

**From:** Hiser, Matthew  
**Sent:** Fri, 21 Apr 2017 17:55:38 +0000  
**To:** Frankl, Istvan  
**Subject:** RE: ACTION: One-pager on the Harvesting Workshop  
**Attachments:** Harvesting One Pager 4-21-17.docx

Here you go Steve.

Thanks!  
Matt

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**From:** Frankl, Istvan  
**Sent:** Friday, April 21, 2017 12:22 PM  
**To:** Hiser, Matthew  
**Subject:** RE: ACTION: One-pager on the Harvesting Workshop

Thanks, Matt.

It's almost done. I have attached my final comments/revisions.

Steve

---

**From:** Hiser, Matthew  
**Sent:** Thursday, April 20, 2017 11:41 AM  
**To:** Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>  
**Subject:** RE: ACTION: One-pager on the Harvesting Workshop

Hi Steve,

OK, I've updated the one-pager with your edits and responded to a couple questions.

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)

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**From:** Frankl, Istvan  
**Sent:** Tuesday, April 18, 2017 5:19 PM  
**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>  
**Subject:** RE: ACTION: One-pager on the Harvesting Workshop

Sorry for being so late with my review.

I left my mark-ups on your chair.

Thanks,

Steve

---

**From:** Hiser, Matthew  
**Sent:** Friday, March 24, 2017 1:51 PM  
**To:** Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>  
**Subject:** RE: ACTION: One-pager on the Harvesting Workshop

Hi Steve,

Here is the one-pager with input from Rob, Pat, and I.

Thanks!  
Matt

---

**From:** Frankl, Istvan  
**Sent:** Monday, March 20, 2017 5:24 PM  
**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>  
**Subject:** ACTION: One-pager on the Harvesting Workshop

Matt,

One of the action items that came out of the bi-weekly CMB/CIB status meeting today was Brian's request for a DE "one-pager" on the harvesting workshop.

Please align on this with Rob and get a draft to me for review **by next Monday.**

Thanks,

Steve

## Ex-Plant Materials Harvesting One-Pager

### Motivation:

- Ex-plant materials are valuable because they have been exposed to actual in-service plant operating conditions (temperature, irradiation, coolant, etc.).
  - ~~Generally, research involves accelerated, simulated aging conditions in a lab which may not be as representative of actual in-service aging unlike virgin materials tested under simulated conditions in the lab~~
  - Highly representative ~~nature of~~ materials (actual plant components) and aging conditions reduces the uncertainty associated with the applicability of ~~the~~ research findings.
- With plants shutting down both in the U.S. and Europe, there are increasing opportunities to harvest components from decommissioning plants.
- Insights from ex-plant harvesting would support regulatory decisions for subsequent license renewal (SLR), and could have implications for the current license period
  - There is a task in the new draft UNR for SLR from NRR/DLR requesting RES to investigate opportunities for harvesting where appropriate.

Commented [IF1]: Perhaps this should be a sub-bullet with clarifications.

Commented [IF2]: Please be more specific.

### Purpose and Objective:

- For NRC staff and interested stakeholders to have greater awareness and knowledge of the benefits and challenges associated with ex-plant harvesting.
- Support initiation of specific cooperative ex-plant harvesting programs by leveraging limited NRC resources to produce highly representative technical data of materials degradation for extended plant operation.

### Workshop Summary:

- NRC staff hosted a 2-day workshop on March 7-8, 2017 with interested stakeholders, including domestic and international utilities and research organizations, to discuss benefits and challenges associated with ex-plant harvesting. Views and insights from various parties contributed to the discussion
- Workshop participants gave presentations and actively engaged in open discussion of different aspects of ex-plant materials harvesting
  - Sessions covered motivation for harvesting, data needs, sources of materials, lessons learned, the practical aspects of harvesting, and harvesting decision-making and planning
- The discussion focused on the importance of clearly identifying the need and purpose for performing a harvesting project.
  - All participants agreed harvesting is a complex and expensive proposition, but one that can be worthwhile if the need is clearly defined and addressed.
- The insights from utilities and decommissioning contractors were extremely valuable.
  - NRC staff and stakeholders are better informed and aware of the benefits and challenges associated with ex-plant harvesting.

### Path Forward:

- Detailed workshop summary report to be distributed among meeting participants by May 2017
- PNNL report on a strategic approach to ex-plant harvesting to be completed by May 2017
- Developing alignment within NRC on prioritization of harvesting data needs in four primary areas:
  - RPV, RPV internals and other metals, electrical cables and components, concrete

- RES staff will engage with interested workshop participants on prioritizing data needs and developing a database identifying sources of materials for harvesting

Note to requester: Attachment is immediately following.

**From:** Hiser, Matthew  
**Sent:** Thu, 20 Apr 2017 15:41:12 +0000  
**To:** Frankl, Istvan  
**Subject:** RE: ACTION: One-pager on the Harvesting Workshop  
**Attachments:** Harvesting One Pager 4-20-17.docx

Hi Steve,

OK, I've updated the one-pager with your edits and responded to a couple questions.

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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)

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**From:** Frankl, Istvan  
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Steve

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**From:** Hiser, Matthew  
**Sent:** Friday, March 24, 2017 1:51 PM  
**To:** Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>  
**Subject:** RE: ACTION: One-pager on the Harvesting Workshop

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Thanks!  
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**From:** Frankl, Istvan  
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**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>

**Subject:** ACTION: One-pager on the Harvesting Workshop

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Please align on this with Rob and get a draft to me for review by next Monday.

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Steve

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- Ex-plant materials are valuable because they have been exposed to actual in-service plant operating conditions (temperature, irradiation, coolant, etc.), unlike virgin materials tested under simulated conditions in the lab
  - Highly representative nature of materials and aging conditions reduces the uncertainty associated with the applicability of the research findings.
- With plants shutting down both in the U.S. and Europe, there are increasing opportunities to harvest components from decommissioning plants.
- Insights from ex-plant harvesting would support regulatory decisions for subsequent license renewal (SLR), and could have implications for the current license period
  - There is a task in the new draft UNR for SLR from NRR/DLR requesting RES to investigate opportunities for harvesting where appropriate.

### Purpose and Objective:

- For NRC staff and interested stakeholders to have greater awareness and knowledge of the benefits and challenges associated with ex-plant harvesting.
- Support initiation of specific cooperative ex-plant harvesting programs by leveraging limited NRC resources to produce highly representative technical data of materials degradation for extended plant operation.

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  - Sessions covered motivation for harvesting, data needs, sources of materials, lessons learned, the practical aspects of harvesting, and harvesting decision-making and planning
- The discussion focused on the importance of clearly identifying the need and purpose for performing a harvesting project.
  - All participants agreed harvesting is a complex and expensive proposition, but one that can be worthwhile if the need is clearly defined and addressed.
- The insights from utilities and decommissioning contractors were extremely valuable.
  - NRC staff and stakeholders are better informed and aware of the benefits and challenges associated with ex-plant harvesting.

### Path Forward:

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- PNNL report on a strategic approach to ex-plant harvesting to be complete by May 2017
- Developing alignment within NRC on prioritization of harvesting data needs in four primary areas:
  - RPV, RPV internals and other metals, electrical cables and components, concrete
- RES staff will engage with interested workshop participants on prioritizing data needs and developing a database identifying sources of materials for harvesting

**Commented [HM1]:** IF comment: irradiated?

MAH: Both irradiated and unirradiated concrete components are of interest

**Commented [HM2]:** IF: who is going to manage this database?

MAH: TBD... perhaps DOE?

**From:** Hiser, Matthew  
**Sent:** Fri, 24 Mar 2017 17:51:17 +0000  
**To:** Frankl, Istvan  
**Subject:** RE: ACTION: One-pager on the Harvesting Workshop  
**Attachments:** Harvesting One Pager.docx

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Hi Steve,

Here is the one-pager with input from Rob, Pat, and I.

Thanks!  
Matt

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**From:** Frankl, Istvan  
**Sent:** Monday, March 20, 2017 5:24 PM  
**To:** Hiser, Matthew <Matthew.Hiser@nrc.gov>  
**Subject:** ACTION: One-pager on the Harvesting Workshop

Matt,

One of the action items that came out of the bi-weekly CMB/CIB status meeting today was Brian's request for a DE "one-pager" on the harvesting workshop.

Please align on this with Rob and get a draft to me for review by next Monday.

Thanks,

Steve

## Ex-Plant Materials Harvesting One-Pager

### Motivation:

- Ex-plant materials are valuable because they have been exposed to actual in-service plant operating conditions (temperature, irradiation, coolant, etc.), unlike virgin materials tested under simulated conditions in the lab, which reduces the uncertainty associated with the applicability of the aging conditions.
  - With the wave of plants shutting down both in the U.S. and Europe, there are increasing opportunities to harvest components from decommissioning plants.
- Insights from ex-plant harvesting research would support regulatory decisions for subsequent license renewal (SLR), and could have implications for the current license period depending on the findings.
  - There is a task in the new draft UNR for SLR from NRR/DLR requesting RES to investigate opportunities for harvesting where appropriate.

### Purpose and Objective:

- For NRC staff and interested stakeholders to have greater awareness and knowledge of the benefits and challenges associated with ex-plant harvesting.
- Facilitate contacts and communication to enable specific cooperative ex-plant harvesting programs to be initiated, leveraging limited NRC resources to produce highly representative technical data of materials degradation for extended plant operation.

### Workshop Summary:

- NRC staff hosted a 2-day workshop with interested stakeholders, including domestic and international utilities and research organizations, to discuss benefits and challenges associated with ex-plant harvesting. Views and insights from various parties contributed to the discussion
- Workshop participants gave presentations and actively engaged in open discussion of different aspects of ex-plant materials harvesting
  - Sessions covered motivation for harvesting, data needs, sources of materials, lessons learned, the practical aspects of harvesting, and harvesting decision-making and planning
- The discussion focused on the importance of clearly identifying the need and purpose for performing a harvesting project.
  - All participants agreed harvesting is a complex and expensive proposition, but one that can be worthwhile if the need to be addressed is clearly defined and addressed by the planned harvesting project.
- The insights from the utility and decommissioning contractor perspective were extremely valuable to the discussion.
  - NRC staff and stakeholders are better informed and aware of the benefits and challenges associated with ex-plant harvesting.

### Path Forward:

- Detailed workshop summary report to be distributed among meeting participants by May 2017
- PNNL report on a strategic approach to ex-plant harvesting to be complete by May 2017
- Developing alignment within NRC on prioritization of harvesting data needs in four primary areas:
  - RPV, internals and other metals, electrical, concrete
- RES staff will engage with interested workshop participants on prioritizing data needs and developing a database identifying sources of materials for harvesting

**From:** Hiser, Matthew  
**Sent:** Fri, 24 Mar 2017 17:47:56 +0000  
**To:** Tregoning, Robert; Purtscher, Patrick  
**Subject:** RE: ACTION: One-pager on the Harvesting Workshop

Thanks guys!

---

**From:** Tregoning, Robert  
**Sent:** Friday, March 24, 2017 1:34 PM  
**To:** Hiser, Matthew <Matthew.Hiser@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>  
**Subject:** RE: ACTION: One-pager on the Harvesting Workshop

Matt:

Generally looks fine but I would tweak the last 2 bullets:

- **Developing** internal alignment within NRC on prioritization of harvesting data needs in four primary areas:
  - RPV, internals and other metals, electrical, concrete
- RES staff will engage with interested workshop participants on prioritizing data needs and **developing a database identifying** sources of materials **for harvesting** database

Rob  
Rob  
ert 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:** Friday, March 24, 2017 11:45 AM  
**To:** Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>; Purtscher, Patrick <[Patrick.Purtscher@nrc.gov](mailto:Patrick.Purtscher@nrc.gov)>  
**Subject:** FW: ACTION: One-pager on the Harvesting Workshop

Hi Rob and Pat,

Here is my first stab at the harvesting one-pager Steve mentioned below. Please take a look and edit as needed and I'll send back to Steve.

Thanks!  
Matt

---

**From:** Frankl, Istvan  
**Sent:** Monday, March 20, 2017 5:24 PM  
**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>  
**Subject:** ACTION: One-pager on the Harvesting Workshop

Matt,

One of the action items that came out of the bi-weekly CMB/CIB status meeting today was Brian's request for a DE "one-pager" on the harvesting workshop.

Please align on this with Rob and get a draft to me for review **by next Monday.**

Thanks,

Steve

Note to requester: Attachment is immediately following.

**From:** Frankl, Istvan  
**Sent:** Fri, 21 Apr 2017 12:22:06 -0400  
**To:** Hiser, Matthew  
**Subject:** RE: ACTION: One-pager on the Harvesting Workshop  
**Attachments:** Harvesting One Pager 4-20-17 (IF).docx

Thanks, Matt.

It's almost done. I have attached my final comments/revisions.

Steve

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**From:** Hiser, Matthew  
**Sent:** Thursday, April 20, 2017 11:41 AM  
**To:** Frankl, Istvan <Istvan.Frankl@nrc.gov>  
**Subject:** RE: ACTION: One-pager on the Harvesting Workshop

Hi Steve,

OK, I've updated the one-pager with your edits and responded to a couple questions.

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**Subject:** RE: ACTION: One-pager on the Harvesting Workshop

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  - There is a task in the new draft UNR for SLR from NRR/DLR requesting RES to investigate opportunities for harvesting where appropriate.

**Commented [IF1]:** Perhaps this should be a sub-bullet with clarifications.

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**Commented [HM3]:** IF comment: irradiated?

MAH: Both irradiated and unirradiated concrete components are of interest

**Commented [HM4]:** IF: who is going to manage this database?

MAH: TBD... perhaps DOE?

Note to requester: Attachment is immediately following.

**From:** Tregoning, Robert  
**Sent:** Fri, 12 Jan 2018 14:51:39 +0000  
**To:** Hiser, Matthew  
**Subject:** RE: ACTION: input to bilateral meeting planning sheets for RIC  
**Attachments:** Steering Committee Briefing on IASCC Code Case 1-11-18 - jcp comm rlt.pptx

I'm in but on a conference call that will end around 10:00. I'll call you when it's over. I've made some changes but think it will be easiest to finish the rest over the phone. Pull up these slides and we'll go over them when I call.

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:** Friday, January 12, 2018 9:48 AM  
**To:** Tregoning, Robert <Robert.Tregoning@nrc.gov>  
**Subject:** RE: ACTION: input to bilateral meeting planning sheets for RIC

Hi Rob,

(b)(6)

I'm working from home today – you can give me a call at [REDACTED] I just tried your office number but you weren't there...

Thanks!  
Matt

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**From:** Tregoning, Robert  
**Sent:** Friday, January 12, 2018 9:39 AM  
**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>  
**Subject:** RE: ACTION: input to bilateral meeting planning sheets for RIC

Where are you working today? I want to talk to you about the briefing slides....

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:** Friday, January 12, 2018 8:22 AM

**To:** Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>; Purtscher, Patrick <[Patrick.Purtscher@nrc.gov](mailto:Patrick.Purtscher@nrc.gov)>;  
Audrain, Margaret <[Margaret.Audrain@nrc.gov](mailto:Margaret.Audrain@nrc.gov)>

**Subject:** RE: ACTION: input to bilateral meeting planning sheets for RIC

Hi guys,

Here is my stab at some language for those RIC meeting talking points – any other thoughts or edits?

1. Request for engagement on materials harvesting from decommissioned reactors\_
  - Overview – Components or materials may be harvested from decommissioning reactors, with particular interest in reactor pressure vessel (RPV) steel, reactor internals, concrete, and cables. NRC is pursuing a comprehensive strategy towards ex-plant harvesting, which involves identifying high-value materials to harvest based on matching available materials for harvesting with prioritized data needs.
  - Regulatory Need – Harvested materials may be tested to assess the effects of in-plant conditions on component integrity, with focus on aging-related degradation relevant to subsequent license renewal
  - Status – NRC is seeking other organizations that are interested in prioritizing data needs for harvesting and identifying optimal opportunities for harvesting.
2. Request for engagement on materials harvesting from decommissioned reactors
  - Overview – Components or materials may be harvested from decommissioning reactors, with particular interest in reactor pressure vessel (RPV) steel, reactor internals, concrete, and cables. NRC is pursuing a comprehensive strategy towards ex-plant harvesting, which involves identifying high-value materials to harvest based on matching available materials for harvesting with prioritized data needs.
  - Regulatory Need – Harvested materials may be tested to assess the effects of in-plant conditions on component integrity, with focus on aging-related degradation relevant to subsequent license renewal
  - Status – NRC is seeking other organizations that are interested in prioritizing data needs for harvesting and identifying optimal opportunities for harvesting.

Thanks!  
Matt

***Matthew Hiser***

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Division of Engineering | Corrosion and Metallurgy Branch

Phone: 301-415-2454 | Office: TWEN 10D62

[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)

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**From:** Tregoning, Robert

**Sent:** Monday, January 08, 2018 7:44 AM

**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>; Purtscher, Patrick <[Patrick.Purtscher@nrc.gov](mailto:Patrick.Purtscher@nrc.gov)>;  
Audrain, Margaret <[Margaret.Audrain@nrc.gov](mailto:Margaret.Audrain@nrc.gov)>

**Subject:** FW: ACTION: input to bilateral meeting planning sheets for RIC

Guys:

See email below and attachments from Greg on upcoming RIC discussions with several countries. There are bullets related to harvesting on France, Japan, and South Korea but we may want to change the wording to reflect the broader harvesting effort that we're doing (i.e., not simply requesting materials but developing a strategy to see what high value materials/components may be available and then proceeding accordingly). Does someone want to take a stab at modifying the bullets? Also, I think we should also add this as a topic with Germany and Canada. Thoughts on this?

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

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**From:** Oberson, Greg

**Sent:** Thursday, January 04, 2018 3:31 PM

**To:** Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>; Iyengar, Raj <[Raj.Iyengar@nrc.gov](mailto:Raj.Iyengar@nrc.gov)>; Boyce (RES), Tom <[Tom.Boyce@nrc.gov](mailto:Tom.Boyce@nrc.gov)>; Seber, Dogan <[Dogan.Seber@nrc.gov](mailto:Dogan.Seber@nrc.gov)>; Jenkins, Ronaldo <[Ronaldo.Jenkins@nrc.gov](mailto:Ronaldo.Jenkins@nrc.gov)>; Miller, Kenneth A <[KennethA.Miller@nrc.gov](mailto:KennethA.Miller@nrc.gov)>; Ake, Jon <[Jon.Ake@nrc.gov](mailto:Jon.Ake@nrc.gov)>; Birla, Sushil <[Sushil.Birla@nrc.gov](mailto:Sushil.Birla@nrc.gov)>; Pires, Jose <[Jose.Pires@nrc.gov](mailto:Jose.Pires@nrc.gov)>; Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>; Homiack, Matthew <[Matthew.Homiack@nrc.gov](mailto:Matthew.Homiack@nrc.gov)>; Gardocki, Stanley <[Stanley.Gardocki@nrc.gov](mailto:Stanley.Gardocki@nrc.gov)>

**Cc:** Regan, Christopher <[Christopher.Regan@nrc.gov](mailto:Christopher.Regan@nrc.gov)>

**Subject:** ACTION: input to bilateral meeting planning sheets for RIC

BCs & SLs:

RES is preparing for bilateral meetings with Canada, France, Japan, Germany, and South Korea at RIC. IPT has requested that for each country, that we provide a listing of requests for assistance or engagement to help support our research programs. These are not intended to document ongoing collaborations, but rather new requests. I've started lists using info previously submitted under the "international prioritization" activity. Please add/delete/edit. The status line should indicate if you have had any previously discussions or interactions on the topic. If you have had none, you should indicate as such. You can mark up these sheets and email back to me. I will consolidate the list. Please aim to provide by Jan. 16. Please let me know if you have any questions.

Greg

# Steering Committee Briefing on IASCC Code Case

Matt Hiser

Jeff Poehler

# Purpose and Context

- Purpose: Brief committee on planned NRC negative vote on IASCC code case (CC).
- ~~Code Case (CC)~~ (ASME Section XI) provides crack growth reference curves for irradiated stainless steels in LWR environments
  - This CC would ~~principally~~ be used ~~in evaluation of~~ ~~to evaluate~~ flaws identified by NDE during reactor internals inspections
- Similar curves currently exist in the NRC-approved BWRVIP-99-A for BWR applications up to a fluence of ~4 dpa
  - This CC expands beyond the BWRVIP-99-A curves to a ~~broader~~ ~~higher~~ fluence range and environments ~~and both BWR and PWR environments~~
- ASME Code Status
  - ~~CC~~ The code case has been approved through the task group and working group levels with NRC voting negative at each level
  - ~~CC~~ The code case is on the agenda for the Subgroup, Evaluation Standards and likely the ASME Standards committee in February

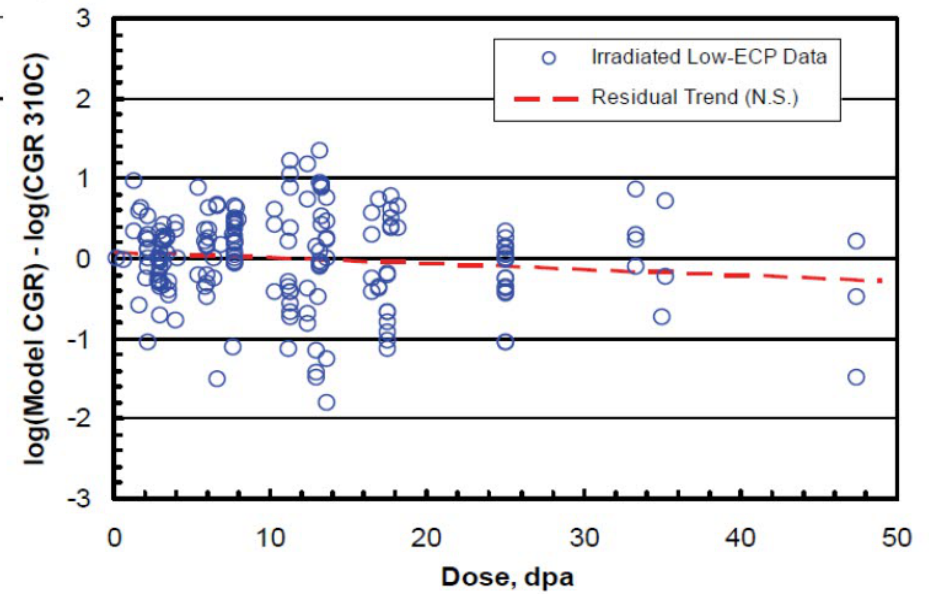
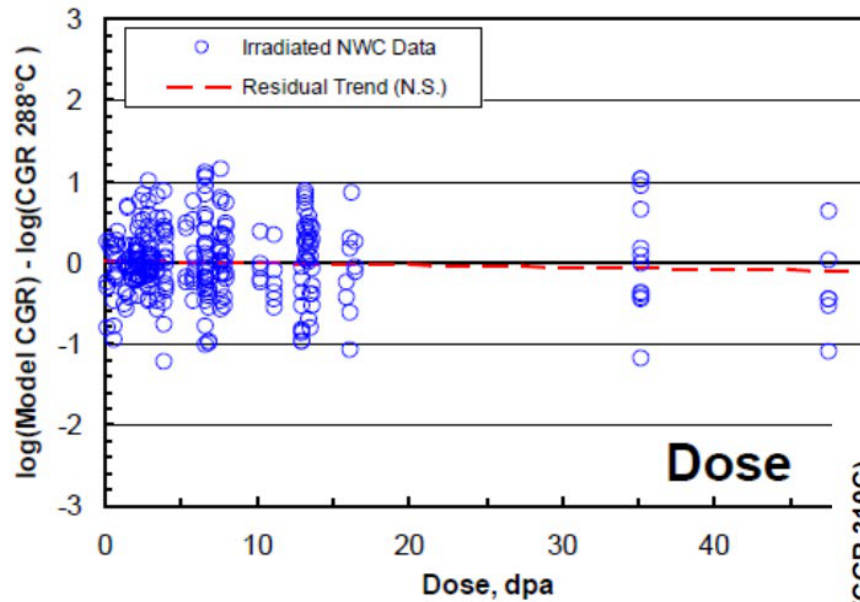
# Description of IASCC Code Case

