motivation

- Recent trends in global nuclear industry:
  - Interest in extending nuclear power plant (NPP) lifespans
  - Numerous NPPs, both in U.S. and internationally, have announced plans to or already have shut down
- Limited budgets have restricted the resources available to support new research, including harvesting programs
  - Aligning interests and leveraging with other organizations is important to maximize value

Summary of Comments on Slide 1

Page: 3

Number: 1 Author: Presenter Subject: Presentation Notes Date: 1/6/2021 9:20:49 AM

Recent trends in global nuclear industry:
Interest in extending nuclear power plant (NPP) lifespans
Technical basis for managing aging of systems, structures, and components for longer time
Numerous NPPs, both in U.S. and internationally, have announced plans to or already have shut down
New opportunities for harvesting components that were aged in representative light water reactor (LWR) environments

Limited budgets have restricted the resources available to support new research, including harvesting programs
Aligning interests and leveraging with other organizations is important to maximize value

NRC Harvesting Experience

- NRC has participated in numerous harvesting programs over the years:
  - RPV, CRDM penetrations, RCS piping, RPV internals, neutron absorbers, and cables
  - From unfinished, operating ,and decommissioning plants in U.S. and internationally
- Significant value in using harvested components to confirm data from other research programs

Page: 4

Number: 1 Author: Presenter Subject: Presentation Notes Date: 1/6/2021 9:20:49 AM

NRC has participated in numerous harvesting programs over the years:
RPV, CRDM penetrations, RCS piping, RPV internals, neutron absorbers, and cables
From unfinished, operating ,and decommissioning plants in U.S. and internationally

Significant value in using harvested components to confirm data from other research programs
Harvesting materials from highly representative long-term aging environments increases confidence in safety margins

Example Projects
RPV materials
Shoreham, Midland
Reactor vessel head CRDM penetrations
North Anna, Davis-Besse
Pressurizer from St. Lucie
Piping from VC Summer, NMP, Oconee
Reactor internals from Zorita
Joint harvesting and testing project with EPRI and international
Neutron absorbers from Zion
Harvesting coordinated with DOE and EPRI; Independent NRC testing
Concrete from Zorita
Cables from Zion and Crystal River

Previous Benefits of Harvesting
Reduce unnecessary conservatism
Flaw distributions and Master Curve information came from harvested materials to support PTS rule
Understand in-service flaws
Mockups for NDE qualification
Leak rate methodology from studying in-service flaws
Identify and better understand safety issues
High-energy arc fault tests on aluminum electrical components

1

Technical Lessons Learned

- Harvesting can provide highly representative aged materials for research
  - May be only practical source of representative aged materials
  - May be able to use limited harvested materials to validate larger accelerated aging data set
- Important to gain as much information as possible in advance before committing to specific harvesting project

Page: 5

Number: 1 Author: Presenter Subject: Presentation Notes Date: 1/6/2021 9:20:49 AM

Harvesting can provide highly representative aged materials for research
May be only practical source of representative aged materials, particularly if irradiation and temperature are important factors
Achieving high fluence levels with representative irradiation conditions through other means is very challenging
May be able to use limited harvested materials to validate larger accelerated aging data set
Important to gain as much information as possible in advance before committing to specific harvesting project
Ideally a bounding, yet realistic, material/environment
Understand material information (CMTRs if available) and plant operating conditions

1

Logistical Lessons Learned

- Harvesting is an expensive, time-consuming effort
- Leveraging resources with other research organizations helps mitigate cost challenges
- Transporting irradiated materials, particularly internationally, is cumbersome and time-consuming

Lifting operation for irradiated materials transport cask

Page: 6

Number: 1 Author: Presenter Subject: Presentation Notes Date: 1/6/2021 9:20:50 AM