- Uses two empirically fit models to ~~generate a predicted~~ **predict** crack growth rate (CGR) ~~as a function of a number of parameters~~
  - One model predicts irradiated yield strength knowing fluence, temperature, cold work, and material
  - One model predict CGR using irradiated yield strength and knowing temperature and applied stress intensity factor, K
- ~~Unique aspect is that irradiation effect is accounted for through the yield stress~~ **strength** model
  - ~~Used to predict irradiated yield stress as a function of fluence, temperature, material cold work and alloy~~
- **Unique aspects of this approach**
  - The effect of fluence only alters the irradiated yield strength
  - Other ASME CGR models are not directly correlated with yield strength
- ~~The resulting yield stress value is used as an input to the CGR model along with temperature and environment~~
- ~~CGR model provides as output a crack growth curve as a function of~~ **fluence** ~~and applied stress intensity factor, K~~

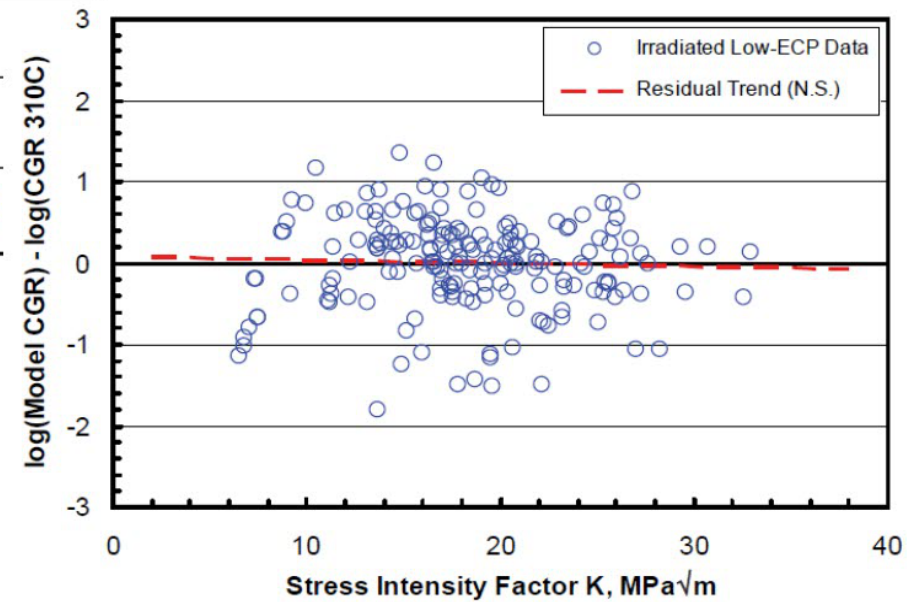
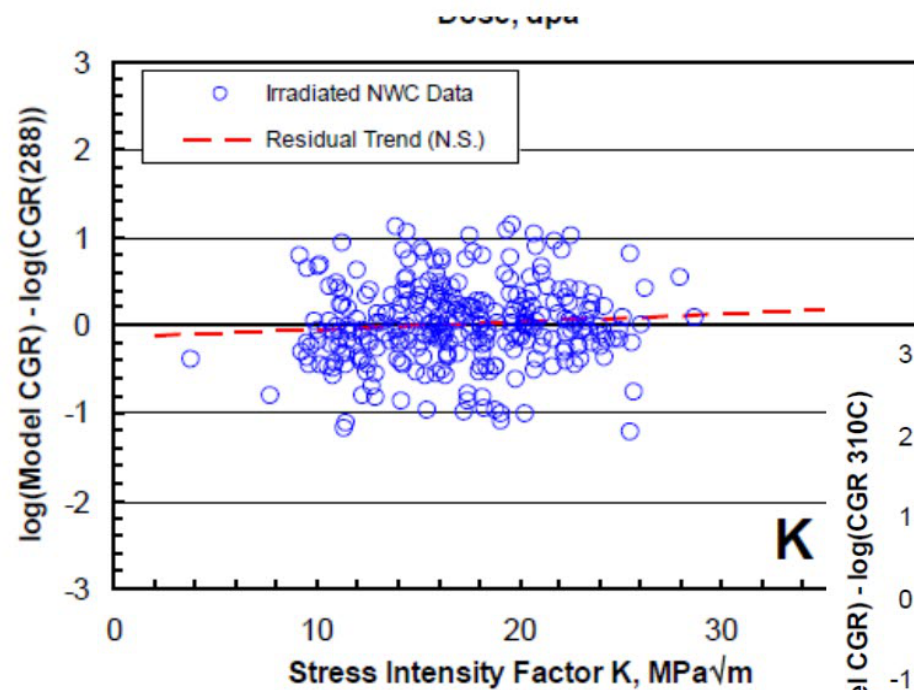
# NRC Concerns

- Applicable fluence range
  - ~~There is very limited data above 20 dpa particularly from~~ for LWR irradiation conditions
    - Preliminary data from Zorita materials testing shows some evidence of increasing CGR at higher fluence levels
  - Minimal impact on industry
    - The only field applications above 20 dpa are very high fluence PWR components, such as baffle plates
- Applicable **stress intensity (K)** range
  - ~~There is v~~Very limited data at low K values
    - The little available data shows a nonconservative bias to the model at low K
  - ~~Likely uses of this CC~~ **may be used at** ~~would be low~~ K due to low operating stresses on reactor internals and irradiation-induced stress relaxation on welds
- Yield stress model
  - Uncertainty and scatter in data could cause predicted CGR to be non-conservative by as much as factor of 10
  - Effect of cold work on saturated yield stress could non-conservatively bias CGR for certain cold-worked materials
- Material applicability

# Fluence Range of Available Data



# K Range of Available Data



# Current Status

- NRC staff has provided multiple rounds of comments on the Code Case
  - Industry has responded to these comments, which have addressed some of the staff concerns
- Staff held a call with industry on Nov. 30 to discuss NRC concerns
  - Limited progress made during this call
- ASME Code Status
  - The code case has been approved through the task group and working group levels with NRC voting negative at each level
  - The code case is on the agenda for the subgroup and likely the ASME Standards committee in February

# ~~Staff Proposal for~~ Next Steps

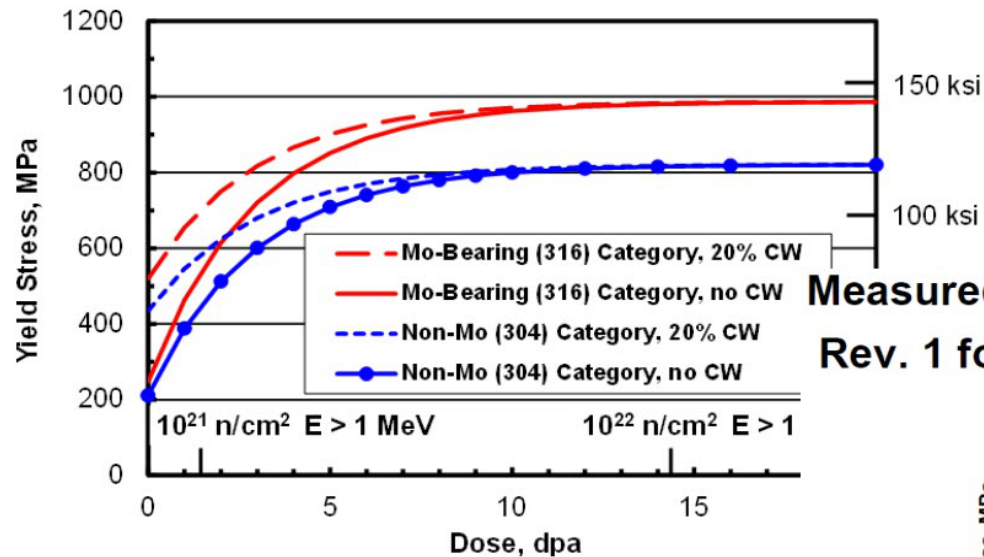
- ASME Code
  - Staff will plan to vote negative at the subgroup ~~the subgroup~~ **SGES** and Standards committee based on the identified concerns, particularly the applicable fluence range
- Future Rulemaking
  - If changes are not made to the CC to address NRC staff concerns, the staff would propose accepting this CC with likely conditions on the:
    - Applicable fluence range
    - Applicable K range
    - Yield stress model
    - Material applicability

# Backup Slides

# Yield Stress Model

(4)

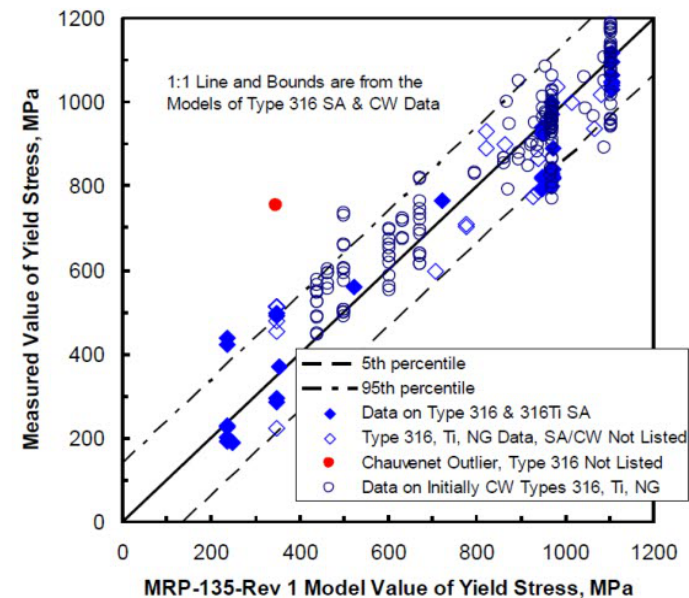
Effect of Dose, Material Category, and Pre-irradiation Cold Work or Welding on Irradiated Yield Stress of Austenitic Stainless Steels  
(6)  
Curves Plotted at 550°F (288°C)



## Yield Stress Model Equation

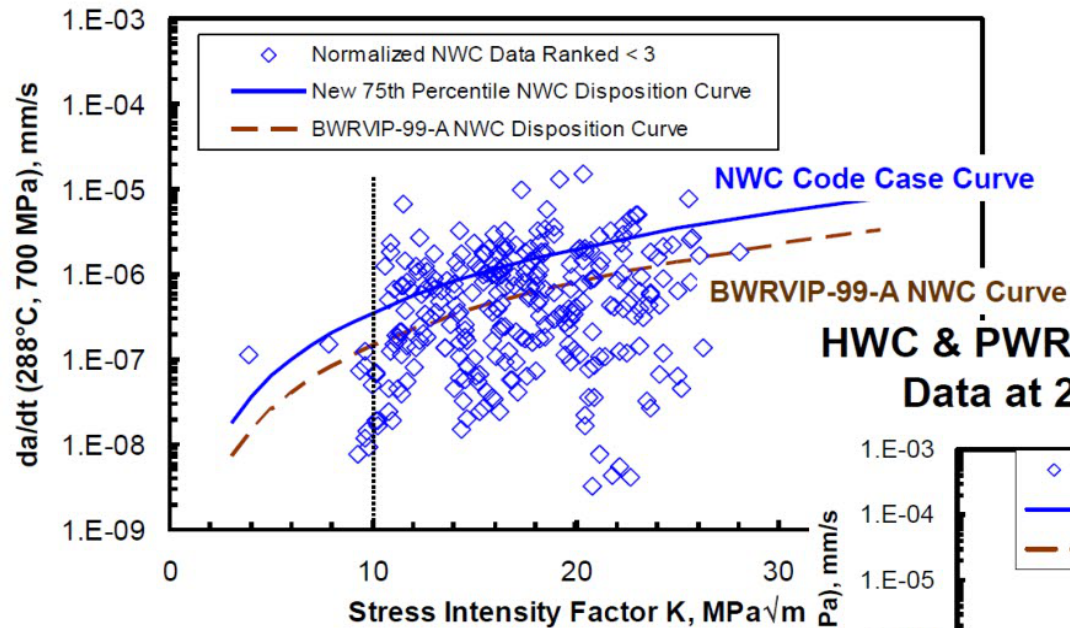
where  
 $A_2, B_2$  Intermediate results, MPa  
 $r$  Pre-irradiation strengthening parameter ( $0 \leq r \leq 0.2$ )  
 $d$  Dose in dpa  
 $m'$  Temperature coefficient,  $1/^\circ\text{C}$   
 $T_c$  Application temperature of metal at flaw location,  $^\circ\text{C}$   
 $\sigma_{0.2}$  Model estimate of irradiated yield stress at the application temperature for use in eq. (1), MPa

Measured  $\sigma_{0.2}$  vs. Model Estimates from MRP-135-Rev. 1 for Types 316, 316Ti & 316NG, SA and CW



# Crack Growth Rate Model

## NWC Code Case Curve vs. Normalized Data at 288 °C and 700 MPa (~4.3 dpa)



Parameters  $C$ ,  $v$ ,  $\eta$  for Calculating IASCC Crack Growth Rate at 550°F (288°C)

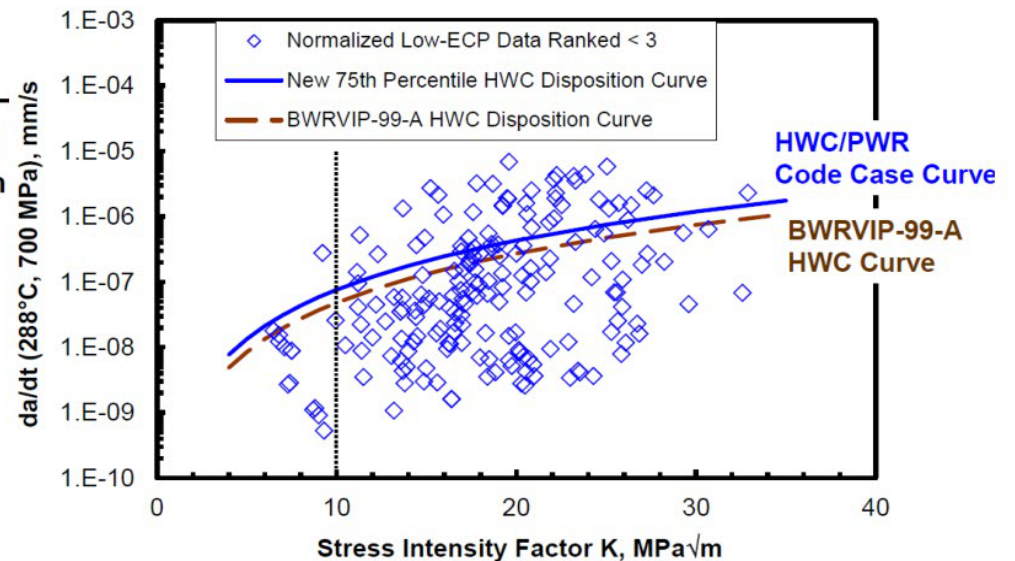
Water Environments at 550°F (288°C)	U.S. Customary Coefficient C [Note 1] da/dt in in./hr, $\sigma_{0.2}$ in ksi, and K in ksi√in.	SI Coefficient C [Note 1] da/dt in mm/s, $\sigma_{0.2}$ in MPa, and K in MPa√m	Exponent $v$ on $\sigma_{0.2}$	Exponent $\eta$ on K
BWR normal water chemistry (NWC)	$8.91 \times 10^{-13}$	$2.84 \times 10^{-17}$	2.675	2.486
BWR hydrogen water chemistry (HWC)	$3.31 \times 10^{-13}$	$1.35 \times 10^{-17}$	2.547	2.504
PWR primary water	$3.31 \times 10^{-13}$	$1.35 \times 10^{-17}$	2.547	2.504

### Crack Growth Rate Equation

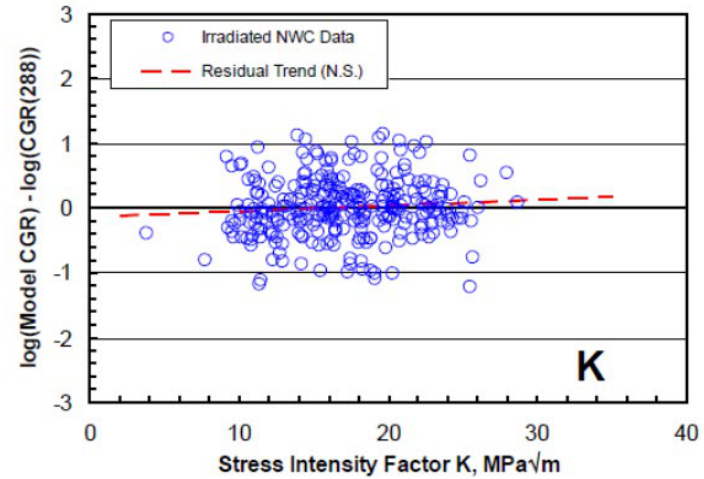
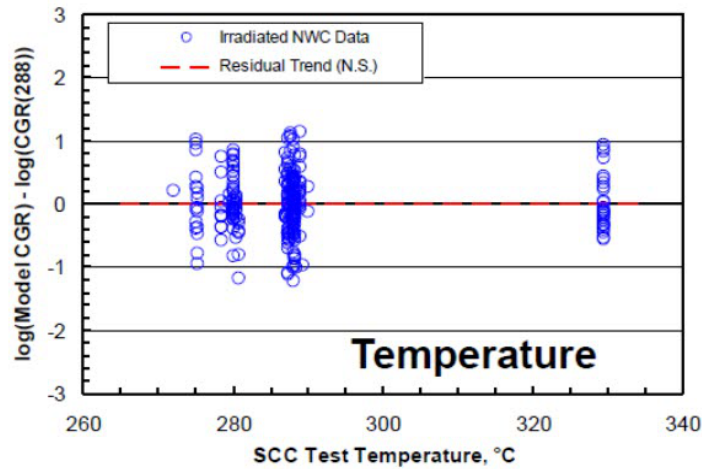
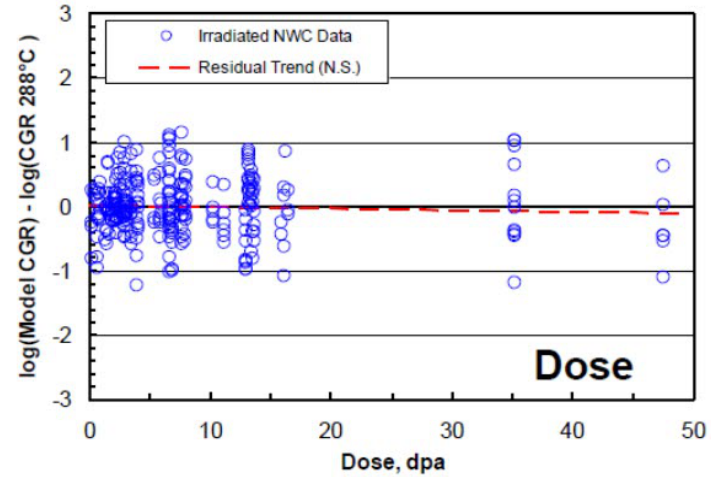
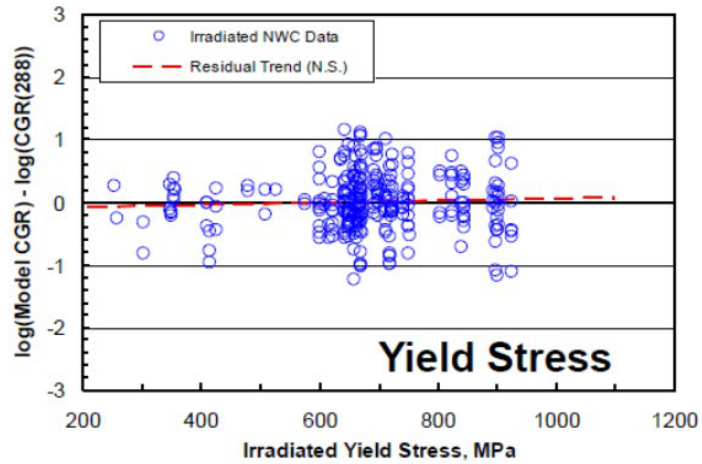
$$\frac{da}{dt} = C S_T \sigma_{0.2}^v K^\eta$$

where: C is a constant coefficient for environment  
 $S_T$  is an adjustment factor for application temperature  
 $v$  and  $\eta$  are exponents  
 $\sigma_{0.2}$  is the irradiated yield stress for the material at the flaw location

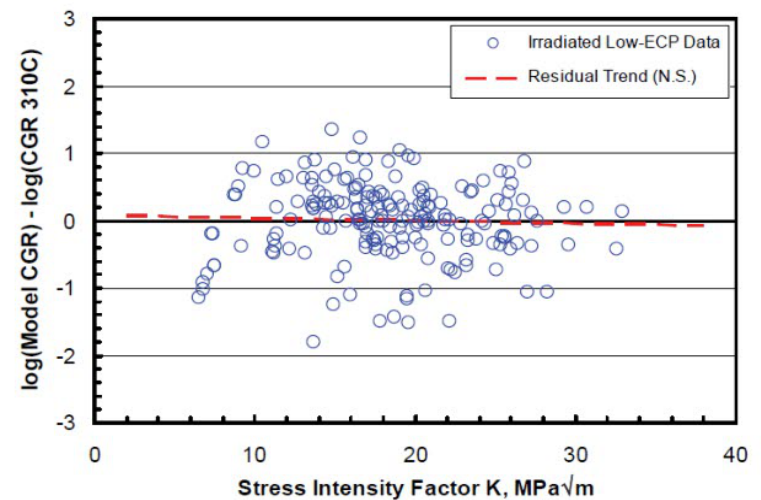
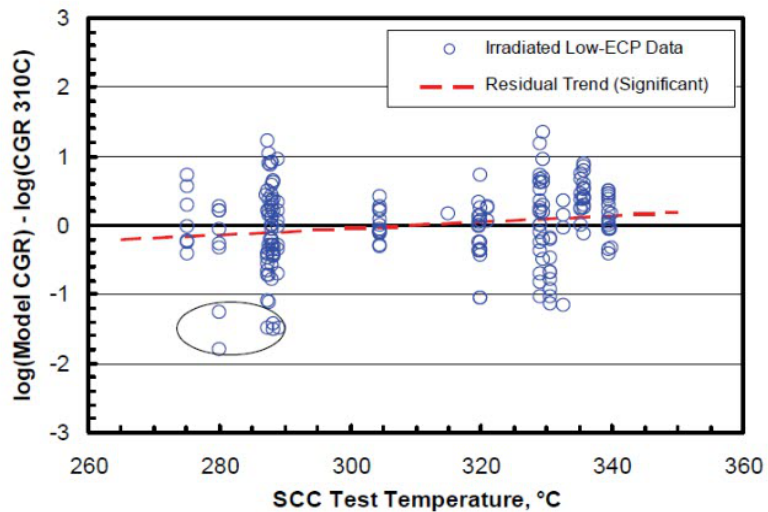
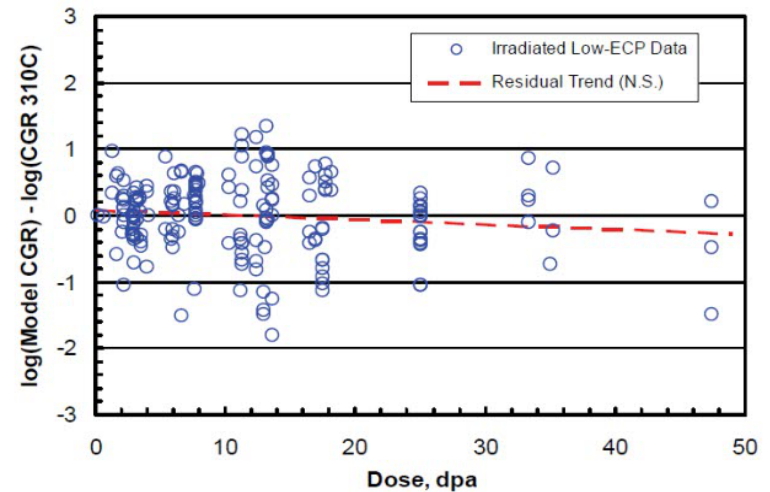
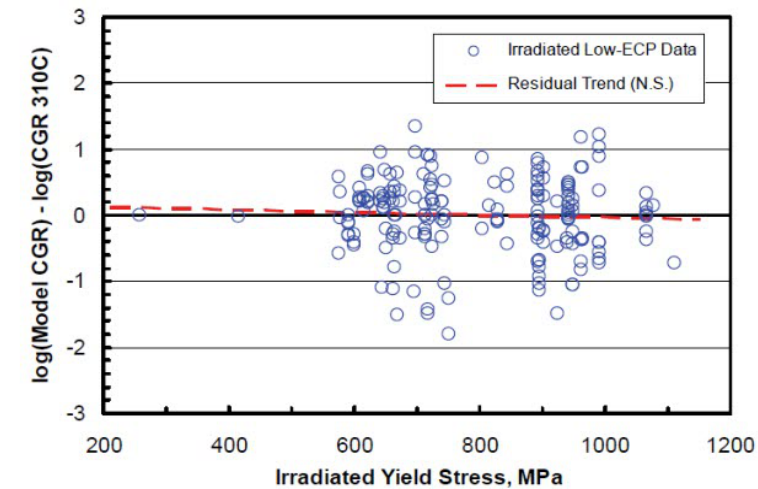
## HWC & PWR Code Case Curve vs. Normalized Data at 288 °C and 700 MPa (~4.3 dpa)