Harvesting is an expensive, time-consuming effort
Must balance cost with potential benefits carefully
High technical relevance of materials is needed to ensure value
Leveraging resources with other research organizations helps mitigate cost challenges
Can introduce challenges for testing when aligning research priorities and interests of multiple organizations
May be needed, particularly for expensive testing of irradiated materials
Transporting irradiated materials, particularly internationally, is cumbersome and time-consuming
Avoiding extra transport, especially between countries, is highly recommended

Recent NRC Activities

- Strategic approach to materials harvesting
  - Due to limited opportunities, past harvesting efforts have generally been reactive to individual plants shutting down
- Prioritize the data needs best addressed by harvesting
- Workshop held in March 2017 at NRC HQ to discuss all aspects of harvesting with other interested stakeholders

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Strategic approach to materials harvesting
Due to limited opportunities, past harvesting efforts have generally been reactive to individual plants shutting down

Prioritize the data needs best addressed by harvesting
Criteria for harvesting prioritization developed by PNNL

Workshop held in March 2017 at NRC HQ to discuss all aspects of harvesting with other interested stakeholders
Good discussion of experience, including challenges and pitfalls, from those with firsthand knowledge

Potential Criteria for Harvesting Prioritization

- Applicability of harvested material for addressing critical gaps
- Ease of laboratory replication of the degradation scenario
- Unique field aspects of degradation
- Fleet-wide vs. plant-specific applicability of data

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Applicability of harvested material for addressing critical gaps
Harvesting for critical gaps prioritized over less essential technical gaps
Ease of laboratory replication of the degradation scenario
For example, simultaneous thermal and irradiation conditions are difficult to replicate
Unique field aspects of degradation
For example, unusual operating experience or legacy materials (fabrication methods, etc.) no longer available
Fleet-wide vs. plant-specific applicability of data

Potential Criteria for Harvesting Prioritization

- Harvesting cost and complexity
- Availability of reliable in-service inspection (ISI) techniques for the material / component
- Availability of materials for harvesting
- Timeliness of the expected research results relative to the objective

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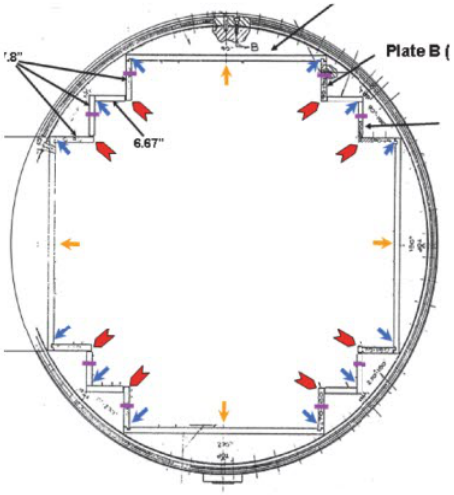
Harvesting cost and complexity
For example, harvesting unirradiated concrete or electrical cables less expensive and less complex than harvesting from the reactor internals
Availability of reliable in-service inspection (ISI) techniques for the material / component
If mature inspection methods exist and are easy to apply, harvesting may be less valuable
Availability of materials for harvesting
Timeliness of the expected research results relative to the objective

Database for Sources of Materials

- NRC is pursuing the development of a database for sources of materials for harvesting
- Allow for aligning of high-priority data needs to the available sources of materials
- NRC is interested in engaging with other organizations in developing the database



Example of reactor internals harvesting plan

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NRC is pursuing the development of a database for sources of materials for harvesting
Includes both previously harvested materials and those available for future harvesting

Allow for aligning of high-priority data needs to the available sources of materials
The level of detail should be appropriate for the factors influencing decision-making

NRC is interested in engaging with other organizations in developing the database

Conclusion and Path Forward

- Harvesting can yield highly representative and valuable data on materials aging
- Data Needs Prioritization and Sources of Materials Database
- As specific harvesting opportunities are identified, NRC welcomes opportunities for cooperation and leveraging with other interested research organizations

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Harvesting can yield highly representative and valuable data on materials aging
Having a clearly defined objective and early engagement with other stakeholders are keys to success

Data Needs Prioritization and Sources of Materials Database
NRC is interested in working with other organizations to identify high-priority data needs of common interest

As specific harvesting opportunities are identified, NRC welcomes opportunities for cooperation and leveraging with other interested research organizations

Note to requester: Attachment is immediately following.