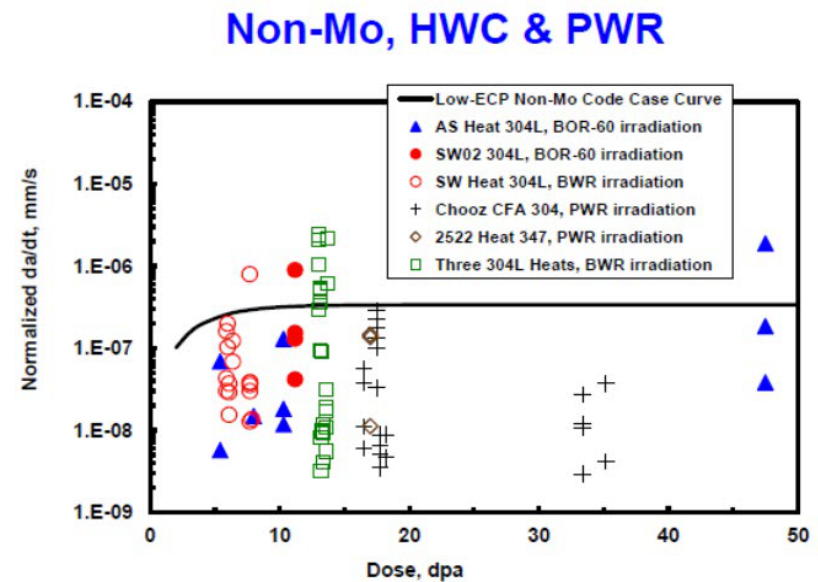
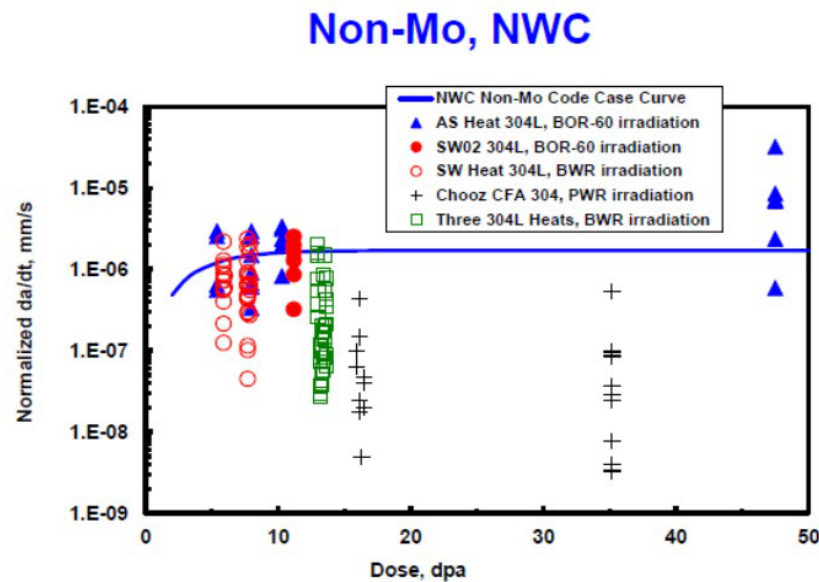
# NWC Residual plots



# PWR/HWC Residual plots

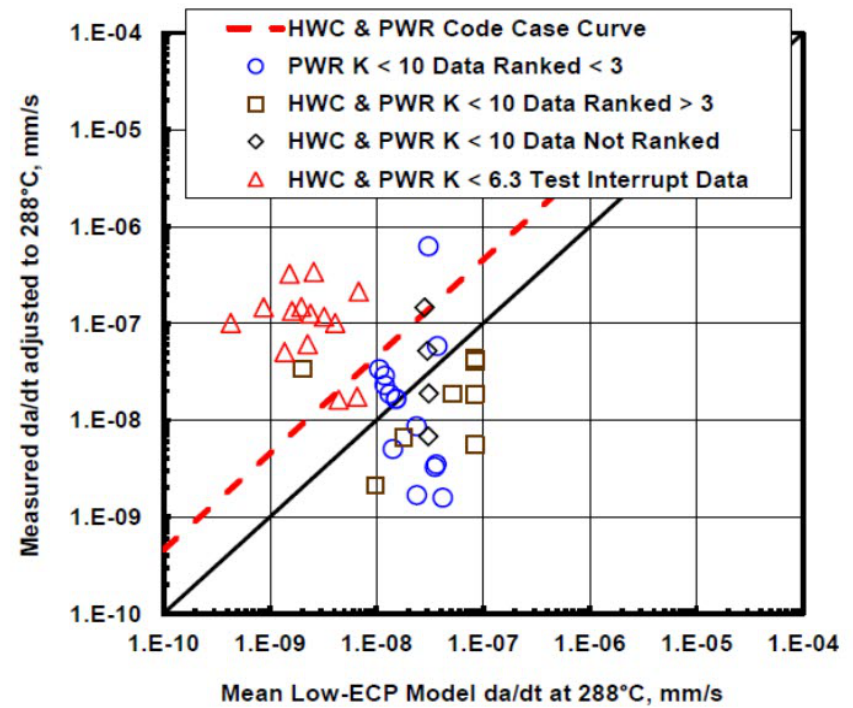
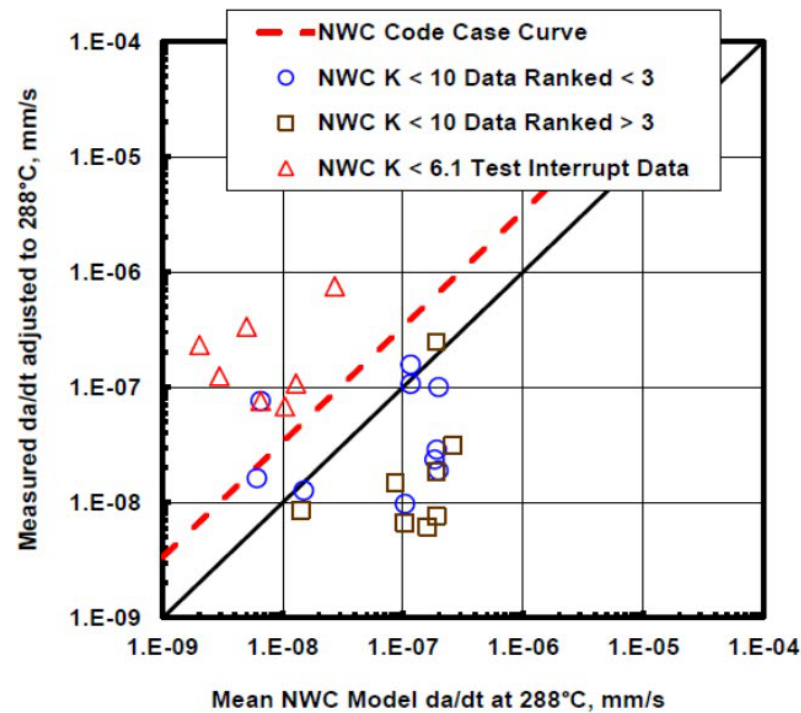


# Fluence range of data

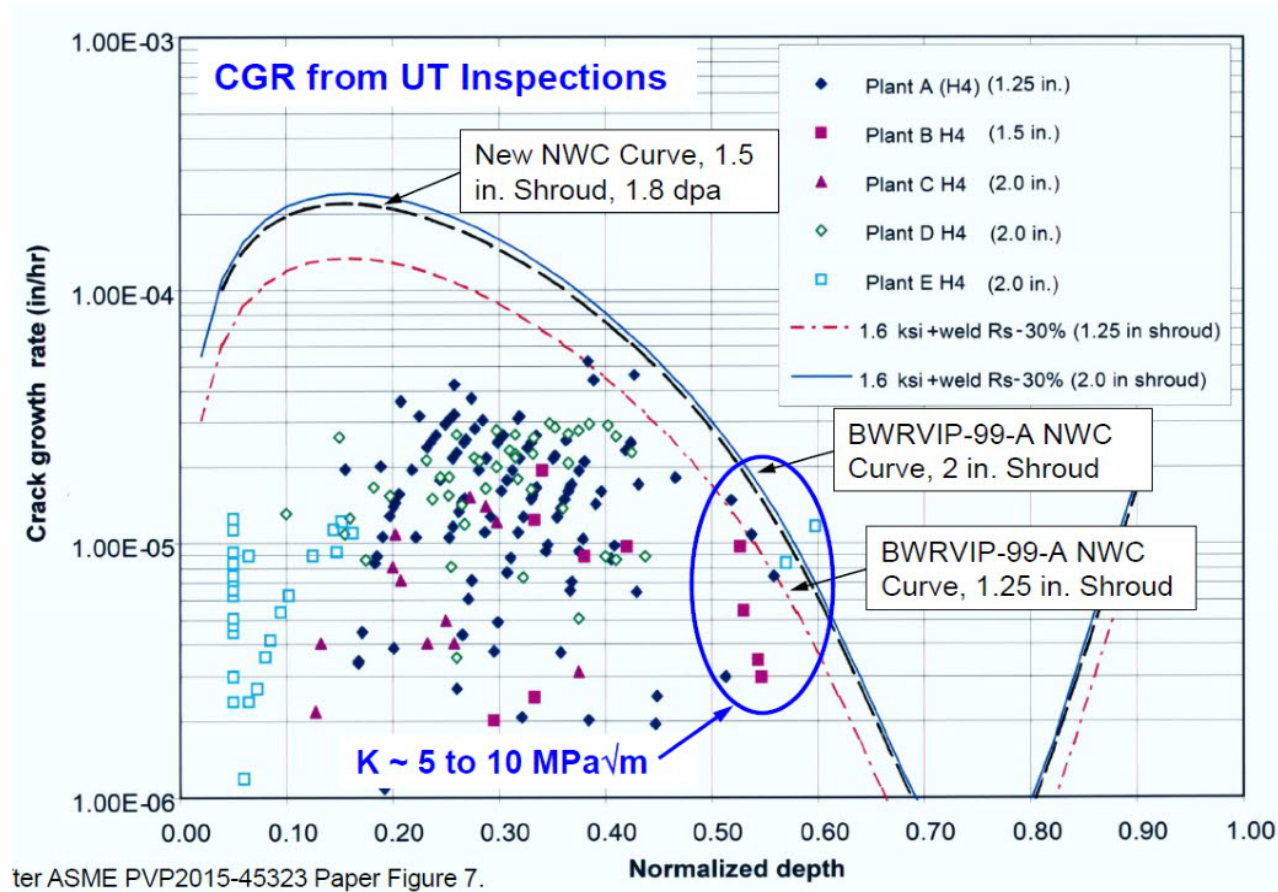


The higher-ranked data (< 3) are normalized to 288°C, log average K, and constant K testing, consistent with the plotted Code Case curves.

# Low K Data



# Field Data from UT Inspections



**From:** Frankl, Istvan  
**Sent:** Tue, 3 Apr 2018 15:47:02 +0000  
**To:** Audrain, Margaret  
**Cc:** Hiser, Matthew  
**Subject:** RE: ACTION: Potential Topics for Materials Exchange Meeting May 22-26  
**Attachments:** Initial Agenda 2018-05 Materials Tech Info Exch Pub Mtg - 3-29-18.docx, Initial Technical Topics for NRC-Industry May 2018 Materials Exchange - 03-29-2018.docx

Note to requester: Attachments are immediately following.

Meg,

You will have only 10-15 minutes to summarize the topic.

I don't yet have the list of attendees, only the draft initial topics and agenda which I circulated earlier (attached).

Thanks,

Steve

---

**From:** Audrain, Margaret  
**Sent:** Tuesday, April 03, 2018 11:33 AM  
**To:** Frankl, Istvan <Istvan.Frankl@nrc.gov>; Hiser, Matthew <Matthew.Hiser@nrc.gov>  
**Subject:** RE: ACTION: Potential Topics for Materials Exchange Meeting May 22-26

Yes, of course, if you think there would be interest. Who's the industry counterparts? I've presented our current research plan/results a few times in the last year at conferences so I wouldn't want to take up too much time over a new topic.

---

**From:** Frankl, Istvan  
**Sent:** Tuesday, April 03, 2018 11:28 AM  
**To:** Audrain, Margaret <[Margaret.Audrain@nrc.gov](mailto:Margaret.Audrain@nrc.gov)>; Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>  
**Subject:** ACTION: Potential Topics for Materials Exchange Meeting May 22-26  
**Importance:** High

Meg and Matt,

Rob has proposed additional topics for the upcoming materials exchange meeting with industry in late May.

This is a great opportunity to align with industry on harvesting as well as PWSCC CGR. Can you support these topics as RES leads?

Please reply ASAP.

Thanks,

Steve

---

**From:** Tregoning, Robert  
**Sent:** Tuesday, April 03, 2018 11:00 AM  
**To:** Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>  
**Subject:** FW: Potential Topics for Materials Exchange Meeting May 22-26

Steve:

Other potential CMB topics – Steve, I think it would be also good to consider presentations on the following CMB topics:

1. Harvesting – Current plans and activities
2. IAD – confirmatory testing plans
3. PWSCC Crack Growth – Current research plans and results

These don't have to be long presentations. I think the harvesting and IAD ones could be 10 minutes each. The PWSCC one could be 10 – 15 minutes.....

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

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**From:** Frankl, Istvan  
**Sent:** Monday, April 02, 2018 6:52 PM  
**To:** Iyengar, Raj <[Raj.Iyengar@nrc.gov](mailto:Raj.Iyengar@nrc.gov)>; Hiser, Allen <[Allen.Hiser@nrc.gov](mailto:Allen.Hiser@nrc.gov)>; Alley, David <[David.Alley@nrc.gov](mailto:David.Alley@nrc.gov)>; Rudland, David <[David.Rudland@nrc.gov](mailto:David.Rudland@nrc.gov)>; Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>; Ruffin, Steve <[Steve.Ruffin@nrc.gov](mailto:Steve.Ruffin@nrc.gov)>  
**Cc:** Focht, Eric <[Eric.Focht@nrc.gov](mailto:Eric.Focht@nrc.gov)>; Audrain, Margaret <[Margaret.Audrain@nrc.gov](mailto:Margaret.Audrain@nrc.gov)>; Hull, Amy <[Amy.Hull@nrc.gov](mailto:Amy.Hull@nrc.gov)>; Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** RE: Potential Topics for Materials Exchange Meeting May 22-26

Allen et al.

I would like to propose three more topics from RES/DE:

- 1) Review of Additive Manufacturing for Reactor Materials and Components - NRC Efforts with RES support – NRO lead: J. Burke, RES lead: A. Hull (Considering the eventual merger of NRR and NRO) (15 mins)
- 2) Status Update on the PWSCC Initiation Program – Lead: E. Focht (15 mins.)
- 3) Status of Subsequent License Renewal (SLR) Confirmatory Research – Lead: C. Moyer (10 -15 mins.)

Thanks,

Steve F.

---

**From:** Iyengar, Raj

**Sent:** Friday, March 30, 2018 11:31 AM

**To:** Hiser, Allen <[Allen.Hiser@nrc.gov](mailto:Allen.Hiser@nrc.gov)>; Alley, David <[David.Alley@nrc.gov](mailto:David.Alley@nrc.gov)>; Rudland, David <[David.Rudland@nrc.gov](mailto:David.Rudland@nrc.gov)>; Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>; Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>; Ruffin, Steve <[Steve.Ruffin@nrc.gov](mailto:Steve.Ruffin@nrc.gov)>

**Subject:** RE: Potential Topics for Materials Exchange Meeting May 22-26

Allen et al.

I made some edits in the attached document.

Time-permitting and if you all agree, I would like to propose two short overview topics:

- 1) Materials/Comp Int for Advanced non-light waters - NRC Efforts – Lead; Matt M. with RES support (Considering the eventual merger of NRR and NRO) (15 mins)
- 2) Overview of RES Support in Materials and Comp. INT for Operating Reactors (15 mins)

Raj

---

**From:** Hiser, Allen

**Sent:** Thursday, March 29, 2018 1:17 PM

**To:** Alley, David <[David.Alley@nrc.gov](mailto:David.Alley@nrc.gov)>; Rudland, David <[David.Rudland@nrc.gov](mailto:David.Rudland@nrc.gov)>; Iyengar, Raj <[Raj.Iyengar@nrc.gov](mailto:Raj.Iyengar@nrc.gov)>; Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>; Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>; Ruffin, Steve <[Steve.Ruffin@nrc.gov](mailto:Steve.Ruffin@nrc.gov)>

**Subject:** Potential Topics for Materials Exchange Meeting May 22-26

**Importance:** High

We need to identify topics for the May 22-24 materials exchange meeting with industry – all day May 22 and 23, until noon on the 24th.

We may have additional meetings with the industry on Monday the 21<sup>st</sup> (PFM and the RES TLR on exclusion of embrittlement effects with  $\Delta T < 25^{\circ}\text{F}$ ) and the afternoon of Thursday the 24th (RES fluence program status).

I have attached the 2017 NRC topic list (with initial deletions) and the 2017 final agenda (with initial deletions) from the meeting last year. The latter provides the list of industry program status reports. Please share with your staff as you consider appropriate

Please identify any additions or deletions by noon on Tuesday (April 3), along with appropriate staff contacts/presenters. .

I would like to get the agenda pinned down with industry by the end of next week.

Allen

## **AGENDA**

INDUSTRY / NRC MATERIALS PROGRAMS TECHNICAL INFORMATION EXCHANGE  
PUBLIC MEETING (CATEGORY 2)  
NRC HEADQUARTERS,  
THREE WHITE FLINT NORTH (ROOMS 1C03 AND 1C05),  
11601 LANDSDOWN STREET, NORTH BETHESDA, MD 20852

**Tuesday, May ~~23~~22, 20172018**

<b>Time</b>	<b>Presentation Topic</b>	<b>Presenter Organization</b>
0830	Introduction and Welcome	NRC – Wilson/Lubinski
0845	<del>01 – NRC structure update</del>	<del>Hiser – NRC</del>
0900	02 - NEI 03-08 Overview	Dyle - EPRI
0945	03 - BWRVIP update	Odell - BWRVIP
1020	Break	
1040	04 - MRP Update	Hoehn - MRP
1130	05 - PWROG MSC update	Malikowski - PWROG
1200	Lunch	
1315	06 - Welding Program update	McCracken - WRTC
1345	07 - Primary Systems Corrosion Research update	Demma - EPRI
1415	08 - Thermal Fatigue update	Crooker - MRP
1440	Break	
1500	09 - Peening confirmatory research status	Alley – NRC
1540	10 - RES status on Weld Residual Stress NUREG	Benson - NRC
1600	11 - NRC Modeling Approach for Welds after Mechanical Stress Improvement Process	Alley - NRC
1630	12 - xLPR status and NRR plans	Kalikian - NRC
1700	Public comment	NRC
1715	Adjourn	NRC

INDUSTRY / NRC MATERIALS PROGRAMS TECHNICAL INFORMATION EXCHANGE  
PUBLIC MEETING (CATEGORY 2)  
NRC HEADQUARTERS,  
THREE WHITE FLINT NORTH (ROOMS 1C03 AND 1C05),  
11601 LANDSDOWN STREET, NORTH BETHESDA, MD 20852

<b>Wednesday, May <del>24</del>23, <del>2017</del>2018</b>		
<b>Time</b>	<b>Presentation Topic</b>	<b>Presenter Organization</b>
0830	<del>13 - BTP 5-3 status</del>	<del>Sheng/Lyons - NRC</del>
0900	<del>14 - Carbon Macrosegregation</del>	<del>Hardin - EPRI</del> <del>Rudland - NRC</del>
1015	15 - Appendix H status	Rudland - NRC
1045	Break	
1100	16 - SCC Growth in Low Alloy Steels	Carter - EPRI
1130	17 - Update on BWR water chemistry	Pathania - EPRI
1200	Lunch	
1300	18 - Welding issues and Code applications	McCracken - WRTC
1330	19 - Advance Welding – Irradiated Material	McCracken - WRTC
1400	20 - PWR vessel internals	Poehler – NRC Amberge/Malikowski - Industry
1515	Break	
1530	21 - Baffle Former Bolt issues	Poehler – NRC Amberge/Malikowski - Industry
1715	Public comment	NRC
1730	Adjourn	NRC

INDUSTRY / NRC MATERIALS PROGRAMS TECHNICAL INFORMATION EXCHANGE  
PUBLIC MEETING (CATEGORY 2)  
NRC HEADQUARTERS,  
THREE WHITE FLINT NORTH (ROOMS 1C03 AND 1C05),  
11601 LANDSDOWN STREET, NORTH BETHESDA, MD 20852

Thursday, May <del>25</del> <u>24</u> , <del>2017</del> <u>2018</u>		
Time	Presentation Topic	Presenter Organization
0830	22 - Probabilistic Fracture Mechanics (PFM)	Cumblidge / Raynaud - NRC
0930	23 - NRR independent flaw evaluations to support relief requests	Collins - NRC
1000	24 - Codes and standards update	Hoffman - NRC
1015	Break	
<del>1030</del>	<del>25 - GALL-SLR status</del>	<del>Hiser - NRC</del>
1045	Discussion, Capture Action Items	NRC and Industry
1115	Public Comment	NRC
1130	Adjourn	NRC

**Topics for Industry/NRC Materials Technical Information Exchange Meeting  
May 22-24 @ NRC headquarters in Rockville, MD (ver. 3/29/2018)**

~~1. Carbon macro-segregation – Hovanec~~

- ~~a. Industry: Plans and schedule~~
- ~~b. NRC activities~~

~~2.1. Baffle-former Bolts – Poehler~~

- ~~a. Industry: Recent OE~~
- ~~b. Industry: Guidance changes~~
  - ~~i. NRC Assessment of Industry Guidance~~
- ~~c. Industry: Status/results from hot cell work~~

~~3.2. PFM – Cumblidge/Raynaud~~

- ~~a. NRC motivation and plans for guidance development~~
- ~~b. NRC status and schedule~~
- ~~c. Public involvement~~
- ~~d. Training (Kirk)~~

~~4. NRC status on BTP 5-3 – Sheng~~

~~5.3. Thermal fatigue – Cumblidge~~

- ~~a. Industry: Operating experience~~
- ~~b. Industry: Any plans for program changes~~

~~6.4. NRR independent flaw evaluations to support relief requests – Collins~~

- ~~a. Development of the RES Flaw Evaluation Software for DM Welds and possible expansion~~
- ~~b. Identify the requested flaw evaluation inputs for NRR staff to perform flaw evaluations~~
  - ~~i. provide clarity to licensee's regarding what we are reviewing~~
  - ~~ii. minimize the need for RAI questions just to obtain inputs for flaw analysis~~

~~7.5. RES status on Weld Residual Stress NUREG – Collins~~

- ~~a. Provide a basis status of the review~~
- ~~b. Solicit stakeholder input for consideration in the final NUREG scheduled for 09/2017 for NRR review~~

~~8.6. Discuss NRC use of xFEM as a tool to simulate PWSCC flaw growth in complex three-dimensional geometries – Collins~~

- ~~a. Provide current basis for the RES choice of working with xFEM~~
- ~~b. Solicit stakeholder input for literature search and future RES research plan.~~

~~9.7. PWR vessel internals – Poehler~~

- ~~a. MRP-227 Rev. 1 review status~~
- ~~b. Review of MRP-227 Action Item Reports~~
- ~~c. Industry: Guide cards – OE and guidance changes~~
- ~~d. Industry: Status of 80 year RVI evaluation~~
- ~~e. Process for gap assessments~~

~~10.8. BWR water chemistry status (BWRVIP-62, 75) – Cheruvenki~~

~~11.9. xLPR - status of deliverables and NRR plans for review – Hovanec/Homiack~~

~~12. Changes to NEI 03-08 – Industry~~

~~13.10. NRR re-structuring in FY2018 – Hiser~~

~~14.11. Status of research on peening – Industry (Alley)~~

~~15.12. NRC Modeling Approach for MSIP'ed Welds – Alley/Benson~~

**From:** Audrain, Margaret  
**Sent:** Fri, 17 Nov 2017 12:42:52 -0500  
**To:** Purtscher, Patrick;Hiser, Matthew  
**Subject:** RE: ANL Harvesting Trip

Great, the 13<sup>th</sup> works best for me. Sending the email shortly.

Meg

---

**From:** Purtscher, Patrick  
**Sent:** Friday, November 17, 2017 12:42 PM  
**To:** Audrain, Margaret <Margaret.Audrain@nrc.gov>; Hiser, Matthew <Matthew.Hiser@nrc.gov>  
**Subject:** RE: ANL Harvesting Trip

I am fine with the letter. Dec. 13 is OK for the harvesting meeting, I think I will travel on the 12<sup>th</sup> and talk to just the SG team, planning to leave the 13<sup>th</sup> open for harvesting.

Pat

---

**From:** Audrain, Margaret  
**Sent:** Thursday, November 16, 2017 3:53 PM  
**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>; Purtscher, Patrick <[Patrick.Purtscher@nrc.gov](mailto:Patrick.Purtscher@nrc.gov)>  
**Subject:** RE: ANL Harvesting Trip

Yes, I didn't know how to spell Yiren's name or who else we should include, hence the "et al"!

Dec 13 or 14 would be my preferred days. I'm good with your changes.

Thanks!

---

**From:** Hiser, Matthew  
**Sent:** Thursday, November 16, 2017 3:05 PM  
**To:** Audrain, Margaret <[Margaret.Audrain@nrc.gov](mailto:Margaret.Audrain@nrc.gov)>; Purtscher, Patrick <[Patrick.Purtscher@nrc.gov](mailto:Patrick.Purtscher@nrc.gov)>  
**Subject:** RE: ANL Harvesting Trip

My suggested edits below are in redline strikeout.

I also threw in a date of December 13 for the visit. Would that work well for your two schedules? I think it'd be good to use this email to at least reserve the date for the visit/meeting.

Thanks!  
Matt

---

**From:** Audrain, Margaret  
**Sent:** Thursday, November 16, 2017 2:06 PM

To: Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>; Purtscher, Patrick <[Patrick.Purtscher@nrc.gov](mailto:Patrick.Purtscher@nrc.gov)>  
Subject: ANL Harvesting Trip

First attempt at ANL letter. Edit away!

Dear Bodgan, Yiren, and ??? et al,

A few of us at the NRC is looking into ~~(, and me),~~ are setting up a database of materials related to ex-plant materials for a harvesting program. A few NRC staff, including Meg Audrain, Matt Hiser, Pat Purtscher, and Rob Tregoning, are involved with this harvesting effort. One of our first steps is to identify materials available from past harvesting programs that may be available in "boneyards" at various labs. We'd like to schedule a visit to ANL to be our "guinea pig" site to get rolling with the effort. Pat Purtscher and Meg Audrain would be the NRC staff attending this visit.

We have four main material areas of interest, aligned with NRC's focus areas for SLR: RPV, RVI, cables, & concrete. We and are interested in what materials ANL may have available has from past programs with the NRC, DOE and others. Our emphasis is in the four areas outlined earlier, but not necessarily limited to those four. Materials of interest also don't necessarily have to be material from plants with extensive service history if they may be of research value for other reasons.

We hope to assemble an inventory of available materials related to ~~consider for a~~ harvesting program-like, or in potentially in coordination with, that in the INL NSUF Nuclear Fuels and Materials Library (NFML). Last week, we had a call with staff from INL that are involved with the NSUF NFML and both sides see potential synergies between our interests and the established NSUF specimen library.

Would you all be available and have the resources to meet with us to discuss go over the materials ANL has in inventory? We hope that all of you, with the potential assistance of prior ANL staff such as Omesh Chopra and Bill Shack, will may be able to begin identifying materials of interest before the visit in mid-December we make the trip. This would involve be some limited prep preliminary work on your part and then roughly a half day in person meeting.

We are thinking about planning the trip in mid-Dec, perhaps on Wed., December 13. Would you be available to meet on that date? Would this give you enough time to compile some information on material of potential interest? We would be happy to can have a phone call in advance to better describe what we're looking for if that would help.

Thanks,

Meg, Matt, and Pat and Rob

**From:** Hiser, Matthew  
**Sent:** Fri, 10 Feb 2017 14:15:42 +0000  
**To:** Tregoning, Robert; Purtscher, Patrick  
**Subject:** Re: AW: AW: Interest in Harvesting Workshop

Hi Rob,

To be honest, with MAI not coming, EPRI not presenting in session 2, CRIEPI only presenting in Sessions 1 and 4 (and no other Japanese talks), we have some room in all but Session 4. Here's the current table based on latest emails. The red shaded lines are slots we'd expected from Japan, MAI, or EPRI.

I'd suggest offering him a slot in session 1 to cover "the role of GRS" and their interest in harvesting and also session 3 if he can quickly go through what plants are decommissioning in Germany.

Session	Topic	Organization	Speaker	Status
1	Why our organization is interested in harvesting	EPRI	Sherry Bernhoft	
		DOE	Rich Reister	
		NRC	Robert Tregoning	
		MAI		Emails exchanged
		CRIEPI	Taku Arai	Emails exchanged
	PANEL DISCUSSION			
2	Overview of data needs best addressed by harvesting	PNNL (for NRC)	Pradeep Ramuhalli	
	Perspective on detailed data needs from harvesting	EPRI		
		DOE	Keith Leonard	
		NRC		
		SCK-CEN		Emails exchanged
		CRIEPI/JAEA		Emails exchanged
3	Available materials from decommissioning plants and past	NRC	Matt Hiser	
	Available materials from operating reactors and past harvesting	EPRI	Al Ahluwalia	PWROG/Korea included
	Available materials at DOE labs from past harvesting programs	DOE	Tom Rosseel	
	Upcoming decommissioning sites	Energy Solutions	Gerry van Noordennen	Confirmed
	International sources of materials	MAI		Emails exchanged
		CRIEPI/JAEA		Emails exchanged
		GRS?		
		CNSC		Confirmed – speaker TBD
		Korea/EPRI		EPRI/ Ahluwalia
4	Perspective on Harvesting Lessons Learned / Prior Experience	EPRI	Jean Smith	
		DOE	Tom Rosseel	
		NRC		
		CRIEPI	Taku Arai	
	Decommissioning process and harvesting: schedule, site-specific,	Energy Solutions	Gerry van Noordennen	Confirmed with intro slides
	Utility-Owner perspective on harvesting and decommissioning	Dominion	Bill Zipp	Confirmed with intro slides
	International decommissioning and harvesting experience	Germany?		Emails exchanged
5	Technical information needed for informed harvesting decisions	PNNL (for NRC)	Pradeep Ramuhalli	
	Perspective on future harvesting planning	EPRI		
		DOE	Rich Reister	
		NRC	Robert Tregoning	
		MAI		Emails exchanged
		JNRA		Emails exchanged
	PANEL DISCUSSION			
	Discussion of Next Steps / Actions			

Thanks!  
 Matt

**From:** Tregoning, Robert  
**Sent:** Friday, February 10, 2017 7:27 AM  
**To:** Hiser, Matthew; Purtscher, Patrick  
**Subject:** FW: AW: AW: Interest in Harvesting Workshop

Seems like a better talk for session 1?

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:** Jendrich, Uwe Dr. [mailto:Uwe.Jendrich@grs.de]  
**Sent:** Friday, February 10, 2017 7:14 AM  
**To:** Tregoning, Robert <Robert.Tregoning@nrc.gov>  
**Cc:** Sievers, Jürgen Dr. <Juergen.Sievers@grs.de>; Hiser, Matthew <Matthew.Hiser@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>  
**Subject:** [External\_Sender] AW: AW: Interest in Harvesting Workshop

Rob,

Thank you for the information about the workshop.

I am willing to give a short presentation in session 3: Role of GRS, plants in decommissioning in Germany.

Another contact address of a state-owned company dedicated to dismantling (Greifswald (WWER 440), German research reactors, presumably involved in KWO(PWR at Obrigheim)):

EWN Entsorgungswerk für Nuklearanlagen GmbH

Postfach 1125

17507 Lubmin

Technical Director: Henry Cordes

Telefon 038354 4-5000

[henry.cordes@ewn-gmbh.de](mailto:henry.cordes@ewn-gmbh.de)

Kind regards

Uwe

---

**Von:** Tregoning, Robert [mailto:Robert.Tregoning@nrc.gov]  
**Gesendet:** Mittwoch, 8. Februar 2017 19:12  
**An:** Jendrich, Uwe Dr.  
**Cc:** Sievers, Jürgen Dr.; Hiser, Matthew; Purtscher, Patrick  
**Betreff:** RE: AW: Interest in Harvesting Workshop

Uwe:

Thanks for your reply. I'm glad you'll be attending the workshop. I've attached a presentation file that has logistical information, the overall workshop objectives, and objectives for individual sessions. Would you be willing to make a presentation in 1 or more of these sessions? In general the presentations should be short (e.g., a few slides at most for sessions 1 and 5; and at most 20 – 30 minutes for one of the other sessions) and the plan is to have everything be informal so that the preparation time is not too great and we leave plenty of time for discussion. Please let me know if you would be amenable to this and if you have any questions about the workshop.

Also, thank you for the contact information at VGB Powertech. We will certainly contact Dr. Mohrbach. Let me know if you have any luck finding any other contacts. We've currently trying to reach someone at EBnW.

Warm regards,

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:** Jendrich, Uwe Dr. [<mailto:Uwe.Jendrich@grs.de>]  
**Sent:** Wednesday, February 08, 2017 12:02 PM  
**To:** Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>  
**Cc:** Sievers, Jürgen Dr. <[Juergen.Sievers@grs.de](mailto:Juergen.Sievers@grs.de)>  
**Subject:** [External\_Sender] AW: Interest in Harvesting Workshop

Dear Rob,

Please apologize my late reply due to two weeks of   (b)(6)  
As answers to your questions:

1. I am planning to participate in the workshop. I just need the traveling permits etc.
2. I try to contact a couple of people to find out persons responsible for decommissioning. These will certainly be different for the plants from different operators. You may also try Mr. Mohrbach at the headqarter of the Association of all power plant operators (VGB Powertech, Dr. Ludger Mohrbach, Tel: +49 201 8128 221, E-Mail: [ludger.mohrbach@vgb.org](mailto:ludger.mohrbach@vgb.org). )

Kind regards

Uwe

Dr. Uwe Jendrich  
Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) gGmbH  
Abteilung Anlagenkonzepte / Plant Concepts Department  
Bereich Reaktorsicherheitsanalysen / Reactor Safety Analyses Division  
Schwertnergasse 1  
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Fax: +49 221 2068-10879  
E-Mail: [uwe.jendrich@grs.de](mailto:uwe.jendrich@grs.de)

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Geschäftsführer: Uwe Stoll, Hans J. Steinhauer  
Registergericht: Amtsgericht Köln, HRB 7665  
Sitz der Gesellschaft: Köln  
Disclaimer: [www.grs.de/content/email-disclaimer](http://www.grs.de/content/email-disclaimer)

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**Von:** Tregoning, Robert [<mailto:Robert.Tregoning@nrc.gov>]  
**Gesendet:** Montag, 30. Januar 2017 13:31  
**An:** Jendrich, Uwe Dr.  
**Cc:** Sievers, Jürgen Dr.  
**Betreff:** RE: Interest in Harvesting Workshop

Dr. Jendrich:

I just want to follow up on the information that I sent you on the Harvesting Workshop that will be held on March 7 – 8, 2017 at the U.S. NRC Headquarters in Rockville, MD USA. I have two questions that I'm hoping you can help me with.

1. Will you or a colleague from GRS attend and hopefully participate in the workshop?
2. We would like to invite a participant from a German decommissioning company. We currently have participants representing U.S. decommissioning companies but the German situation is both unique and different compared to the U.S. Is there someone in one of these companies that you can put me in touch with? I'm aware of a few companies but I would prefer not to just randomly contact them.

Thank you so much for your consideration and support of the workshop.

All the best,

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:** Tregoning, Robert  
**Sent:** Tuesday, January 17, 2017 4:56 PM  
**To:** Jendrich, Uwe Dr. <[Uwe.Jendrich@grs.de](mailto:Uwe.Jendrich@grs.de)>  
**Cc:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>; Purtscher, Patrick <[Patrick.Purtscher@nrc.gov](mailto:Patrick.Purtscher@nrc.gov)>  
**Subject:** Interest in Harvesting Workshop

Dear Dr. Jendrich:

Thank you so much for your email and your interest in getting more information about the harvesting workshop. I've attached a workshop announcement as well as a condensed workshop agenda for your information. You can see that we are planning five unique sessions as part of the workshop. Each session has a specific theme, or objective, as outlined below (and in the attached agenda).

1. Session 1 will consist of short presentations and a panel discussion on the motivation for harvesting.
2. Session 2 will discuss data needs best met through harvesting.
3. Session 3 will discuss sources of materials for harvesting programs
4. Session 4 will discuss lessons-learned from past harvesting programs and practical aspects associated with harvesting.
5. Session 5 will attempt to summarize the workshop and planning a harvesting program, as well as discuss actions and next steps

Please let me know if you have any questions or would like any additional information after reviewing the attachments. Thank you again for your interest.

Regards,

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  
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fax: 301-415-6671

---

**From:** Jendrich, Uwe Dr. [<mailto:Uwe.Jendrich@grs.de>]  
**Sent:** Monday, January 16, 2017 3:38 AM

**To:** Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>  
**Subject:** [External\_Sender] Interest in Harvesting Workshop

Dear Mr. Tregoning,

I am interested in the topic of the Harvesting Workshop.  
Can you please provide me with more detailed information.  
Thank you.

With kind regards

Uwe Jendrich

Dr. Uwe Jendrich  
Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) gGmbH  
Abteilung Anlagenkonzepte / Plant Concepts Department  
Bereich Reaktorsicherheitsanalysen / Reactor Safety Analyses Division  
Schwertnergasse 1  
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Geschäftsführer: Uwe Stoll, Hans J. Steinhauer  
Registergericht: Amtsgericht Köln, HRB 7665  
Sitz der Gesellschaft: Köln  
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Note to requester: The box with the X inside it is the Word attachment, which is immediately following.

**From:** Hiser, Matthew  
**Sent:** Tue, 18 Oct 2016 16:26:19 +0000  
**To:** Tregoning, Robert;Iyengar, Raj  
**Subject:** RE: Bi-weekly coordiantion call  
**Attachments:** Harvesting Workshop Announcement 10-17-16 .docx



Hi Raj,

Here is the latest info on the workshop. I wouldn't share the actual document just yet, but feel free to use it for verbal discussion.

Thanks!  
Matt

---

**From:** Tregoning, Robert  
**Sent:** Tuesday, October 18, 2016 12:24 PM  
**To:** Iyengar, Raj <Raj.Iyengar@nrc.gov>  
**Cc:** Hiser, Matthew <Matthew.Hiser@nrc.gov>  
**Subject:** RE: Bi-weekly coordiantion call

Raj:

Please cover the latest SLR guidance document status and plans: we're basically in the internal review and concurrence portion of the process.

Also, please provide information on the latest plans for the material harvesting workshop during the RIC. Matt can provide you with the latest information on this.

I guess I would cover PLIM as well to see what keynote speakers from NRC are going to be requested.

You also might want to mention that you'll be briefing Mike W. on SLR activities

I also presume you'll recap your AREVA trip and highlight any more of these (are there any?)

I'm sure you'll have many other things to cover ☺

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:** Iyengar, Raj  
**Sent:** Tuesday, October 18, 2016 12:18 PM  
**To:** Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>  
**Subject:** RE: Bi-weekly coordiantion call

Rob,

Thanks. Do you want me to mention anything during the call?

Raj

---

**From:** Tregoning, Robert  
**Sent:** Tuesday, October 18, 2016 12:14 PM  
**To:** Bernhoft, Sherry <[sbernhof@epri.com](mailto:sbernhof@epri.com)>; Rich Reister ([Richard.Reister@nuclear.energy.gov](mailto:Richard.Reister@nuclear.energy.gov)) <[Richard.Reister@nuclear.energy.gov](mailto:Richard.Reister@nuclear.energy.gov)>; Iyengar, Raj <[Raj.Iyengar@nrc.gov](mailto:Raj.Iyengar@nrc.gov)>  
**Cc:** Hull, Amy <[Amy.Hull@nrc.gov](mailto:Amy.Hull@nrc.gov)>  
**Subject:** RE: Bi-weekly coordiantion call

Sherry/Rich:

I've got a conflict with another meeting this afternoon and, unfortunately, will not be on this week's call.

Regards,

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  
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fax: 301-415-6671

-----Original Appointment-----

**From:** Bernhoft, Sherry [<mailto:sbernhof@epri.com>]

**Sent:** Thursday, September 29, 2016 3:52 PM

**To:** Bernhoft, Sherry; Rich Reister ([Richard.Reister@nuclear.energy.gov](mailto:Richard.Reister@nuclear.energy.gov)); Tregoning, Robert; Iyengar, Raj

**Cc:** Hull, Amy

**Subject:** [External\_Sender] Bi-weekly coordiantion call

**When:** Tuesday, October 18, 2016 2:00 PM-3:00 PM (UTC-05:00) Eastern Time (US & Canada).

**Where:** 1-855-797-9485 PIN   (b)(6)

Please note new conference call #

Thanks

Sherry

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# Ex-Plant Materials Harvesting Workshop

**Location:** NRC HQ in Rockville, MD

**Potential Dates:**

- March 16-17, 2017 – Thursday/Friday of RIC week
- March 20-21, 2017 – Monday/Tuesday after RIC

**Motivation:**

- There are increasing opportunities to harvest the safety-critical components from decommissioning plants, both domestic and international.
- The harvested materials are valuable because they have been exposed to actual in-service plant operating conditions (temperature, irradiation, coolant, etc.), unlike virgin materials tested under simulated conditions in the lab.

**Purpose and Objective:**

- For NRC staff and interested stakeholders to have greater awareness and knowledge of the benefits and challenges associated with ex-plant harvesting.
- Facilitate contacts and communication to enable specific cooperative ex-plant harvesting programs to be initiated.

**Workshop Topics:**

- Harvesting decision-making and prioritization
  - Technical data needs best addressed by harvesting
  - Technical information needed in advance of harvesting
- Sources of materials:
  - Decommissioning reactors
  - Operating reactors – replaced components
  - Previous harvesting programs – “boneyards”
  - Tracking available materials
- Harvesting process
  - Lessons learned from harvesting experience
  - Perspective of utility-owner and decommissioning contractor on harvesting
  - Communication and coordination between decommissioning and researchers
- International collaborative programs on specific components at specific plants

**From:** Frankl, Istvan  
**Sent:** Wed, 6 Dec 2017 14:23:40 +0000  
**To:** Hiser, Matthew  
**Cc:** Audrain, Margaret; Purtscher, Patrick  
**Subject:** RE: DE Briefing on Harvesting  
**Attachments:** Harvesting One Pager 12-1-17 (IF).docx  
**Importance:** High

Note to requester: Attachment is immediately following.
---

Matt,

I have attached my revisions and comments.

Are you planning to draft slides as well? Please see my comment on this in the attachment.

Also, Chris declined the briefing scheduled for Monday. Usually, briefings like this cannot be completed in less than an hour. I would have liked the briefing to take place before the ANL trip but please try to reschedule to address Chris' request.

Thanks,

Steve

---

**From:** Hiser, Matthew  
**Sent:** Friday, December 01, 2017 3:33 PM  
**To:** Frankl, Istvan <Istvan.Frankl@nrc.gov>; Tregoning, Robert <Robert.Tregoning@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>; Audrain, Margaret <Margaret.Audrain@nrc.gov>  
**Subject:** DE Briefing on Harvesting

Hi Steve,

I have attached a draft one-pager that could be used to brief Brian and Chris on the harvesting efforts in the context of their questions regarding the ANL travel. Do you mind if I go ahead and schedule something with them for next week?

Meg, Pat, and Rob, please feel free to edit / comment on this draft one-pager as necessary.

Thanks!  
Matt

## Ex-Plant Materials Harvesting UpdateOne-Pager

### Motivation and Objective:

- Ex-plant materials are valuable for confirmatory testing because they have been exposed to actual in-service plant operating conditions (temperature, irradiation, coolant, etc.)
  - Generally, research involves accelerated, simulated aging conditions in a lab which may not be as representative of actual in-service aging
  - Highly representative materials (actual plant components) and aging conditions reduces the uncertainty associated with the applicability of research findings.
- With plants shutting down both in the U.S. and Europe, there are increasing opportunities to harvest components from decommissioning plants.
- Insights from ex-plant harvesting would support regulatory decisions for subsequent license renewal (SLR), and could have implications for the current license period
  - There is a task in the new UNR for SLR from NRR/DLR requesting RES to investigate opportunities for harvesting where appropriate.

**Commented [F11]:** Please summarize full scope of this task including related database.

### Past Activities:

- Workshop in March 2017
  - NRC staff hosted a 2-day workshop with interested stakeholders, including domestic and international utilities and research organizations, to discuss benefits and challenges associated with ex-plant harvesting.
  - Sessions covered motivation for harvesting, data needs, sources of materials, lessons learned, the practical aspects of harvesting, and harvesting decision-making and planning
  - The discussion focused on the importance of clearly identifying the need and purpose for performing a harvesting project. All participants agreed harvesting is a complex and expensive proposition, but one that can be worthwhile if the need is clearly defined and addressed.
- PNNL Report on Harvesting Criteria
  - PNNL has produced a draft final report for NRC on criteria for harvesting decision-making and planning
  - Provides overview of past harvesting efforts and lessons learned as well as suggestions for approach to prioritize data needs for harvesting
- PLIM
  - NRC staff provided a presentation, poster, and paper for the recent PLiM conference in October 2017.

### Path Forward:

- Focused on two parallel efforts:
  - Developing alignment within NRC on prioritization of harvesting data needs
    - Use criteria identified in PNNL report to establish effective prioritization scheme for relevant areas: RPV, RPV internals and other metals, electrical components, concrete
  - Developing a database identifying sources of materials for harvesting
    - Start with lab-based "boneyards" of prior harvested materials
      - Visits to ANL, PNNL, and ORNL (leveraged with already planned travel) support this activity
    - Coordinate with DOE NSUF Nuclear Fuel and Materials Library (NFML) run by INL as appropriate and beneficial

**Commented [F12]:** Please mention above that this is supported by the SLR UNR.

**Commented [F13]:** This needs to be expanded in this one-pager or on separate slides to address DE management comments/questions on the ANL and follow-on trips (please see my prior email on this).

**Commented [F14]:** There is no approved travel to ORNL in 2018.

Note to requester: Attachment is immediately following.

**From:** Hiser, Matthew  
**Sent:** Wed, 6 Dec 2017 16:21:28 +0000  
**To:** Frankl, Istvan  
**Cc:** Audrain, Margaret; Purtscher, Patrick  
**Subject:** RE: DE Briefing on Harvesting  
**Attachments:** Harvesting One Pager 12-6-17 (IF) mah.docx

Hi Steve,

If it's OK with you, I'd prefer to keep it to a one-pager (or 1+ pager) and not go to the effort making slides. My updated one-pager addressing your comments / accepting your edits is attached.

I scheduled this for 30 minutes at Rob's suggestion. He didn't think they would need longer than that, although perhaps this is new material for Chris. Brian accepted the meeting request for Monday, but I will try to reschedule, perhaps for Friday the 15th if you will be in the office. That shows free on everyone's calendar. I'll work with the AAs. (Meg and Pat, can you do next Friday?)