From: Hiser, Matthew
Sent: Thu, 23 Feb 2017 12:43:52 +0000
To: Tregoning, Robert;Purtscher, Patrick
Subject: RE: NRC Staff Attendance at Workshop
Attachments: Harvesting Workshop Agenda 2-23-17.docx

Hi Rob,

No, I think we just got our wires crossed a bit when discussing it on Tuesday. I updated the agenda document (attached) and rearranged session 5. How does this look?

<table>
<tr><td rowspan="7">5</td><td rowspan="7">1:30 – 4:00</td><td>PNNL (for NRC)</td><td>Pradeep Ramuhalli</td><td>Technical Information Needed for Informed Harvesting Decisions</td></tr>
<tr><td colspan="3">DISCUSSION</td></tr>
<tr><td colspan="3">Action Items and Next Steps</td></tr>
<tr><td>EPRI</td><td>Sherry Bernhoft</td><td rowspan="4">Closing Thoughts</td></tr>
<tr><td>DOE</td><td>Rich Reister</td></tr>
<tr><td>NRC</td><td>Robert Tregoning</td></tr>
<tr><td colspan="2">ALL</td></tr>
</table>

Thanks!

Matt

From: Tregoning, Robert
Sent: Wednesday, February 22, 2017 2:58 PM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: RE: NRC Staff Attendance at Workshop

Matt:

I'm still a bit unclear on session 5. Maybe I'm being dense

PNNL (for NRC)	Pradeep Ramuhalli	Technical Information Needed for Informed Harvesting Decisions
EPRI	Sherry Bernhoft	
DOE	Rich Reister	
NRC	Robert Tregoning	NRC Perspective on Future Harvesting Planning
DISCUSSION		
Action Items and Closing Thoughts		

What specifically do we want Sherry and Rich to cover in their remarks? I thought we talked yesterday about EPRI, DOE, and NRC just providing some closing thoughts and then opening it up to the group. I envisioned that the session would look like this

1. Pradeep's talk
2. General Discussion using seeded questions.
3. Summary of action items
4. Closing thoughts about workshop and harvesting in general: first DOE, EPRI, and NRC and then open it up to the group.

While I'm not opposed to the above layout, I just want to make sure that we're clear what we want Sherry and Rich to communicate in their separate talks prior to the discussion.

On another note, I think it would be good to indicate specific times for each talk, especially within session 2 – 4 to reinforce the notion that each speaker only has been allotted that amount of time.

Otherwise, it looks good but I'd really like to get titles ☺

Rob

Robert Tregoning
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US Nuclear Regulatory Commission
Two White Flint North, M/S T-10 A36
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From: Hiser, Matthew
Sent: Wednesday, February 22, 2017 1:27 PM
To: Tregoning, Robert <Robert.Tregoning@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: RE: NRC Staff Attendance at Workshop

Hi Rob,

I've attached the latest workshop attendee and webinar contact list. It's only a few external people. INL will be sending John Jackson who will give a brief talk on the NSUF sample library in session 3. Any other INL staff will participate via webinar.

I haven't heard back from EnBW, so I put together the agenda assuming they will not present. We could easily add them into session 4 if necessary. I've attached the final agenda. Please take a look and let me know what you guys think.

Thanks!

Matt

From: Tregoning, Robert
Sent: Wednesday, February 22, 2017 10:11 AM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: RE: NRC Staff Attendance at Workshop

Matt:

Who's on the final webinar list? I think we have like 3 or 4 people correct? Do we have final confirmation that INL will just send one person? I think adding Mark is fine as long as we're right around 30 people.