Thanks!  
Matt

---

**From:** Frankl, Istvan  
**Sent:** Wednesday, December 06, 2017 9:24 AM  
**To:** Hiser, Matthew <Matthew.Hiser@nrc.gov>  
**Cc:** Audrain, Margaret <Margaret.Audrain@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>  
**Subject:** RE: DE Briefing on Harvesting  
**Importance:** High

Matt,

I have attached my revisions and comments.

Are you planning to draft slides as well? Please see my comment on this in the attachment.

Also, Chris declined the briefing scheduled for Monday. Usually, briefings like this cannot be completed in less than an hour. I would have liked the briefing to take place before the ANL trip but please try to reschedule to address Chris' request.

Thanks,

Steve

---

**From:** Hiser, Matthew  
**Sent:** Friday, December 01, 2017 3:33 PM  
**To:** Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>; Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>; Purtscher, Patrick <[Patrick.Purtscher@nrc.gov](mailto:Patrick.Purtscher@nrc.gov)>; Audrain, Margaret <[Margaret.Audrain@nrc.gov](mailto:Margaret.Audrain@nrc.gov)>  
**Subject:** DE Briefing on Harvesting

Hi Steve,

I have attached a draft one-pager that could be used to brief Brian and Chris on the harvesting efforts in the context of their questions regarding the ANL travel. Do you mind if I go ahead and schedule something with them for next week?

Meg, Pat, and Rob, please feel free to edit / comment on this draft one-pager as necessary.

Thanks!

Matt

## Ex-Plant Materials Harvesting Update

### Motivation and Objective:

- Ex-plant materials are valuable for confirmatory testing because they have been exposed to actual in-service plant operating conditions (temperature, irradiation, coolant, etc.)
  - Generally, research involves accelerated, simulated aging conditions in a lab which may not be as representative of actual in-service aging
  - Highly representative materials (actual plant components) and aging conditions reduces the uncertainty associated with the applicability of research findings.
- With plants shutting down both in the U.S. and Europe, there are increasing opportunities to harvest components from decommissioning plants.
- Insights from ex-plant harvesting would support regulatory decisions for subsequent license renewal (SLR), and could have implications for the current license period
  - There is a task in the new UNR for SLR from NRR/DLR requesting RES to investigate opportunities for harvesting where appropriate.

• Requests RES to develop a database to prioritize needs best addressed by harvesting and develop a process to evaluate the suitability of materials available for harvesting

**Commented [F11]:** Please summarize full scope of this task including related database.

### Past Activities:

- Workshop in March 2017
  - NRC staff hosted a 2-day workshop with interested stakeholders, including domestic and international utilities and research organizations, to discuss benefits and challenges associated with ex-plant harvesting.
  - Sessions covered motivation for harvesting, data needs, sources of materials, lessons learned, the practical aspects of harvesting, and harvesting decision-making and planning
  - The discussion focused on the importance of clearly identifying the need and purpose for performing a harvesting project. All participants agreed harvesting is a complex and expensive proposition, but one that can be worthwhile if the need is clearly defined and addressed.
- PNNL Report on Harvesting Criteria
  - PNNL has produced a draft final report for NRC on criteria for harvesting decision-making and planning
  - Provides overview of past harvesting efforts and lessons learned as well as suggestions for approach to prioritize data needs for harvesting
- PLIM
  - NRC staff provided a presentation, poster, and paper for the recent PLIM conference in October 2017.

### Path Forward:

- Focused on two parallel efforts:
  - Developing alignment within NRC on prioritization of harvesting data needs
    - Use criteria identified in PNNL report to establish effective prioritization scheme for relevant areas: RPV, RPV internals and other metals, electrical components, concrete
  - Developing a database identifying sources of materials for harvesting as requested in UNR
    - Start with lab-based "boneyards" of prior harvested materials
    - "Low-hanging fruit" opportunities before tackling more challenging prospect of decommissioning plants

**Commented [F12]:** Please mention above that this is supported by the SLR UNR.

**Commented [F13]:** This needs to be expanded in this one-pager or on separate slides to address DE management comments/questions on the ANL and follow-on trips (please see my prior email on this).

**Commented [HM4R4]:** I added a little more detail here. Chris' question was how this fits into the broader strategy. I think the full one-pager helps explain that. We'll probably also bring our example "data needs prioritization" table for them to look at as well to help things make more sense.

- Visits to ANL, PNNL, and ORNL (leveraged with already planned travel) support this activity
- Coordinate with DOE NSUF Nuclear Fuel and Materials Library (NFML) run by INL as appropriate and beneficial to leverage limited NRC resources

**Commented [F15]:** There is no approved travel to ORNL in 2018.

**Commented [HM6R6]:** Meg and I are approved to attend the ICG-EAC in Knoxville in April 2018.

**From:** Hiser, Matthew  
**Sent:** Thu, 10 Nov 2016 21:14:52 +0000  
**To:** Ramuhalli, Pradeep; Purtscher, Patrick  
**Subject:** RE: Draft report  
**Attachments:** Workshop Agenda 11-4-16.docx

Note to requester: Attachment is immediately following.

Hi Pradeep,

Thank you for the update today. We will take a look at the report and provide you feedback and understand you will be fleshing out a couple sections a bit more.

I have attached the current draft agenda for the harvesting workshop for your information and any comments or suggestions.

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:** Ramuhalli, Pradeep [mailto:Pradeep.Ramuhalli@pnnl.gov]  
**Sent:** Thursday, November 10, 2016 3:17 PM  
**To:** Hiser, Matthew <Matthew.Hiser@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>  
**Subject:** [External\_Sender] Draft report

Matt, Pat,

The attached document is a draft and should be treated as such. As discussed, the document is missing some references, and is awaiting some input for the sections on information tools for harvesting. Also note that the section on examples is being rewritten to homogenize the language.

Any feedback on the updates is appreciated.

On the other items:

- We would prefer to combine the report and the workshop summary and issue a single report. This should help with managing costs associated with producing the report, and will ensure that the report includes the latest information from the workshop.
- I will work with our financial specialists to see where we stand on spending to date and anticipated costs through January. I will touch base with Pat on Monday about this.
- As discussed, it would be helpful to have two people from PNNL (me, plus our materials SME) attend the workshop. This (and the associated planning and post-workshop summary generation) will require a modification to the scope and costs on the contract.

Please let me know when you receive this.

With best regards,

Pradeep

---

Pradeep Ramuhalli, PhD  
Senior Research Scientist,  
Applied Physics Group  
Pacific Northwest National Laboratory  
902 Battelle Blvd.  
P.O.Box 999, MSIN K5-26  
Richland, WA 99352  
Tel: 509-375-2763  
Email: [pradeep.ramuhalli@pnnl.gov](mailto:pradeep.ramuhalli@pnnl.gov)  
<http://www.pnnl.gov>

## Draft Agenda – March 7-8, 2017 Harvesting Workshop

**Tuesday, March 7, 2017**

### Introduction

- NRC overview of workshop purpose and objectives 8:00 – 8:10

### Session 1: Lessons learned from harvesting experience

- EPRI Perspective on Harvesting Lessons Learned 8:10 – 8:45
  - Zorita, Baffle Bolts, Barsebeck, etc.
- DOE Perspective on Harvesting Lessons Learned 8:45 – 9:20
  - Zion, etc.
- NRC Perspective on Harvesting Lessons Learned 9:20 – 9:50
  - Shoreham, St. Lucie, Zorita, Zion, etc.

BREAK 9:50 – 10:05

- Japan – JNES / JNRA 10:05 – 10:40
  - International Perspective on Harvesting Lessons Learned

DISCUSSION 10:40 – 11:30

LUNCH 11:30 – 12:30

### Session 2: Technical data needs best addressed by harvesting

- PNNL/NRC 12:30 – 12:55
  - Overview of data needs best addressed by harvesting
- Belgium - Tractebel 12:55 – 1:20
  - Perspective on harvesting data needs, particularly RPV
- Korea – KAERI? 1:20 – 1:45
  - Perspective on harvesting data needs, Kori plant
- Switzerland – ENSI or PSI? 1:45 – 2:10
  - Perspective on harvesting data needs, Muhleberg

DISCUSSION 2:10 – 2:45

BREAK 2:45 – 3:00

### Session 3: Sources of Materials

- NRC 3:00 – 3:15
  - Available materials from decommissioning plants and past harvesting programs
- EPRI / NEI 3:15 – 3:45
  - Available materials from operating reactors and past harvesting programs
- DOE (ORNL?) 3:45 – 4:15
  - Available materials at DOE labs from past harvesting programs
- IAEA ? 4:15 – 4:45
  - International harvesting opportunities

DISCUSSION 4:45 – 5:30

**Wednesday, March 8, 2017**

**Session 4: Practical aspects of Harvesting**

- US decommissioning company 8:00 – 8:40
  - Decommissioning process vs. harvesting: schedule, site-specific, timing for different components
- International decommissioning company – Germany? 8:40 – 9:20
  - Decommissioning and harvesting plans and experience
- US utility 9:20 – 10:00
  - Decommissioning process and plans
  - Owner perspective on harvesting and decommissioning

BREAK 10:00 – 10:15

- Researcher perspective – EPRI or DOE or international 10:15 – 10:45
  - Practical challenges to plan for and carry out harvesting

DISCUSSION 10:45 – 11:45

LUNCH 11:45 – 12:45

**Session 5: Harvesting Decision-making**

- PNNL / NRC 12:45 – 1:15
  - Technical information needed for informed harvesting decisions
- EPRI/NEI 1:15 – 1:45
  - Balancing costs and benefits to ensure value from harvesting
- DOE 1:45 – 2:15
  - Applying past experience to future harvesting decisions
- International - ? 2:15 – 2:45
  - Harvesting decision-making
- DISCUSSION 2:45 – 4:00
  - Potential harvesting partnerships
    - RPV, internals, piping, concrete, cables
    - US, international opportunities

## Discussion Topics

- Harvesting decision-making and prioritization
  - Technical data needs best addressed by harvesting
  - Technical information needed in advance of harvesting
- Sources of materials:
  - Decommissioning reactors
  - Operating reactors – replaced components
  - Previous harvesting programs – “boneyards”
  - Tracking available materials
- Harvesting process
  - Lessons learned from harvesting experience
  - Perspective of utility-owner and decommissioning contractor on harvesting
  - Communication and coordination between decommissioning and researchers
- International collaborative programs on specific components at specific plants

**From:** Moyer, Carol  
**Sent:** Wed, 21 Feb 2018 12:49:52 +0000  
**To:** Hull, Amy  
**Subject:** RE: draft SLR one-pager Feb2018.docx  
**Attachments:** SLR one-pager Feb2018\_cem.docx

Note to requester: Attachment is immediately following.
---

Amy,

You packed a lot of information into two pages – that's great. I made some editorial suggestions in the attached.

Carol

---

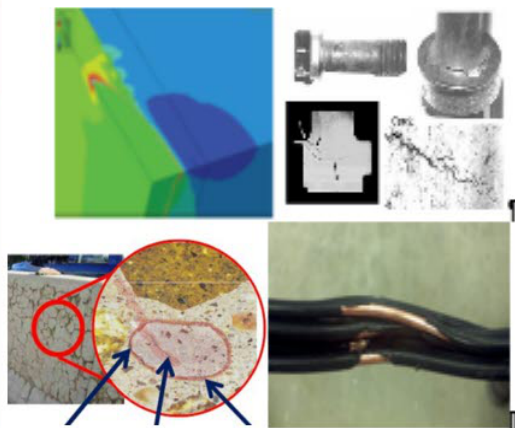
**From:** Hull, Amy  
**Sent:** Tuesday, February 20, 2018 5:20 PM  
**To:** Frankl, Istvan <Istvan.Frankl@nrc.gov>  
**Cc:** Moyer, Carol <Carol.Moyer@nrc.gov>  
**Subject:** draft SLR one-pager Feb2018.docx

Draft document, The quad chart I made in the upper left hand corner of document needs some finessing. Please take a look.

## Research to Support the Review of Subsequent License Renewal Applications

**Issue:** As nuclear power plants (NPPs) age, components degrade due to exposure to temperature, neutron irradiation, stress, and/or corrosive media. Research is being conducted to understand the causes and control of degradation mechanisms and provide reasonable assurance of safe operation as NPPs age, particularly beyond the first extended operating period and into subsequent license renewal (SLR).

Fig 1: From top left, clockwise: representation of the four most significant technical issues: RPV embrittlement, IAD of baffle bolt in PWR; concrete degradation, and cable aging.



### Key Messages:

- The NRC [Office of Nuclear Regulatory Research \(RES\)](#) staff continues to work with the industry, Department of Energy (DOE), and Electric Power Research Institute (EPRI) to leverage research to ensure that aging effects will be adequately managed during the 60 to 80 year operating period.
- RES staff is collaborating with EPRI's Long-Term Operations (LTO) program and DOE's Light Water Reactor Sustainability (LWRS) staff on SLR-related research topics. The four most significant technical issues as identified in the SRM on SECY 14-006 (ADAMS ML 14241A578) are reactor pressure vessel (RPV) neutron embrittlement, irradiation-assisted degradation (IAD) in reactor internals, concrete degradation, and electrical cable qualification and condition assessment.
- The SLR guidance documents were completed in 2017-2018 and consist of 2693 pages in 4 reports (NUREG-2191, 2192, 2221, and 2222); significant progress has been made in addressing the key technical issues therein.
- SLR applicants may need to augment their aging management plans to address these issues in their applications, unless and until a generic safety basis can be established through this ongoing research.
- The first SLR application was received in late January 2018, from Florida Power & Light for Turkey Point. Near-term research will inform staff reviews of the initial SLR applications.
- Long-term confirmatory research will augment the technical basis for updating regulatory guidance in the future, as necessary, and inform staff reviews of future SLR applications.

### Background:

- Working together, [NRR](#) and RES conducted three audits to investigate the effectiveness of aging management programs (AMPs) used in the plant operating period from 40 to 60 years. The findings from the audits ~~is~~ are documented in the ~~TLR~~ "Review of Aging Management Programs: Compendium of Insights from License Renewal Applications and from AMP Effectiveness Audits Conducted to Inform Subsequent License Renewal Guidance Documents," (ADAMS Accession No. ML16167A076).
- RES also completed the Expanded Materials Degradation Assessment (EMDA) in cooperation with the DOE LWRS Program. The resultant reports, NUREG/CR-7153, EMDA, Vol. 1-5 (ADAMS ML14279A321, ML14279A331, ML14279A349, ML14279A430, and ML14279A461), describe the conclusions from an expert elicitation process to identify the most significant aging degradation

**Commented [CM1]:** Is this intended to be only an NRC-internal document? If so, RES and NRR may be OK without definitions.

**Commented [CM2]:** TLR is undefined. I suggest either "in the report" or simply "in."

February 2018

technical issues for nuclear power reactor operation beyond 60 years.

- The [AMP](#) audits and EMDA volumes provided NRC with over 800 suggestions for changes to the license renewal guidance and aging management program activities found acceptable for operation from 60 to 80 years.
- To support their SLR applications, applicants need to demonstrate that the effects of aging will be adequately managed for an operating period from 60 to 80 years. RES was requested (UNR-2017-006) to assist NRR in holding meetings on these issues, participating and interacting with the DOE and other industry organizations, cataloging the materials needed for research, and documenting the status and products of research for SLR.

#### Current Status:

RES has ongoing activities in the following categories, as described in UNR-3017-006 (ML 17227A483):

- **Task 1:** Hold NRC/industry workshops on the status of research activities to address and evaluate aging degradation issues identified in the SRM on SECY 14-0016 and in NUREG-2191.
- **Task 2:** Develop and implement a long-term strategy for obtaining information on materials degradation from decommissioned NPPs, as well as from ex-plant components harvested from operating plants.
- **Task 3:** Continue to develop domestic and international partnerships to share expertise, capabilities, and resources related to aging management research.
- **Task 4:** Periodically evaluate significant technical issues germane to review of SLR applications.
- **Task 5:** Provide expert assistance, as requested, with reviewing SLR applications

#### Next Steps/Path-Forward:

- RES will continue to provide NRR with information from the research programs and make recommendations regarding potential impacts to regulatory or inspection criteria.
- RES interfaces with other international efforts, such as the International Forum for Reactor Aging Management (IFRAM), and participates in technical meetings focused on some elements of proactive management of materials degradation. These efforts leverage ~~the~~ highly-skilled resources [outside the NRC](#) to support RES goals in SLR research.
- RES/DE and NRR/DMLR are identifying research vehicles to address any technical gaps. The SRM-SECY-2014-0016 emphasized *"the need to strive for satisfactory resolution of these issues prior to the NRC beginning a review of any SLR application."*
- RES staff continues to interact with the DOE-LWRS Program, EPRI's LTO initiatives, and IFRAM to monitor relevant developments and, where appropriate, [to](#) engage in joint research activities. The NRC staff is performing the necessary confirmatory research to support timely and efficient reviews of future SLR applications.



#### Contact Information:

Amy Hull and Carol Moyer  
Senior Materials Engineers  
Corrosion and Metallurgy Branch  
Division of Engineering  
Office of Nuclear Regulatory Research

Fig 2: Florida Power & Light Co. (FPL) officially submitted [the](#) first subsequent license renewal application on January 30, 2018 for Turkey Point Nuclear Generating Units 3 and 4 in accordance with general information required by 10 CFR 54.17 and 10 CFR 54.19 and technical information required by 10 CFR 54.21, 10 CFR 54.22, and 10 CFR 54.23.

Note to requester: The attachments are immediately following.

**From:** Tregoning, Robert  
**Sent:** Mon, 9 Jan 2017 06:00:18 -0600  
**To:** Bernhoft, Sherry  
**Cc:** Dyle, Robin;Hiser, Matthew  
**Subject:** RE: Final agenda for Harvesting workshop  
**Attachments:** Harvesting Workshop Announcement.docx, Workshop Agenda 12-12-16.docx

Sherry:

The announcement and agenda that I sent you previously are the latest ones. I've attached both again FYI. The announcement won't change further. The final agenda is still evolving. We won't have a final agenda until we identify all the speakers and titles of talks. I'm shooting for the end of January to pin down most of these details.

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:** Bernhoft, Sherry [mailto:sbernhoft@epri.com]  
**Sent:** Sunday, January 08, 2017 9:55 AM  
**To:** Tregoning, Robert <Robert.Tregoning@nrc.gov>  
**Cc:** Dyle, Robin <rdyle@epri.com>  
**Subject:** [External\_Sender] Final agenda for Harvesting workshop

Rob

Hope you are off to a good start for the New Year

Do you have the final announcement and agenda for the Harvesting Workshop?

Sherry Bernhoft  
**Electric Power Research Institute**  
EPRI, Senior Program Manager  
1300 West WT Harris Boulevard | Charlotte, NC 28262  
704.595.2740 (office)

(b)(6)

[REDACTED] (cell)  
Email: [sbernhoft@epri.com](mailto:sbernhoft@epri.com)  
[www.epri.com](http://www.epri.com)

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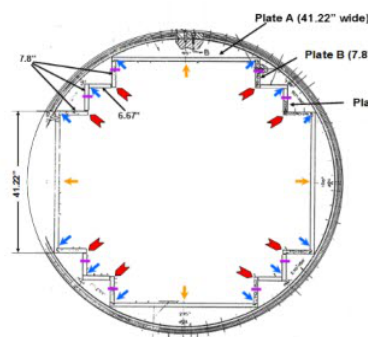
# Ex-Plant Materials Harvesting Workshop

**Location:** NRC Headquarters in Rockville, MD, USA

**Dates:** March 7-8, 2017

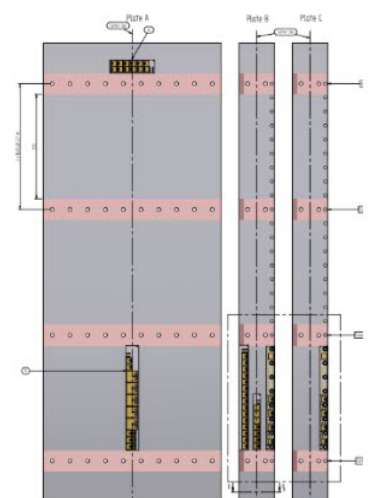
**Motivation:**

- There are increasing opportunities to harvest the safety-critical components from decommissioning plants, both domestic and international.
- The harvested materials are valuable because they have been exposed to actual in-service plant operating conditions (temperature, irradiation, coolant, etc.), unlike virgin materials tested under simulated conditions in the lab.
- Data from ex-plant materials should help address technical gaps identified for extended operation of nuclear power plants due to highly relevant aging conditions.



### Purpose and Objective:

- For NRC staff and interested stakeholders to have greater awareness and knowledge of the benefits and challenges associated with ex-plant harvesting.
- Facilitate contacts and communication to enable specific cooperative ex-plant harvesting programs to be initiated.



### Workshop Topics:

- Harvesting decision-making and prioritization
  - Technical data needs best addressed by harvesting
  - Technical information needed in advance of harvesting
- Sources of materials:
  - Decommissioning reactors
  - Operating reactors – replaced components
  - Previous harvesting programs – “boneyards”
  - Tracking available materials
- Harvesting process
  - Lessons learned from harvesting experience
  - Perspective of utility-owner and decommissioning contractor on harvesting
  - Communication and coordination between decommissioning and researchers
- International collaborative programs on specific components at specific plants

Workshop will consist of solicited presentations followed by discussion periods. If interested in attending or learning more about the workshop, please reach out to the contacts below.

**Contacts:** Robert Tregoning, [Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)  
Matthew Hiser, [Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)  
Patrick Purtscher, [Patrick.Purtscher@nrc.gov](mailto:Patrick.Purtscher@nrc.gov)

## Draft Agenda – March 7-8, 2017 Harvesting Workshop

**Tuesday, March 7, 2017**

### Introduction

- Overview of workshop purpose and objectives 8:00 – 8:15
  - NRC

### Session 1: Motivation for Harvesting 8:15 – 9:45

- Why our organization is interested in harvesting (short, 5-10 min presentations)
  - EPRI
  - DOE
  - NRC
  - MAI or JRC
  - JNRA
- PANEL DISCUSSION with prepared questions

BREAK 9:45 - 10:00

### Session 2: Technical data needs best addressed by harvesting 10:00 – 12:00

- Overview of data needs best addressed by harvesting
  - NRC/PNNL
- Perspective on detailed data needs from harvesting
  - DOE
  - EPRI
  - MAI or JRC

LUNCH 12:00 – 1:00

- Perspective on harvesting data needs 1:00 – 2:15
  - JNRA
- DISCUSSION

BREAK 2:15 – 2:30

### Session 3: Sources of Materials 2:30 – 5:30

- Available materials from decommissioning plants and past harvesting programs
  - NRC
- Available materials from operating reactors and past harvesting programs
  - EPRI
- Available materials at DOE labs from past harvesting programs
  - DOE (ORNL?)
- International sources of materials
  - IAEA?
- DISCUSSION

**Wednesday, March 8, 2017**

**Session 4:** Harvesting Experience: Lessons learned and practical aspects 8:00 – 12:00

- Perspective on Harvesting Lessons Learned / Prior Experience
  - EPRI
  - DOE
  - NRC
- Decommissioning process vs. harvesting: schedule, site-specific, timing for different components
  - US decommissioning company (Energy Solutions)
- Decommissioning and harvesting plans and experience
  - International decommissioning company (Germany?)
- Owner perspective on harvesting and decommissioning
  - US utility (Dominion/Kewaunee, other?)
- DISCUSSION

LUNCH 12:00 – 1:00

**Session 5:** Future Harvesting Program Planning 1:00 – 4:00

- Technical information needed for informed harvesting decisions
  - NRC/PNNL
- DISCUSSION of Next Steps / Actions
- Perspective on future harvesting planning
  - EPRI
  - NRC
  - DOE
  - MAI or JRC
  - JNRA
- PANEL DISCUSSION with prepared questions

Note to requester:  
Attachments are  
immediately following.

**From:** Frankl, Istvan  
**Sent:** Tue, 3 Oct 2017 08:40:58 -0600  
**To:** Hiser, Matthew  
**Cc:** Purtscher, Patrick; Moyer, Carol  
**Subject:** RE: For Review: Harvesting Poster for PLiM  
**Attachments:** Harvesting NRC Poster for PLiM\_cem\_ptp (IF).pptx,  
PLiM2017\_HarvestingPoster\_Hiser\_F390 (IF).pdf, NRC 665 Harvesting Poster (IF).pdf  
**Importance:** High

Matt,

Thanks for the reminder. Somehow I did not flag this action on my calendar last week.

I completed my review. The poster looks good. (I only finalized minor fixes that were shown with strikeout.)

Please ask the AAs to put the poster in ADAMS with delayed public release (the date should be specified in form 665 and should correspond to the date of the conference). This will make it easier to make changes to the document before the conference.

Meg has recent experience with publishing posters, so please reach out to her for advice on how to get this done ASAP.

Thanks,

Steve

---

**From:** Moyer, Carol  
**Sent:** Thursday, September 28, 2017 2:30 PM  
**To:** Frankl, Istvan <Istvan.Frankl@nrc.gov>  
**Cc:** Hiser, Matthew <Matthew.Hiser@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>  
**Subject:** For Review: Harvesting Poster for PLiM

Steve,

Matt created the attached Harvesting poster for the PLiM conference. The attached version includes some minor edits by Pat and myself.

Carol

---

**From:** Hiser, Matthew  
**Sent:** Friday, September 15, 2017 11:07 AM  
**To:** Moyer, Carol <Carol.Moyer@nrc.gov>; Hull, Amy <Amy.Hull@nrc.gov>  
**Cc:** Purtscher, Patrick <Patrick.Purtscher@nrc.gov>  
**Subject:** RE: FW: PLiM abstract on harvesting

Hi Amy and Carol,

Here's my initial stab at the harvesting poster for PLiM.

Please take a look and let me know what you think.

Thanks!

Matt

---

**From:** Moyer, Carol

**Sent:** Friday, July 21, 2017 11:26 AM

**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>; Hull, Amy <[Amy.Hull@nrc.gov](mailto:Amy.Hull@nrc.gov)>

**Subject:** RE: FW: PLiM abstract on harvesting

Thank you both!

The conference website is here: <http://www-pub.iaea.org/iaeaemeetings/50811/Fourth-International-Conference-on-Nuclear-Power-Plant-Life-Management>

Poster guidelines are here: <http://www-pub.iaea.org/MTCD/Meetings/PDFplus/2017/cn246/cn246PosterGuidelines.pdf>

No specific due date is listed for posters.

**M. Key Dates and Deadlines**

Submission of Form for Submission of a Paper (Form B)  
and extended synopsis (800 words) 28 May 2017

Submission of Grant Application Form (Form C): 28 May 2017

Notification of acceptance of papers/posters: 30 June 2017

Submission of full paper (only upon request by the IAEA): 18 October 2017

Posters may only be "due" at the conference itself? It would not hurt to have it done by 18 Oct., the paper deadline, though. It is unclear to me what they would do with a full paper, if one was not requested by IAEA. But I think you can prepare one, if you like. If they will not publish it as part of PLiM, we can find another home for it, or just release it as an NRC document.

-Carol

---

**From:** Hiser, Matthew

**Sent:** Friday, July 21, 2017 11:12 AM

**To:** Hull, Amy <[Amy.Hull@nrc.gov](mailto:Amy.Hull@nrc.gov)>; Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>

**Subject:** RE: FW: PLiM abstract on harvesting

OK, I can work with Amy to make a poster. Rob and Pat and our PNNL contractor are also listed as co-authors...

---

**From:** Hull, Amy

**Sent:** Friday, July 21, 2017 11:08 AM

**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>; Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>

**Subject:** RE: FW: PLiM abstract on harvesting

I think this is a good opportunity to publicize harvesting work and develop collaboration. Task 2 in UNR. I will make the poster. When is it due?

---

**From:** Moyer, Carol  
**Sent:** Friday, July 21, 2017 10:57 AM  
**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>; Hull, Amy <[Amy.Hull@nrc.gov](mailto:Amy.Hull@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

I'm pretty ambivalent about it. Amy, do you have a strong desire to make up a poster for the PLiM? Are there other co-authors to be consulted?

-Carol

---

**From:** Hiser, Matthew  
**Sent:** Friday, July 21, 2017 7:28 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

Hi Carol,

Not terribly interested in a poster... The other thing is then you'd have to babysit the poster during poster session(s)?

I'd suggest we say thanks for the offer, but that's alright... what do you think?

Thanks!  
Matt

---

**From:** Moyer, Carol  
**Sent:** Thursday, July 20, 2017 12:49 PM  
**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>  
**Subject:** FW: FW: PLiM abstract on harvesting

Matt,

I am a bit confused by the pronoun used in this email...

Are you interested in doing a poster instead?

Carol

---

**From:** KRIVANEK, Robert [<mailto:R.Krivanek@iaea.org>]  
**Sent:** Thursday, July 20, 2017 11:10 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** [External\_Sender] FW: PLiM abstract on harvesting

You have just agreed that we will add this paper to poster session.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |

LTO Programme Manager

Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |

[International Atomic Energy Agency](#) | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |

Email: [r.krivanek@iaea.org](mailto:r.krivanek@iaea.org) | T: (+43-1) 2600-22018 | F: (+43-1) 2600-26007 |



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**From:** KRIVANEK, Robert

**Sent:** Thursday, 20 July 2017 16:10

**To:** 'Carol.Moyer@nrc.gov' <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>

**Subject:** FW: PLiM abstract on harvesting

Dear Carol,

We asked you to submit your synopsis through INDICO (see email below) but it did not happen. So we were not able to send your synopsis to programme committee for evaluation and it will not occur on the conference programme.

Sorry for that but there are currently 300 delegates and 150 synopsis, so we were not able to track each of them separately.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |

LTO Programme Manager

Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |

**International Atomic Energy Agency** | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |

Email: [r.krivanek@iaea.org](mailto:r.krivanek@iaea.org) | T: (+43-1) 2600-22018 | F: (+43-1) 2600-26007 |



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---

**From:** KRIVANEK, Robert  
**Sent:** Friday, 26 May 2017 08:55  
**To:** 'Carol.Moyer@nrc.gov' <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Cc:** KHAELSS, Martina <[M.Khaelss@iaea.org](mailto:M.Khaelss@iaea.org)>  
**Subject:** FW: PLiM abstract on harvesting

Dear Carol,

Thank you for your synopsis. We have opened INDICO system for this week, so please submit it through the system.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |  
LTO Programme Manager  
Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |  
[International Atomic Energy Agency](http://www.iaea.org) | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |  
Email: [r.krivanek@iaea.org](mailto:r.krivanek@iaea.org) | T: (+43-1) 2600-22018 | F: (+43-1) 2600-26007 |



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---

**From:** [Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov) [<mailto:Carol.Moyer@nrc.gov>]

**Sent:** Friday, 26 May 2017 00:19

**To:** KRIVANEK, Robert <[R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)>

**Cc:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>; Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>; Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>

**Subject:** PLiM abstract on harvesting

Dear Mr. Krivanek,

The US NRC would like to propose one more presentation for this autumn's PLiM conference, on harvesting of materials from operating and decommissioning power plants. I understand

from Sherry Bernhoft that you already have an impressive number of abstracts, so I will understand if there is not room in the program for this one. Nevertheless, we would appreciate your consideration of this proposal.

Again, please let me know if you need any additional information. Many thanks,

Carol

---

*Carol E. Moyer*  
*Sr. Materials Engineer*  
*Office of Nuclear Regulatory Research*  
*RES/DE/CMB*  
[carol.moyer@nrc.gov](mailto:carol.moyer@nrc.gov)  
301-415-2153

---

**From:** KRIVANEK, Robert [<mailto:R.Krivanek@iaea.org>]  
**Sent:** Tuesday, May 23, 2017 2:41 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** [External\_Sender] RE: RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear Carol,

I will arrange it. Thank you.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |  
LTO Programme Manager  
Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |  
**International Atomic Energy Agency** | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |  
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**From:** [Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov) [<mailto:Carol.Moyer@nrc.gov>]

**Sent:** Monday, 22 May 2017 20:44

**To:** KRIVANEK, Robert <[R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)>

**Subject:** RE: RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear Mr. Krivanek,

Since the formal deadline for abstract submissions has passed, I am no longer able to access the Indico system through the PLiM website (<https://conferences.iaea.org/indico/event/134/>).

My abstract and Form B are attached.

Are you able to work with these documents? Is there anything else that you need me to do at this time?

Thanks again for your patience and assistance,  
Carol

---

**From:** Moyer, Carol  
**Sent:** Monday, May 22, 2017 10:59 AM  
**To:** 'KRIVANEK, Robert' <[R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)>  
**Cc:** Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>  
**Subject:** RE: RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear Mr. Krivanek,

My abstract is attached to this message, for your info. Separately, I will submit it through the Indico system. Please let me know if you need any other information at this stage.

Thank you,  
Mrs. Carol Moyer

---

**From:** KRIVANEK, Robert [<mailto:R.Krivanek@iaea.org>]  
**Sent:** Monday, May 22, 2017 2:56 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Cc:** Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>  
**Subject:** [External\_Sender] RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear Mr Moyer,

It will be fine if you submit your abstracts this week.  
We are looking forward to see a strong NRC delegation in Lyon.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |  
LTO Programme Manager  
Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |  
[International Atomic Energy Agency](http://www.iaea.org) | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |  
Email: [r.krivanek@iaea.org](mailto:r.krivanek@iaea.org) | T: (+43-1) 2600-22018 | F: (+43-1) 2600-26007 |

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---

**From:** [Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov) [<mailto:Carol.Moyer@nrc.gov>]

**Sent:** Friday, 19 May 2017 23:19

**To:** KRIVANEK, Robert <[R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)>

**Cc:** KANG, Ki-Sig <[K.S.Kang@iaea.org](mailto:K.S.Kang@iaea.org)>; Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>

**Subject:** RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear Mr. Krivanek,

The U.S. NRC intends to submit several abstracts for consideration for the PLiM conference in October. We have a short delay in completing one of our abstracts. I will be submitting it early next week, and I hope that you still will be able to consider it for the conference.

Thank you,  
Carol Moyer

---

*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](mailto:carol.moyer@nrc.gov)  
301-415-2153

---

**From:** [R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org) [<mailto:R.Krivanek@iaea.org>]  
**Sent:** Friday, April 21, 2017 8:44 AM  
**To:** [R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)  
**Subject:** [External\_Sender] CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear all,

Please be informed that we extended the abstract submission deadline to 19 May 2017 and updated the conference accordingly.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |  
LTO Programme Manager  
Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |  
[International Atomic Energy Agency](http://www.iaea.org) | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |  
Email: [r.krivanek@iaea.org](mailto:r.krivanek@iaea.org) | T: (+43-1) 2600-22018 | F: (+43-1) 2600-26007 |



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# Harvesting of Aged Materials from Operating and Decommissioning Nuclear Power Plants

M. Hiser<sup>a</sup>, P. Purtscher<sup>a</sup>, P. Ramuhalli<sup>b</sup>, A. B. Hull<sup>a</sup>, and R. Tregoning<sup>a</sup>

<sup>a</sup>U.S. Nuclear Regulatory Commission (NRC), Washington, D.C., USA

<sup>b</sup>Pacific Northwest National Laboratory (PNNL), Richland, WA, USA

## Background and Motivation

- 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.
- Extended plant operation and SLR raise a number of technical issues that may require further research to understand and quantify aging mechanisms. U.S. utilities and the U.S. Nuclear Regulatory Commission (NRC) have focused on the aging of systems, structures, and components and in particular four key SLR issues: reactor pressure vessel (RPV) embrittlement, irradiation-assisted stress corrosion cracking of reactor internals, concrete structures and containment degradation, and electrical cable qualification and condition assessment.
- Meanwhile, 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 plants shutting down, these new developments provide opportunities for harvesting components that were aged in representative light water reactor (LWR) environments.
- In a third related development, economic challenges and limited budgets have restricted the resources available to support new research, including harvesting programs. Given this constrained budget environment, aligning interests and leveraging with other organizations is important to allow maximum benefit and value for future research programs.

## Current Activities

- NRC has recently undertaken an effort, with the assistance of Pacific Northwest National Laboratory (PNNL), to develop a strategic approach to harvesting aged materials from NPPs. Due to limited opportunities, past harvesting efforts have been reactive to individual plants shutting down and beginning decommissioning. Given the expected availability of materials from numerous plants and anticipated research needs to better understand aging out to 80 years of operation, the NRC is pursuing 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.
- The first step in this strategic approach is to prioritize data needs for harvesting. A data need describes a particular degradation scenario and should be defined with as much detail as appropriate in terms of the material (alloy, composition, etc.) and environment (temperature, fluence, chemistry, etc.).



## Potential Criteria for Harvesting Prioritization

A number of criteria may be considered when prioritizing the data needs for harvesting, including:

- 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, and accelerated aging may not be feasible for a mechanism sensitive to dose rate.
- 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
  - Greater value in addressing an issue applicable to a larger number of plants.
- Harvesting cost and complexity
  - For example, harvesting un-irradiated concrete or electrical cables less expensive and less complex than harvesting from the reactor internals or RPV.
- 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.

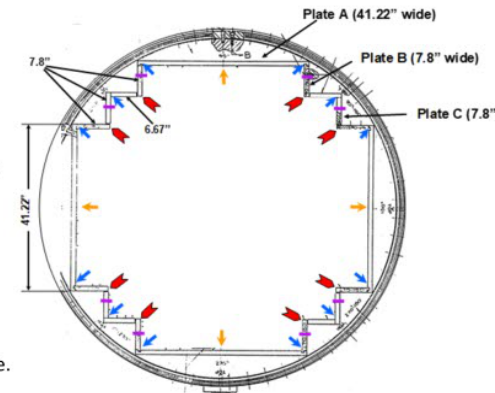
The above potential criteria provide a systematic approach to prioritize data needs for harvesting. Different organizations may weigh and consider each of these criteria differently based on their interests and perspectives, but each criterion is likely relevant to some degree for any organization. NRC is interested in engaging with other organizations to prioritize data needs for harvesting and identify areas of common interest.

## Harvesting Database

- The NRC is pursuing the development of a database for sources of materials for harvesting, which could include both previously harvested materials and those available for future harvesting. This database would allow for aligning of high-priority data needs to the available sources of materials. The level of detail for the database should be appropriate for the factors influencing decision-making. NRC is interested in engaging with other organizations in developing the database.

## Path Forward

- NRC's experience is that harvesting can yield highly representative and valuable data on materials aging, but these efforts will be challenging. Having a clearly defined objective and early engagement with other stakeholders are keys to success. As specific harvesting opportunities are identified through this strategic approach, the NRC welcomes opportunities for cooperation and leveraging of resources with other interested research organizations.



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<b>3. AUTHOR(s)</b>  Matthew Hiser, Patrick Purtscher, P. Ramuhalli, Amy Hull, Robert Tregoning			
<b>4. NAME OF CONFERENCE, LOCATION, AND DATE(s)</b> Fourth International Conference on Nuclear Power Plant Life Management, Lyon, France, October 23-26, 2017			
<b>5. NAME OF PUBLICATION</b>  Proceedings from Fourth International Conference on Nuclear Power Plant Life Management			
<b>6. NAME AND ADDRESS OF THE PUBLISHER</b>  IAEA		<b>7. TELEPHONE NUMBER OF THE PUBLISHER</b>	
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Matthew Hiser		RES/DE	T-10A36
SIGNATURE	DATE	TELEPHONE NUMBER	E-MAIL I.D.
		(301) 415-2454	MAH3
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<input type="checkbox"/> A.7 Sensitive Internal Info - No Periodic Review (attorney work product & client privilege, and pre-decisional enforcement)	<input type="checkbox"/> A.3 Sensitive-Security Related - Periodic Review Required													
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Note to requester: Attachment is immediately following.

**From:** Moyer, Carol  
**Sent:** Wed, 27 Sep 2017 11:31:17 -0400  
**To:** Hiser, Matthew  
**Cc:** Purtscher, Patrick; Hull, Amy  
**Subject:** RE: FW: PLiM abstract on harvesting  
**Attachments:** Harvesting NRC Poster for PLiM\_cem.pptx

Hi Matt,

I think the poster looks really good. It is wordy, but for what it is, I think that is fine. You have two eye-catching figures in it, at least, even if they are not directly referenced by the text.

I made some nitpicky edits to the text. I also cut a few words that I thought were redundant (in Current Activities) or that made a sentence unnecessarily convoluted (in Harvesting Database).

Amy has her hands full with other near-term stuff this week, I think. **Pat** – Do you have a chance to provide a second opinion on this? I will do the release form (390) to go with it for Steve's approval.

-Carol

---

**From:** Hiser, Matthew  
**Sent:** Friday, September 15, 2017 11:07 AM  
**To:** Moyer, Carol <Carol.Moyer@nrc.gov>; Hull, Amy <Amy.Hull@nrc.gov>  
**Cc:** Purtscher, Patrick <Patrick.Purtscher@nrc.gov>  
**Subject:** RE: FW: PLiM abstract on harvesting

Hi Amy and Carol,

Here's my initial stab at the harvesting poster for PLiM.

Please take a look and let me know what you think.

Thanks!  
Matt

---

**From:** Moyer, Carol  
**Sent:** Friday, July 21, 2017 11:26 AM  
**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>; Hull, Amy <[Amy.Hull@nrc.gov](mailto:Amy.Hull@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

Thank you both!

The conference website is here: <http://www-pub.iaea.org/iaeameetings/50811/Fourth-International-Conference-on-Nuclear-Power-Plant-Life-Management>  
Poster guidelines are here: <http://www-pub.iaea.org/MTCD/Meetings/PDFplus/2017/cn246/cn246PosterGuidelines.pdf>

No specific due date is listed for posters.

**M. Key Dates and Deadlines**

Submission of Form for Submission of a Paper (Form B)  
and extended synopsis (800 words) 28 May 2017  
Submission of Grant Application Form (Form C): 28 May 2017  
Notification of acceptance of papers/posters: 30 June 2017  
Submission of full paper (only upon request by the IAEA): 18 October 2017

Posters may only be "due" at the conference itself? It would not hurt to have it done by 18 Oct., the paper deadline, though. It is unclear to me what they would do with a full paper, if one was not requested by IAEA. But I think you can prepare one, if you like. If they will not publish it as part of PLiM, we can find another home for it, or just release it as an NRC document.

-Carol

---

**From:** Hiser, Matthew  
**Sent:** Friday, July 21, 2017 11:12 AM  
**To:** Hull, Amy <[Amy.Hull@nrc.gov](mailto:Amy.Hull@nrc.gov)>; Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

OK, I can work with Amy to make a poster. Rob and Pat and our PNNL contractor are also listed as co-authors...

---

**From:** Hull, Amy  
**Sent:** Friday, July 21, 2017 11:08 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>; Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

I think this is a good opportunity to publicize harvesting work and develop collaboration. Task 2 in UNR. I will make the poster. When is it due?

---

**From:** Moyer, Carol  
**Sent:** Friday, July 21, 2017 10:57 AM  
**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>; Hull, Amy <[Amy.Hull@nrc.gov](mailto:Amy.Hull@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

I'm pretty ambivalent about it. Amy, do you have a strong desire to make up a poster for the PLiM? Are there other co-authors to be consulted?

-Carol

---

**From:** Hiser, Matthew  
**Sent:** Friday, July 21, 2017 7:28 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

Hi Carol,

Not terribly interested in a poster... The other thing is then you'd have to babysit the poster during poster session(s)?

I'd suggest we say thanks for the offer, but that's alright... what do you think?

Thanks!  
Matt

---

**From:** Moyer, Carol  
**Sent:** Thursday, July 20, 2017 12:49 PM  
**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>  
**Subject:** FW: FW: PLiM abstract on harvesting

Matt,

I am a bit confused by the pronoun used in this email...

Are you interested in doing a poster instead?

Carol

---

**From:** KRIVANEK, Robert [<mailto:R.Krivanek@iaea.org>]  
**Sent:** Thursday, July 20, 2017 11:10 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** [External\_Sender] FW: PLiM abstract on harvesting

You have just agreed that we will add this paper to poster session.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |  
LTO Programme Manager  
Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |  
[International Atomic Energy Agency](http://www.iaea.org) | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |  
Email: [r.krivanek@iaea.org](mailto:r.krivanek@iaea.org) | T: (+43-1) 2600-22018 | F: (+43-1) 2600-26007 |



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---

**From:** KRIVANEK, Robert  
**Sent:** Thursday, 20 July 2017 16:10  
**To:** 'Carol.Moyer@nrc.gov' <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** FW: PLiM abstract on harvesting

Dear Carol,

We asked you to submit your synopsis through INDICO (see email below) but it did not happen. So we were not able to send your synopsis to programme committee for evaluation and it will not occur on the conference programme.

Sorry for that but there are currently 300 delegates and 150 synopsis, so we were not able to track each of them separately.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |  
LTO Programme Manager

Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |  
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---

**From:** KRIVANEK, Robert  
**Sent:** Friday, 26 May 2017 08:55  
**To:** 'Carol.Moyer@nrc.gov' <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Cc:** KHAELSS, Martina <[M.Khaelss@iaea.org](mailto:M.Khaelss@iaea.org)>  
**Subject:** FW: PLiM abstract on harvesting

Dear Carol,

Thank you for your synopsis. We have opened INDICO system for this week, so please submit it through the system.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |

LTO Programme Manager

Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |

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---

**From:** [Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov) [<mailto:Carol.Moyer@nrc.gov>]

**Sent:** Friday, 26 May 2017 00:19

**To:** KRIVANEK, Robert <[R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)>

**Cc:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>; Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>; Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>

**Subject:** PLiM abstract on harvesting

Dear Mr. Krivanek,

The US NRC would like to propose one more presentation for this autumn's PLiM conference, on harvesting of materials from operating and decommissioning power plants. I understand from Sherry Bernhoft that you already have an impressive number of abstracts, so I will understand if there is not room in the program for this one. Nevertheless, we would appreciate your consideration of this proposal.

Again, please let me know if you need any additional information. Many thanks,

Carol

---

*Carol E. Moyer*  
Sr. Materials Engineer  
Office of Nuclear Regulatory Research  
RES/DE/CMB  
[carol.moyer@nrc.gov](mailto:carol.moyer@nrc.gov)  
301-415-2153

---

**From:** KRIVANEK, Robert [<mailto:R.Krivanek@iaea.org>]

**Sent:** Tuesday, May 23, 2017 2:41 AM

**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>

**Subject:** [External\_Sender] RE: RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear Carol,

I will arrange it. Thank you.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |

LTO Programme Manager

Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |

International Atomic Energy Agency | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |

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---

**From:** [Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov) [<mailto:Carol.Moyer@nrc.gov>]

**Sent:** Monday, 22 May 2017 20:44

**To:** KRIVANEK, Robert <[R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)>

**Subject:** RE: RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear Mr. Krivanek,

Since the formal deadline for abstract submissions has passed, I am no longer able to access the Indico system through the PLiM website (<https://conferences.iaea.org/indico/event/134/>). My abstract and Form B are attached.

Are you able to work with these documents? Is there anything else that you need me to do at this time?

Thanks again for your patience and assistance,  
Carol

---

**From:** Moyer, Carol  
**Sent:** Monday, May 22, 2017 10:59 AM  
**To:** 'KRIVANEK, Robert' <[R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)>  
**Cc:** Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>  
**Subject:** RE: RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear Mr. Krivanek,

My abstract is attached to this message, for your info. Separately, I will submit it through the Indico system. Please let me know if you need any other information at this stage.

Thank you,  
Mrs. Carol Moyer

---

**From:** KRIVANEK, Robert [<mailto:R.Krivanek@iaea.org>]  
**Sent:** Monday, May 22, 2017 2:56 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Cc:** Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>  
**Subject:** [External\_Sender] RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear Mr Moyer,

It will be fine if you submit your abstracts this week.  
We are looking forward to see a strong NRC delegation in Lyon.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |  
LTO Programme Manager  
Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |  
[International Atomic Energy Agency](http://www.iaea.org) | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |  
Email: [r.krivanek@iaea.org](mailto:r.krivanek@iaea.org) | T: (+43-1) 2600-22018 | F: (+43-1) 2600-26007 |



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---

**From:** [Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov) [<mailto:Carol.Moyer@nrc.gov>]

**Sent:** Friday, 19 May 2017 23:19

**To:** KRIVANEK, Robert <[R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)>

**Cc:** KANG, Ki-Sig <[K.S.Kang@iaea.org](mailto:K.S.Kang@iaea.org)>; Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>

**Subject:** RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear Mr. Krivanek,

The U.S. NRC intends to submit several abstracts for consideration for the PLiM conference in October. We have a short delay in completing one of our abstracts. I will be submitting it early next week, and I hope that you still will be able to consider it for the conference.