Robert Tregoning
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From: Hiser, Matthew
Sent: Wednesday, February 22, 2017 9:30 AM
To: Tregoning, Robert <Robert.Tregoning@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: NRC Staff Attendance at Workshop

NRC	Pat Purtscher	NRC
	Rob Tregoning	NRC
	Matt Hiser	NRC
	Mita Sircar	NRC
	Tom Koshy	NRC
	NRR/DE	NRC
	NRR/DLR	NRC
	NRR concrete	NRC

Hi Rob and Pat,

This is the current list of NRC staff attending the workshop. Tom Koshy indicated a NRR electrical wouldn't be needed (or if NRR sent an electrical person then Tom wouldn't be needed), so I haven't included them on here. With these 8 NRC staff plus 23 external participants, we are at 31 total.

The other person that I have discussed this workshop with that has expressed strong interest in attending is Mark Kirk. Given the Belgian participation and interest in RPV topics, we might want to allow him to attend as well. That would put us at 32 total in the room. Thoughts?

Thanks!

Matt

Ex-Plant Materials Harvesting Workshop Agenda

Tuesday, March 7

Session	Time	Organization	Speaker	Presentation Title
Intro	8:00	NRC		Welcome and Introduction to Workshop
1	8:15-9:45	EPRI	Sherry Bernhoft	
		DOE	Rich Reister	
		NRC	Robert Tregoning	NRC Perspective on Motivation for Harvesting
		GRS	Uwe Jendrich	
		CRIEPI	Taku Arai	
		DISCUSSION		
9:45-10:00		**BREAK**		
2	10:00 – 10:20	PNNL (for NRC)	Pradeep Ramuhalli	Data Needs Best Addressed By Harvesting
	10:20 – 10:40	NRC	Matthew Hiser	High-Priority Data Needs for Harvesting
	10:40 – 11:00	DOE	Keith Leonard	
	11:00 – 11:20	SCK-CEN	Rachid Chaouadi	Review of past RPV sampling test programs and perspective for long term operation
	11:20 – 11:40	Westinghouse	Arzu Alpan	Importance of Harvesting to Evaluate Radiation Effects on Concrete Properties
	11:40 – 12:30	DISCUSSION		
12:30 – 2:00		**LUNCH**		
3	2:00 – 2:15	NRC	Matthew Hiser	Sources of Materials: Past NRC Harvesting and U.S. Decommissioning Plants
	2:15 – 2:30	EPRI	Al Ahluwalia	
	2:30 – 2:45	DOE/ORNL	Tom Rosseel	
	2:45 – 3:00	DOE/INL	John Jackson	NSUF Material Sample Library
	3:00 – 3:15	Energy Solutions	Gerry van Noordennen	
	3:15 – 3:30	Westinghouse	Arzu Alpan	Potential Harvesting of Concrete from Mihama Unit 1
	3:30 – 3:45	**BREAK**		
	3:45 – 4:00	GRS	Uwe Jendrich	
	4:00 – 4:15	CNSC	Daniel Tello	
	4:15 – 5:00	DISCUSSION		

Wednesday, March 8

Session	Time	Organization	Speaker	Presentation Title
4	8:00 – 8:30	EPRI	Jean Smith	
	8:30 – 9:00	DOE	Tom Rosseel	
	9:00 – 9:30	NRC	Matthew Hiser	NRC Perspective on Harvesting Experience and Lessons Learned
	9:30 – 10:00	CRIEPI	Taku Arai	
	10:00 – 10:15	**BREAK**		
	10:15 - 10:45	Energy Solutions	Gerry van Noordennen	
	10:45 - 11:15	Dominion	Bill Zipp	
	11:15 – 12:00	DISCUSSION		
12:00 – 1:30		**LUNCH**		
5	1:30 – 4:00	PNNL (for NRC)	Pradeep Ramuhalli	Technical Information Needed for Informed Harvesting Decisions
		DISCUSSION		
		Action Items and Next Steps		
		EPRI	Sherry Bernhoft	Closing Thoughts
		DOE	Rich Reister	
		NRC	Robert Tregoning	
		ALL		