Thank you,  
Carol Moyer

---

*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](mailto:carol.moyer@nrc.gov)  
301-415-2153

---

**From:** [R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org) [<mailto:R.Krivanek@iaea.org>]  
**Sent:** Friday, April 21, 2017 8:44 AM  
**To:** [R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)  
**Subject:** [External\_Sender] CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear all,

Please be informed that we extended the abstract submission deadline to 19 May 2017 and updated the conference accordingly.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |  
LTO Programme Manager  
Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |  
[International Atomic Energy Agency](http://www.iaea.org) | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |  
Email: [r.krivanek@iaea.org](mailto:r.krivanek@iaea.org) | T: (+43-1) 2600-22018 | F: (+43-1) 2600-26007 |



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communication to others. Also please notify the sender by replying to this message and then delete it from your system.

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# Harvesting of Aged Materials from Operating and Decommissioning Nuclear Power Plants

M. Hiser<sup>a</sup>, P. Purtscher<sup>a</sup>, P. Ramuhalli<sup>b</sup>, A. B. Hull<sup>a</sup>, R. Tregoning<sup>a</sup>, and C. E. Moyer<sup>a</sup>

<sup>a</sup>U.S. Nuclear Regulatory Commission (NRC), Washington, D.C., USA

<sup>b</sup>Pacific Northwest National Laboratory (PNNL), Richland, WA, USA

## Background and Motivation

- 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.
- Extended plant operation and SLR raise a number of technical issues that may require further research to understand and quantify aging mechanisms. U.S. utilities and the U.S. Nuclear Regulatory Commission (NRC) have focused on the aging of systems, structures, and components and in particular four key SLR issues: reactor pressure vessel (RPV) embrittlement, irradiation-assisted stress corrosion cracking of reactor internals, concrete structures and containment degradation, and electrical cable qualification and condition assessment.
- Meanwhile, 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 plants shutting down, these new developments provide opportunities for harvesting components that were aged in representative light water reactor (LWR) environments.
- In a third related development, economic challenges and limited budgets have restricted the resources available to support new research, including harvesting programs. Given this constrained budget environment, aligning interests and leveraging with other organizations is important to allow maximum benefit and value for future research programs.

## Current Activities

- NRC has recently undertaken an effort, with the assistance of Pacific Northwest National Laboratory (PNNL), to develop a strategic approach to harvesting aged materials from NPPs. Due to limited opportunities, past harvesting efforts have been reactive to individual plants shutting down and beginning decommissioning. Given the expected availability of materials from numerous plants and anticipated research needs to better understand aging out to 80 years of operation, the NRC is pursuing 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.
- The first step in this strategic approach is to prioritize data needs for harvesting. A data need describes a particular degradation scenario (combination of material and environment) and should be defined with as much detail as appropriate in terms of the material (alloy, composition, etc.) and environment (temperature, fluence, chemistry, etc.).



## Potential Criteria for Harvesting Prioritization

A number of criteria may be considered when prioritizing the data needs for harvesting, including:

- 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, and accelerated aging may not be feasible for a mechanism sensitive to dose rate.
- 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
  - Greater value in addressing an issue applicable to a larger number of plants.
- Harvesting cost and complexity
  - For example, harvesting un-irradiated concrete or electrical cables less expensive and less complex than harvesting from the reactor internals or RPV.
- 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.

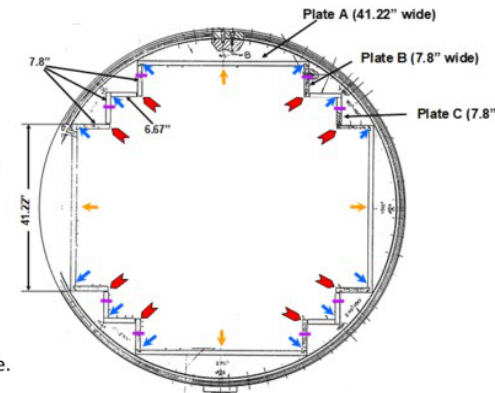
The above potential criteria provide a systematic approach to prioritize data needs for harvesting. Different organizations may weigh and consider each of these criteria differently based on their interests and perspectives, but each criterion is likely relevant to some degree for any organization. NRC is interested in engaging with other organizations to prioritize data needs for harvesting and identify areas of common interest.

## Harvesting Database

- Another activity NRC is pursuing is the potential development of a database for sources of materials for harvesting, which could include both previously harvested materials and those available for future harvesting. This database would allow for aligning of high-priority data needs to the available sources of materials. As with the data-needs 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 for sources of materials for harvesting.

## Path Forward

- NRC's experience is that harvesting can yield highly representative and valuable data on materials aging, but these efforts may be expensive and challenging. Having a clearly defined objective and early engagement with other stakeholders, including the NPP from which harvesting will take place, are key to success. As specific harvesting opportunities are identified through this strategic approach, the NRC welcomes opportunities for cooperation and leveraging of resources with other interested research organizations.



**From:** Purtscher, Patrick  
**Sent:** Wed, 27 Sep 2017 12:05:49 -0400  
**To:** Moyer, Carol; Hiser, Matthew  
**Cc:** Hull, Amy  
**Subject:** RE: FW: PLiM abstract on harvesting  
**Attachments:** Harvesting NRC Poster for PLiM\_cem-ntp comments.pptx

Note to requester: Attachment is immediately following.

Here are some more nitpicky edits to consider or reject before you give it to Steve.

Pat

---

**From:** Moyer, Carol  
**Sent:** Wednesday, September 27, 2017 11:31 AM  
**To:** Hiser, Matthew <Matthew.Hiser@nrc.gov>  
**Cc:** Purtscher, Patrick <Patrick.Purtscher@nrc.gov>; Hull, Amy <Amy.Hull@nrc.gov>  
**Subject:** RE: FW: PLiM abstract on harvesting

Hi Matt,

I think the poster looks really good. It is wordy, but for what it is, I think that is fine. You have two eye-catching figures in it, at least, even if they are not directly referenced by the text.

I made some nitpicky edits to the text. I also cut a few words that I thought were redundant (in Current Activities) or that made a sentence unnecessarily convoluted (in Harvesting Database).

Amy has her hands full with other near-term stuff this week, I think. **Pat** – Do you have a chance to provide a second opinion on this? I will do the release form (390) to go with it for Steve's approval.

-Carol

---

**From:** Hiser, Matthew  
**Sent:** Friday, September 15, 2017 11:07 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>; Hull, Amy <[Amy.Hull@nrc.gov](mailto:Amy.Hull@nrc.gov)>  
**Cc:** Purtscher, Patrick <[Patrick.Purtscher@nrc.gov](mailto:Patrick.Purtscher@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

Hi Amy and Carol,

Here's my initial stab at the harvesting poster for PLiM.

Please take a look and let me know what you think.

Thanks!  
Matt

---

**From:** Moyer, Carol  
**Sent:** Friday, July 21, 2017 11:26 AM  
**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>; Hull, Amy <[Amy.Hull@nrc.gov](mailto:Amy.Hull@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

Thank you both!

The conference website is here: <http://www-pub.iaea.org/iaeameetings/50811/Fourth-International-Conference-on-Nuclear-Power-Plant-Life-Management>  
Poster guidelines are here: <http://www-pub.iaea.org/MTCD/Meetings/PDFplus/2017/cn246/cn246PosterGuidelines.pdf>

No specific due date is listed for posters.

**M. Key Dates and Deadlines**

Submission of Form for Submission of a Paper (Form B)  
and extended synopsis (800 words) 28 May 2017  
Submission of Grant Application Form (Form C): 28 May 2017  
Notification of acceptance of papers/posters: 30 June 2017  
Submission of full paper (only upon request by the IAEA): 18 October 2017

Posters may only be "due" at the conference itself? It would not hurt to have it done by 18 Oct., the paper deadline, though. It is unclear to me what they would do with a full paper, if one was not requested by IAEA. But I think you can prepare one, if you like. If they will not publish it as part of PLiM, we can find another home for it, or just release it as an NRC document.

-Carol

---

**From:** Hiser, Matthew  
**Sent:** Friday, July 21, 2017 11:12 AM  
**To:** Hull, Amy <[Amy.Hull@nrc.gov](mailto:Amy.Hull@nrc.gov)>; Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

OK, I can work with Amy to make a poster. Rob and Pat and our PNNL contractor are also listed as co-authors...

---

**From:** Hull, Amy  
**Sent:** Friday, July 21, 2017 11:08 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>; Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

I think this is a good opportunity to publicize harvesting work and develop collaboration. Task 2 in UNR. I will make the poster. When is it due?

---

**From:** Moyer, Carol  
**Sent:** Friday, July 21, 2017 10:57 AM  
**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>; Hull, Amy <[Amy.Hull@nrc.gov](mailto:Amy.Hull@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

I'm pretty ambivalent about it. Amy, do you have a strong desire to make up a poster for the PLiM? Are there other co-authors to be consulted?

-Carol

---

**From:** Hiser, Matthew  
**Sent:** Friday, July 21, 2017 7:28 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

Hi Carol,

Not terribly interested in a poster... The other thing is then you'd have to babysit the poster during poster session(s)?

I'd suggest we say thanks for the offer, but that's alright... what do you think?

Thanks!  
Matt

---

**From:** Moyer, Carol  
**Sent:** Thursday, July 20, 2017 12:49 PM  
**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>  
**Subject:** FW: FW: PLiM abstract on harvesting

Matt,

I am a bit confused by the pronoun used in this email...

Are you interested in doing a poster instead?

Carol

---

**From:** KRIVANEK, Robert [<mailto:R.Krivanek@iaea.org>]  
**Sent:** Thursday, July 20, 2017 11:10 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** [External\_Sender] FW: PLiM abstract on harvesting

You have just agreed that we will add this paper to poster session.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |  
LTO Programme Manager  
Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |  
**International Atomic Energy Agency** | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |  
Email: [r.krivanek@iaea.org](mailto:r.krivanek@iaea.org) | T: (+43-1) 2600-22018 | F: (+43-1) 2600-26007 |

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---

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**Sent:** Thursday, 20 July 2017 16:10  
**To:** 'Carol.Moyer@nrc.gov' <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** FW: PLiM abstract on harvesting

Dear Carol,

We asked you to submit your synopsis through INDICO (see email below) but it did not happened. So we were not able to send your synopsis to programme committee for evaluation and it will not occur on the conference programme.

Sorry for that but there are currently 300 delegates and 150 synopsis, so we were not able to track each of them separately.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |

LTO Programme Manager

Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |

[International Atomic Energy Agency](#) | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |

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---

**From:** KRIVANEK, Robert  
**Sent:** Friday, 26 May 2017 08:55  
**To:** 'Carol.Moyer@nrc.gov' <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Cc:** KHAELSS, Martina <[M.Khaelss@iaea.org](mailto:M.Khaelss@iaea.org)>  
**Subject:** FW: PLiM abstract on harvesting

Dear Carol,

Thank you for your synopsis. We have opened INDICO system for this week, so please submit it through the system.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |  
LTO Programme Manager  
Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |  
[International Atomic Energy Agency](#) | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |  
Email: [r.krivanek@iaea.org](mailto:r.krivanek@iaea.org) | T: (+43-1) 2600-22018 | F: (+43-1) 2600-26007 |



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---

**From:** [Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov) [<mailto:Carol.Moyer@nrc.gov>]

**Sent:** Friday, 26 May 2017 00:19

**To:** KRIVANEK, Robert <[R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)>

**Cc:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>; Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>; Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>

**Subject:** PLiM abstract on harvesting

Dear Mr. Krivanek,

The US NRC would like to propose one more presentation for this autumn's PLiM conference, on harvesting of materials from operating and decommissioning power plants. I understand from Sherry Bernhoft that you already have an impressive number of abstracts, so I will understand if there is not room in the program for this one. Nevertheless, we would appreciate your consideration of this proposal.

Again, please let me know if you need any additional information. Many thanks,

Carol

---

*Carol E. Moyer*  
*Sr. Materials Engineer*  
*Office of Nuclear Regulatory Research*  
*RES/DE/CMB*  
[carol.moyer@nrc.gov](mailto:carol.moyer@nrc.gov)  
301-415-2153

---

**From:** KRIVANEK, Robert [<mailto:R.Krivanek@iaea.org>]  
**Sent:** Tuesday, May 23, 2017 2:41 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** [External\_Sender] RE: RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear Carol,

I will arrange it. Thank you.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |  
LTO Programme Manager  
Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |  
**International Atomic Energy Agency** | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |  
Email: [r.krivanek@iaea.org](mailto:r.krivanek@iaea.org) | T: (+43-1) 2600-22018 | F: (+43-1) 2600-26007 |



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---

**From:** [Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov) [<mailto:Carol.Moyer@nrc.gov>]

**Sent:** Monday, 22 May 2017 20:44

**To:** KRIVANEK, Robert <[R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)>

**Subject:** RE: RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear Mr. Krivanek,

Since the formal deadline for abstract submissions has passed, I am no longer able to access the Indico system through the PLiM website (<https://conferences.iaea.org/indico/event/134/>). My abstract and Form B are attached.

Are you able to work with these documents? Is there anything else that you need me to do at this time?

Thanks again for your patience and assistance,  
Carol

---

**From:** Moyer, Carol  
**Sent:** Monday, May 22, 2017 10:59 AM  
**To:** 'KRIVANEK, Robert' <[R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)>  
**Cc:** Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>  
**Subject:** RE: RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear Mr. Krivanek,

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Thank you,  
Mrs. Carol Moyer

---

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**Sent:** Monday, May 22, 2017 2:56 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Cc:** Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>  
**Subject:** [External\_Sender] RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear Mr Moyer,

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We are looking forward to see a strong NRC delegation in Lyon.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |  
LTO Programme Manager  
Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |  
[International Atomic Energy Agency](http://www.iaea.org) | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |  
Email: [r.krivanek@iaea.org](mailto:r.krivanek@iaea.org) | T: (+43-1) 2600-22018 | F: (+43-1) 2600-26007 |



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---

**From:** [Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov) [<mailto:Carol.Moyer@nrc.gov>]

**Sent:** Friday, 19 May 2017 23:19

**To:** KRIVANEK, Robert <[R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)>

**Cc:** KANG, Ki-Sig <[K.S.Kang@iaea.org](mailto:K.S.Kang@iaea.org)>; Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>

**Subject:** RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

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Thank you,  
Carol Moyer

---

*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](mailto:carol.moyer@nrc.gov)  
301-415-2153

---

**From:** [R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org) [<mailto:R.Krivanek@iaea.org>]  
**Sent:** Friday, April 21, 2017 8:44 AM  
**To:** [R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)  
**Subject:** [External\_Sender] CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear all,

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Best regards,

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LTO Programme Manager  
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# Harvesting of Aged Materials from Operating and Decommissioning Nuclear Power Plants

M. Hiser<sup>a</sup>, P. Purtscher<sup>a</sup>, P. Ramuhalli<sup>b</sup>, A. B. Hull<sup>a</sup>, R. Tregoning<sup>a</sup>, and C. E. Moyer<sup>a</sup>

<sup>a</sup>U.S. Nuclear Regulatory Commission (NRC), Washington, D.C., USA

<sup>b</sup>Pacific Northwest National Laboratory (PNNL), Richland, WA, USA

## Background and Motivation

- 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.
- Extended plant operation and SLR raise a number of technical issues that may require further research to understand and quantify aging mechanisms. U.S. utilities and the U.S. Nuclear Regulatory Commission (NRC) have focused on the aging of systems, structures, and components and in particular four key SLR issues: reactor pressure vessel (RPV) embrittlement, irradiation-assisted stress corrosion cracking of reactor internals, concrete structures and containment degradation, and electrical cable qualification and condition assessment.
- Meanwhile, 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 plants shutting down, these new developments provide opportunities for harvesting components that were aged in representative light water reactor (LWR) environments.
- In a third related development, economic challenges and limited budgets have restricted the resources available to support new research, including harvesting programs. Given this constrained budget environment, aligning interests and leveraging with other organizations is important to allow maximum benefit and value for future research programs.

## Current Activities

- NRC has recently undertaken an effort, with the assistance of Pacific Northwest National Laboratory (PNNL), to develop a strategic approach to harvesting aged materials from NPPs. Due to limited opportunities, past harvesting efforts have been reactive to individual plants shutting down and beginning decommissioning. Given the expected availability of materials from numerous plants and anticipated research needs to better understand aging out to 80 years of operation, the NRC is pursuing 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.
- The first step in this strategic approach is to prioritize data needs for harvesting. A data need describes a particular degradation scenario (combination of material and environment) and should be defined with as much detail as appropriate in terms of the material (alloy, composition, etc.) and environment (temperature, fluence, chemistry, etc.).



## Potential Criteria for Harvesting Prioritization

A number of criteria may be considered when prioritizing the data needs for harvesting, including:

- 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, and accelerated aging may not be feasible for a mechanism sensitive to dose rate.
- 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
  - Greater value in addressing an issue applicable to a larger number of plants.
- Harvesting cost and complexity
  - For example, harvesting un-irradiated concrete or electrical cables less expensive and less complex than harvesting from the reactor internals or RPV.
- 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.

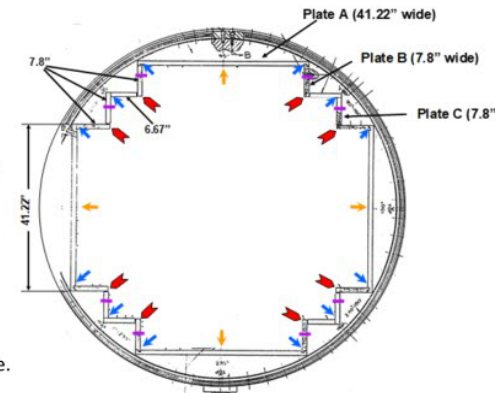
The above potential criteria provide a systematic approach to prioritize data needs for harvesting. Different organizations may weigh and consider each of these criteria differently based on their interests and perspectives, but each criterion is likely relevant to some degree for any organization. NRC is interested in engaging with other organizations to prioritize data needs for harvesting and identify areas of common interest.

## Harvesting Database

- Another activity The NRC is pursuing is the potential development of a database for sources of materials for harvesting, which could include both previously harvested materials and those available for future harvesting. This database would allow for aligning of high-priority data needs to the available sources of materials. As with the data needs 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 the database for sources of materials for harvesting.

## Path Forward

- NRC's experience is that harvesting can yield highly representative and valuable data on materials aging, but these efforts may will be expensive and challenging. Having a clearly defined objective and early engagement with other stakeholders, including the NPP from which harvesting will take place, are keys to success. As specific harvesting opportunities are identified through this strategic approach, the NRC welcomes opportunities for cooperation and leveraging of resources with other interested research organizations.



**From:** Hiser, Matthew  
**Sent:** Fri, 22 Sep 2017 12:19:11 +0000  
**To:** Moyer, Carol; Hull, Amy  
**Cc:** Purtscher, Patrick  
**Subject:** RE: FW: PLiM abstract on harvesting  
**Attachments:** Harvesting NRC Poster for PLiM.PPTX

Note to requester: Attachment is immediately following.
---

I just wanted to send a reminder on this poster for PLiM. It looks like the lead time for a poster is 2-3 weeks ([http://www.internal.nrc.gov/ADM/manuscriptdev\\_print/graphics.html](http://www.internal.nrc.gov/ADM/manuscriptdev_print/graphics.html)), so we really need to finalize this quickly. I will be on travel next week, so I hope you guys may be able to run with this and get it signed off by Steve next week.

The contact for printing posters is [graphics.resource@nrc.gov](mailto:graphics.resource@nrc.gov).

Thanks!  
Matt

---

**From:** Hiser, Matthew  
**Sent:** Friday, September 15, 2017 11:07 AM  
**To:** Moyer, Carol ; Hull, Amy  
**Cc:** Purtscher, Patrick  
**Subject:** RE: FW: PLiM abstract on harvesting

Hi Amy and Carol,

Here's my initial stab at the harvesting poster for PLiM.

Please take a look and let me know what you think.

Thanks!  
Matt

---

**From:** Moyer, Carol  
**Sent:** Friday, July 21, 2017 11:26 AM  
**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>; Hull, Amy <[Amy.Hull@nrc.gov](mailto:Amy.Hull@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

Thank you both!

The conference website is here: <http://www-pub.iaea.org/iaeaemeetings/50811/Fourth-International-Conference-on-Nuclear-Power-Plant-Life-Management>  
Poster guidelines are here: <http://www-pub.iaea.org/MTCD/Meetings/PDFplus/2017/cn246/cn246PosterGuidelines.pdf>

No specific due date is listed for posters.

## M. Key Dates and Deadlines

Submission of Form for Submission of a Paper (Form B)  
and extended synopsis (800 words) 28 May 2017  
Submission of Grant Application Form (Form C): 28 May 2017  
Notification of acceptance of papers/posters: 30 June 2017  
Submission of full paper (only upon request by the IAEA): 18 October 2017

Posters may only be "due" at the conference itself? It would not hurt to have it done by 18 Oct., the paper deadline, though. It is unclear to me what they would do with a full paper, if one was not requested by IAEA. But I think you can prepare one, if you like. If they will not publish it as part of PLiM, we can find another home for it, or just release it as an NRC document.

-Carol

---

**From:** Hiser, Matthew  
**Sent:** Friday, July 21, 2017 11:12 AM  
**To:** Hull, Amy <[Amy.Hull@nrc.gov](mailto:Amy.Hull@nrc.gov)>; Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

OK, I can work with Amy to make a poster. Rob and Pat and our PNNL contractor are also listed as co-authors...

---

**From:** Hull, Amy  
**Sent:** Friday, July 21, 2017 11:08 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>; Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

I think this is a good opportunity to publicize harvesting work and develop collaboration. Task 2 in UNR. I will make the poster. When is it due?

---

**From:** Moyer, Carol  
**Sent:** Friday, July 21, 2017 10:57 AM  
**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>; Hull, Amy <[Amy.Hull@nrc.gov](mailto:Amy.Hull@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

I'm pretty ambivalent about it. Amy, do you have a strong desire to make up a poster for the PLiM? Are there other co-authors to be consulted?

-Carol

---

**From:** Hiser, Matthew  
**Sent:** Friday, July 21, 2017 7:28 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

Hi Carol,

Not terribly interested in a poster... The other thing is then you'd have to babysit the poster during poster session(s)?

I'd suggest we say thanks for the offer, but that's alright... what do you think?

Thanks!  
Matt

---

**From:** Moyer, Carol  
**Sent:** Thursday, July 20, 2017 12:49 PM  
**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>  
**Subject:** FW: FW: PLiM abstract on harvesting

Matt,

I am a bit confused by the pronoun used in this email...

Are you interested in doing a poster instead?

Carol

---

**From:** KRIVANEK, Robert [<mailto:R.Krivanek@iaea.org>]  
**Sent:** Thursday, July 20, 2017 11:10 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** [External\_Sender] FW: PLiM abstract on harvesting

You have just agreed that we will add this paper to poster session.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |  
LTO Programme Manager  
Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |  
**International Atomic Energy Agency** | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |  
Email: [r.krivanek@iaea.org](mailto:r.krivanek@iaea.org) | T: (+43-1) 2600-22018 | F: (+43-1) 2600-26007 |



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---

**From:** KRIVANEK, Robert  
**Sent:** Thursday, 20 July 2017 16:10

**To:** 'Carol.Moyer@nrc.gov' <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>

**Subject:** FW: PLiM abstract on harvesting

Dear Carol,

We asked you to submit your synopsis through INDICO (see email below) but it did not happen. So we were not able to send your synopsis to programme committee for evaluation and it will not occur on the conference programme.

Sorry for that but there are currently 300 delegates and 150 synopsis, so we were not able to track each of them separately.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |

LTO Programme Manager

Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |

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---

**From:** KRIVANEK, Robert

**Sent:** Friday, 26 May 2017 08:55

**To:** 'Carol.Moyer@nrc.gov' <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>

**Cc:** KHAELSS, Martina <[M.Khaelss@iaea.org](mailto:M.Khaelss@iaea.org)>

**Subject:** FW: PLiM abstract on harvesting

Dear Carol,

Thank you for your synopsis. We have opened INDICO system for this week, so please submit it through the system.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |

LTO Programme Manager

Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |

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**Sent:** Friday, 26 May 2017 00:19  
**To:** KRIVANEK, Robert <[R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)>  
**Cc:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>; Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>; Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>  
**Subject:** PLiM abstract on harvesting

Dear Mr. Krivanek,

The US NRC would like to propose one more presentation for this autumn's PLiM conference, on harvesting of materials from operating and decommissioning power plants. I understand from Sherry Bernhoft that you already have an impressive number of abstracts, so I will understand if there is not room in the program for this one. Nevertheless, we would appreciate your consideration of this proposal.

Again, please let me know if you need any additional information. Many thanks,

Carol

---

*Carol E. Moyer*  
*Sr. Materials Engineer*  
*Office of Nuclear Regulatory Research*  
*RES/DE/CMB*  
[carol.moyer@nrc.gov](mailto:carol.moyer@nrc.gov)  
301-415-2153

---

**From:** KRIVANEK, Robert [<mailto:R.Krivanek@iaea.org>]  
**Sent:** Tuesday, May 23, 2017 2:41 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** [External\_Sender] RE: RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear Carol,

I will arrange it. Thank you.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |

LTO Programme Manager  
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**Sent:** Monday, 22 May 2017 20:44  
**To:** KRIVANEK, Robert <[R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)>  
**Subject:** RE: RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

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Carol Moyer

---

*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](mailto:carol.moyer@nrc.gov)  
301-415-2153

---

**From:** [R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org) [mailto:[R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)]

**Sent:** Friday, April 21, 2017 8:44 AM

**To:** [R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)

**Subject:** [External\_Sender] CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear all,

Please be informed that we extended the abstract submission deadline to 19 May 2017 and updated the conference accordingly.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |

LTO Programme Manager

Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |

[International Atomic Energy Agency](#) | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |

Email: [r.krivanek@iaea.org](mailto:r.krivanek@iaea.org) | T: (+43-1) 2600-22018 | F: (+43-1) 2600-26007 |



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# Harvesting of Aged Materials from Operating and Decommissioning Nuclear Power Plants

M. Hiser<sup>a</sup>, P. Purtscher<sup>a</sup>, P. Ramuhalli<sup>b</sup>, A. B. Hull<sup>a</sup>, R. Tregoning<sup>a</sup>, and C. E. Moyer<sup>a</sup>

<sup>a</sup>U.S. Nuclear Regulatory Commission (NRC), Washington, D.C., USA

<sup>b</sup>Pacific Northwest National Laboratory (PNNL), Richland, WA, USA

## Background and Motivation

- 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.
- Extended plant operation and SLR raise a number of technical issues that may require further research to understand aging mechanisms. U.S. utilities and the U.S. Nuclear Regulatory Commission (NRC) have focused on the aging of systems, structures, and components and in particular four key SLR issues: reactor pressure vessel (RPV) embrittlement, irradiation-assisted stress corrosion cracking of reactor internals, concrete structures and containment degradation, and electrical cable qualification and condition assessment.
- Meanwhile, 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 plants shutting down, these new developments provide opportunities for harvesting components that were aged in representative light water reactor (LWR) environments.
- In a third related development, economic challenges and limited budgets have restricted the resources available to support new research, including harvesting programs. Given this constrained budget environment, aligning interests and leveraging with other organizations is important to allow maximum benefit and value for future research programs.

## Current Activities

- NRC has recently undertaken an effort, with the assistance of Pacific Northwest National Lab (PNNL), to develop a strategic approach for harvesting aged materials from NPPs. Due to limited opportunities, past harvesting efforts have been reactive to individual plants shutting down and beginning decommissioning. Given the expected availability of materials from numerous plants and anticipated research needs to better understand aging out to 80 years of operation, the NRC is pursuing 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.
- The first step in this strategic approach is to prioritize data needs for harvesting. A data need describes a particular degradation scenario (combination of material and environment) and should be defined with as much detail as appropriate in terms of the material (alloy, composition, etc.) and environment (temperature, fluence, chemistry, etc.).



## Potential Criteria for Harvesting Prioritization

A number of criteria may be considered when prioritizing the data needs for harvesting, including:

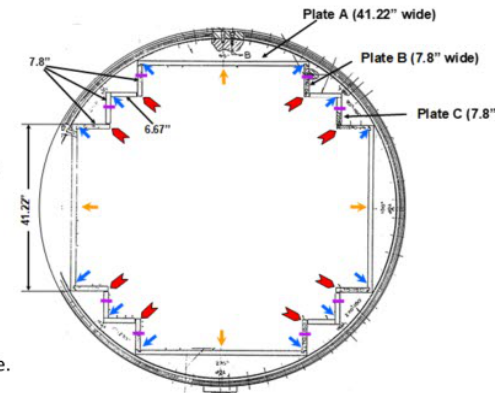
- Applicability of harvested material for addressing critical gaps
  - Harvesting for critical gaps prioritized over less essential technical gaps.
- Ease of laboratory replication of the degradation scenario
  - For example, simultaneous thermal and irradiation conditions are difficult to replicate or accelerated aging may not be feasible for a mechanism sensitive to dose rate.
- 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
  - Greater value in addressing an issue applicable to a larger number of plants.
- Harvesting cost and complexity
  - For example, harvesting unirradiated concrete or electrical cables less expensive and less complex than harvesting from the reactor internals or RPV.
- 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.
- The above potential criteria provide a systematic approach to prioritize data needs for harvesting. Different organizations may weigh and consider each of these criteria differently based on their interests and perspectives, but each criteria is likely relevant to some degree for any organization. NRC is interested in engaging with other organizations to prioritize data needs for harvesting and identify areas of common interest.

## Harvesting Database

- Another activity NRC is pursuing is the potential development of a database for sources of materials for harvesting, which could include both previously harvested materials and those available for future harvesting. This database would allow for aligning of high-priority data needs to the available sources of materials. As with the data needs 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 for sources of materials for harvesting.

## Path Forward

- NRC's experience is that harvesting can yield highly representative and valuable data on materials aging, but these efforts may be expensive and challenging. Having a clearly defined objective and early engagement with other stakeholders, including the NPP from which harvesting will take place, are key to success. As specific harvesting opportunities are identified through this strategic approach, the NRC welcomes opportunities for cooperation and leveraging resources with other interested research organizations.



**From:** Hiser, Matthew  
**Sent:** Fri, 15 Sep 2017 15:06:51 +0000  
**To:** Moyer, Carol; Hull, Amy  
**Cc:** Purtscher, Patrick  
**Subject:** RE: FW: PLiM abstract on harvesting  
**Attachments:** Harvesting NRC Poster for PLiM.pptx

Note to requester:  
Attachment is  
immediately following.

Hi Amy and Carol,

Here's my initial stab at the harvesting poster for PLiM.

Please take a look and let me know what you think.

Thanks!  
Matt

---

**From:** Moyer, Carol  
**Sent:** Friday, July 21, 2017 11:26 AM  
**To:** Hiser, Matthew ; Hull, Amy  
**Subject:** RE: FW: PLiM abstract on harvesting

Thank you both!

The conference website is here: <http://www-pub.iaea.org/iaeameetings/50811/Fourth-International-Conference-on-Nuclear-Power-Plant-Life-Management>  
Poster guidelines are here: <http://www-pub.iaea.org/MTCD/Meetings/PDFplus/2017/cn246/cn246PosterGuidelines.pdf>

No specific due date is listed for posters.

**M. Key Dates and Deadlines**

Submission of Form for Submission of a Paper (Form B)  
and extended synopsis (800 words) 28 May 2017  
Submission of Grant Application Form (Form C): 28 May 2017  
Notification of acceptance of papers/posters: 30 June 2017  
Submission of full paper (only upon request by the IAEA): 18 October 2017

Posters may only be "due" at the conference itself? It would not hurt to have it done by 18 Oct., the paper deadline, though. It is unclear to me what they would do with a full paper, if one was not requested by IAEA. But I think you can prepare one, if you like. If they will not publish it as part of PLiM, we can find another home for it, or just release it as an NRC document.

-Carol

---

**From:** Hiser, Matthew  
**Sent:** Friday, July 21, 2017 11:12 AM

**To:** Hull, Amy <[Amy.Hull@nrc.gov](mailto:Amy.Hull@nrc.gov)>; Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

OK, I can work with Amy to make a poster. Rob and Pat and our PNNL contractor are also listed as co-authors...

---

**From:** Hull, Amy  
**Sent:** Friday, July 21, 2017 11:08 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>; Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

I think this is a good opportunity to publicize harvesting work and develop collaboration. Task 2 in UNR. I will make the poster. When is it due?

---

**From:** Moyer, Carol  
**Sent:** Friday, July 21, 2017 10:57 AM  
**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>; Hull, Amy <[Amy.Hull@nrc.gov](mailto:Amy.Hull@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

I'm pretty ambivalent about it. Amy, do you have a strong desire to make up a poster for the PLiM? Are there other co-authors to be consulted?

-Carol

---

**From:** Hiser, Matthew  
**Sent:** Friday, July 21, 2017 7:28 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** RE: FW: PLiM abstract on harvesting

Hi Carol,

Not terribly interested in a poster... The other thing is then you'd have to babysit the poster during poster session(s)?

I'd suggest we say thanks for the offer, but that's alright... what do you think?

Thanks!  
Matt

---

**From:** Moyer, Carol  
**Sent:** Thursday, July 20, 2017 12:49 PM  
**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>  
**Subject:** FW: FW: PLiM abstract on harvesting

Matt,

I am a bit confused by the pronoun used in this email...

Are you interested in doing a poster instead?

Carol

---

**From:** KRIVANEK, Robert [<mailto:R.Krivanek@iaea.org>]  
**Sent:** Thursday, July 20, 2017 11:10 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** [External\_Sender] FW: PLiM abstract on harvesting

You have just agreed that we will add this paper to poster session.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |  
LTO Programme Manager  
Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |  
[International Atomic Energy Agency](#) | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |  
Email: [r.krivanek@iaea.org](mailto:r.krivanek@iaea.org) | T: (+43-1) 2600-22018 | F: (+43-1) 2600-26007 |



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**From:** KRIVANEK, Robert  
**Sent:** Thursday, 20 July 2017 16:10  
**To:** 'Carol.Moyer@nrc.gov' <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** FW: PLiM abstract on harvesting

Dear Carol,

We asked you to submit your synopsis through INDICO (see email below) but it did not happen. So we were not able to send your synopsis to programme committee for evaluation and it will not occur on the conference programme.

Sorry for that but there are currently 300 delegates and 150 synopsis, so we were not able to track each of them separately.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |  
LTO Programme Manager  
Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |  
[International Atomic Energy Agency](#) | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |

Email: [r.krivanek@iaea.org](mailto:r.krivanek@iaea.org) | T: (+43-1) 2600-22018 | F: (+43-1) 2600-26007 |



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**From:** KRIVANEK, Robert  
**Sent:** Friday, 26 May 2017 08:55  
**To:** 'Carol.Moyer@nrc.gov' <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Cc:** KHAELSS, Martina <[M.Khaelss@iaea.org](mailto:M.Khaelss@iaea.org)>  
**Subject:** FW: PLiM abstract on harvesting

Dear Carol,

Thank you for your synopsis. We have opened INDICO system for this week, so please submit it through the system.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |  
LTO Programme Manager  
Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |  
**International Atomic Energy Agency** | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |  
Email: [r.krivanek@iaea.org](mailto:r.krivanek@iaea.org) | T: (+43-1) 2600-22018 | F: (+43-1) 2600-26007 |



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**From:** [Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov) [<mailto:Carol.Moyer@nrc.gov>]  
**Sent:** Friday, 26 May 2017 00:19  
**To:** KRIVANEK, Robert <[R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)>  
**Cc:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>; Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>; Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>  
**Subject:** PLiM abstract on harvesting

Dear Mr. Krivanek,

The US NRC would like to propose one more presentation for this autumn's PLiM conference, on harvesting of materials from operating and decommissioning power plants. I understand from Sherry Bernhoft that you already have an impressive number of abstracts, so I will understand if there is not room in the program for this one. Nevertheless, we would appreciate your consideration of this proposal.

Again, please let me know if you need any additional information. Many thanks,

Carol

---

*Carol E. Moyer*  
*Sr. Materials Engineer*  
*Office of Nuclear Regulatory Research*  
*RES/DE/CMB*  
[carol.moyer@nrc.gov](mailto:carol.moyer@nrc.gov)  
301-415-2153

---

**From:** KRIVANEK, Robert [<mailto:R.Krivanek@iaea.org>]  
**Sent:** Tuesday, May 23, 2017 2:41 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Subject:** [External\_Sender] RE: RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear Carol,

I will arrange it. Thank you.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |  
LTO Programme Manager  
Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |  
**International Atomic Energy Agency** | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |  
Email: [r.krivanek@iaea.org](mailto:r.krivanek@iaea.org) | T: (+43-1) 2600-22018 | F: (+43-1) 2600-26007 |



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**From:** [Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov) [<mailto:Carol.Moyer@nrc.gov>]  
**Sent:** Monday, 22 May 2017 20:44  
**To:** KRIVANEK, Robert <[R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)>  
**Subject:** RE: RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear Mr. Krivanek,

Since the formal deadline for abstract submissions has passed, I am no longer able to access the Indico system through the PLiM website (<https://conferences.iaea.org/indico/event/134/>). My abstract and Form B are attached.

Are you able to work with these documents? Is there anything else that you need me to do at this time?

Thanks again for your patience and assistance,  
Carol

---

**From:** Moyer, Carol  
**Sent:** Monday, May 22, 2017 10:59 AM  
**To:** 'KRIVANEK, Robert' <[R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)>  
**Cc:** Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>  
**Subject:** RE: RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear Mr. Krivanek,

My abstract is attached to this message, for your info. Separately, I will submit it through the Indico system. Please let me know if you need any other information at this stage.

Thank you,  
Mrs. Carol Moyer

---

**From:** KRIVANEK, Robert [<mailto:R.Krivanek@iaea.org>]  
**Sent:** Monday, May 22, 2017 2:56 AM  
**To:** Moyer, Carol <[Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov)>  
**Cc:** Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>  
**Subject:** [External\_Sender] RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear Mr Moyer,

It will be fine if you submit your abstracts this week.  
We are looking forward to see a strong NRC delegation in Lyon.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |  
LTO Programme Manager  
Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |  
**International Atomic Energy Agency** | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |  
Email: [r.krivanek@iaea.org](mailto:r.krivanek@iaea.org) | T: (+43-1) 2600-22018 | F: (+43-1) 2600-26007 |

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**From:** [Carol.Moyer@nrc.gov](mailto:Carol.Moyer@nrc.gov) [<mailto:Carol.Moyer@nrc.gov>]  
**Sent:** Friday, 19 May 2017 23:19  
**To:** KRIVANEK, Robert <[R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)>  
**Cc:** KANG, Ki-Sig <[K.S.Kang@iaea.org](mailto:K.S.Kang@iaea.org)>; Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>  
**Subject:** RE: CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear Mr. Krivanek,

The U.S. NRC intends to submit several abstracts for consideration for the PLiM conference in October. We have a short delay in completing one of our abstracts. I will be submitting it early next week, and I hope that you still will be able to consider it for the conference.

Thank you,  
Carol Moyer

---

*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](mailto:carol.moyer@nrc.gov)  
301-415-2153

---

**From:** [R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org) [<mailto:R.Krivanek@iaea.org>]  
**Sent:** Friday, April 21, 2017 8:44 AM  
**To:** [R.Krivanek@iaea.org](mailto:R.Krivanek@iaea.org)  
**Subject:** [External\_Sender] CN246\_PLiM\_Abstract deadline extended to 19 May 2017

Dear all,

Please be informed that we extended the abstract submission deadline to 19 May 2017 and updated the conference accordingly.

Best regards,

**Mr Robert KRIVANEK** | Senior Safety Officer |

LTO Programme Manager

Operational Safety Section | Division of Nuclear Installation Safety | Department of Nuclear Safety and Security |

International Atomic Energy Agency | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |

Email: [r.krivanek@iaea.org](mailto:r.krivanek@iaea.org) | T: (+43-1) 2600-22018 | F: (+43-1) 2600-26007 |



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# Harvesting of Aged Materials from Operating and Decommissioning Nuclear Power Plants

M. Hiser<sup>a</sup>, P. Purtscher<sup>a</sup>, P. Ramuhalli<sup>b</sup>, A. B. Hull<sup>a</sup>, R. Tregoning<sup>a</sup>, and C. E. Moyer<sup>a</sup>

<sup>a</sup>U.S. Nuclear Regulatory Commission (NRC), Washington, D.C., USA

<sup>b</sup>Pacific Northwest National Laboratory (PNNL), Richland, WA, USA

## Background and Motivation

- 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.
- Extended plant operation and SLR raise a number of technical issues that may require further research to understand aging mechanisms. U.S. utilities and the U.S. Nuclear Regulatory Commission (NRC) have focused on the aging of systems, structures, and components and in particular four key SLR issues: reactor pressure vessel (RPV) embrittlement, irradiation-assisted stress corrosion cracking of reactor internals, concrete structures and containment degradation, and electrical cable qualification and condition assessment.
- Meanwhile, 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 plants shutting down, these new developments provide opportunities for harvesting components that were aged in representative light water reactor (LWR) environments.
- In a third related development, economic challenges and limited budgets have restricted the resources available to support new research, including harvesting programs. Given this constrained budget environment, aligning interests and leveraging with other organizations is important to allow maximum benefit and value for future research programs.

## Current Activities

- NRC has recently undertaken an effort, with the assistance of Pacific Northwest National Lab (PNNL), to develop a strategic approach for harvesting aged materials from NPPs. Due to limited opportunities, past harvesting efforts have been reactive to individual plants shutting down and beginning decommissioning. Given the expected availability of materials from numerous plants and anticipated research needs to better understand aging out to 80 years of operation, the NRC is pursuing 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.
- The first step in this strategic approach is to prioritize data needs for harvesting. A data need describes a particular degradation scenario (combination of material and environment) and should be defined with as much detail as appropriate in terms of the material (alloy, composition, etc.) and environment (temperature, fluence, chemistry, etc.).



## Potential Criteria for Harvesting Prioritization

A number of criteria may be considered when prioritizing the data needs for harvesting, including:

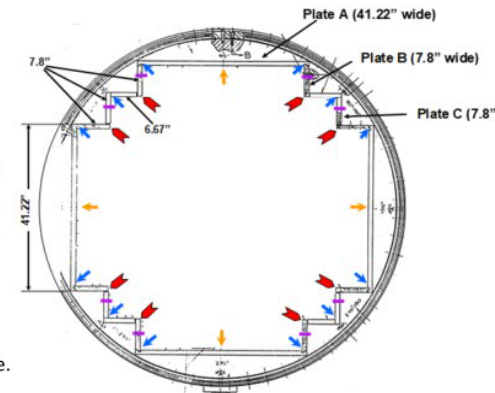
- Applicability of harvested material for addressing critical gaps
  - Harvesting for critical gaps prioritized over less essential technical gaps.
- Ease of laboratory replication of the degradation scenario
  - For example, simultaneous thermal and irradiation conditions are difficult to replicate or accelerated aging may not be feasible for a mechanism sensitive to dose rate.
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  - For example, unusual operating experience or legacy materials (fabrication methods, etc.) no longer available.
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- Another activity NRC is pursuing is the potential development of a database for sources of materials for harvesting, which could include both previously harvested materials and those available for future harvesting. This database would allow for aligning of high-priority data needs to the available sources of materials. As with the data needs 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 for sources of materials for harvesting.

## Path Forward

- NRC's experience is that harvesting can yield highly representative and valuable data on materials aging, but these efforts may be expensive and challenging. Having a clearly defined objective and early engagement with other stakeholders, including the NPP from which harvesting will take place, are key to success. As specific harvesting opportunities are identified through this strategic approach, the NRC welcomes opportunities for cooperation and leveraging resources with other interested research organizations.



**From:** Hiser, Matthew  
**Sent:** Fri, 24 Feb 2017 17:43:06 +0000  
**To:** Frankl, Istvan  
**Subject:** RE: Harvesting Announcement Email  
**Attachments:** Harvesting Workshop Attendees.docx

Note to requester: Attachment is immediately following.
---

Hi Steve,

No, I haven't received any more presentation titles since the agenda I sent yesterday, so that is the latest.

I have attached a list of attendees, both external and NRC.

Thanks!  
Matt

---

**From:** Frankl, Istvan  
**Sent:** Friday, February 24, 2017 12:30 PM  
**To:** Hiser, Matthew <Matthew.Hiser@nrc.gov>  
**Subject:** RE: Harvesting Announcement Email  
**Importance:** High

Matt,

I expect questions from my NRR counterparts, so please send me the preliminary list of attendees and their affiliation. If from NRC, please identify the office/division/branch.

I am ready to send the announcement, so if you have more up-to-date draft agenda, please attach it to your response.

Thanks,

Steve

---

**From:** Frankl, Istvan  
**Sent:** Friday, February 24, 2017 9:31 AM  
**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>  
**Subject:** RE: Harvesting Announcement Email

Thanks, Matt.

I will .

Steve

---

**From:** Hiser, Matthew  
**Sent:** Friday, February 24, 2017 9:27 AM  
**To:** Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>  
**Subject:** RE: Harvesting Announcement Email

Hi Steve,

Feel free to go ahead and send the email if you like Rob's edits. They're fine with me...

Thanks!  
Matt

---

**From:** Tregoning, Robert  
**Sent:** Thursday, February 23, 2017 3:45 PM  
**To:** Hiser, Matthew <[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)>; Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>  
**Cc:** Purtscher, Patrick <[Patrick.Purtscher@nrc.gov](mailto:Patrick.Purtscher@nrc.gov)>  
**Subject:** RE: Harvesting Announcement Email

Matt:

See my suggested edits and comments;

Dear RES and NRR BCs:

RES is hosting a workshop on ex-plant materials harvesting at NRC headquarters on March 7-8, 2017. The scope includes **any metallic, electrical, and concrete materials or components** that could benefit from harvesting, ~~including metallic, electrical, and concrete components~~. I have attached the agenda and workshop introduction slides that cover meeting logistics, motivation, approach, expected outcome, and session expectations.

This workshop includes about two dozen external participants, including representatives from DOE and EPRI as well as international research organizations ~~in from~~ Japan, Europe, and Canada. ~~Unfortunately, there is limited space available for NRC staff in the room. We have reached out to selected staff in RES and NRR to participate in the room to ensure we can fully support the workshop topics. {I would delete this; why do we need to raise this and provide a negative impression}. A webinar will be available to allow additional NRC staff to observe and participate in the workshop:~~ <https://attendee.gotowebinar.com/register/6076202901971284226> .

If you have any questions or need additional information about the workshop, please contact myself or Matt Hiser on my staff.

Sincerely,  
Steve Frankl

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:** Thursday, February 23, 2017 2:23 PM  
**To:** Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>  
**Cc:** Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>; Purtscher, Patrick <[Patrick.Purtscher@nrc.gov](mailto:Patrick.Purtscher@nrc.gov)>  
**Subject:** RE: Harvesting Announcement Email

Updated attachments with slight tweaks per our discussion Steve (added "draft" label to agenda given missing presentation titles, added summary report bullet to expected outcome slide).

Rob and Pat, feel free to wordsmith email below before Steve sends it out tomorrow.

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)

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**From:** Hiser, Matthew  
**Sent:** Thursday, February 23, 2017 9:27 AM  
**To:** Frankl, Istvan <[Istvan.Frankl@nrc.gov](mailto:Istvan.Frankl@nrc.gov)>  
**Cc:** Tregoning, Robert <[Robert.Tregoning@nrc.gov](mailto:Robert.Tregoning@nrc.gov)>; Purtscher, Patrick <[Patrick.Purtscher@nrc.gov](mailto:Patrick.Purtscher@nrc.gov)>  
**Subject:** Harvesting Announcement Email

Email to send to following RES and NRR BCs regarding workshop. Please take a look and provide any comments or feedback today if possible, so Steve can send email.

Send to:

RES/DE/CIB – Raj Iyengar  
RES/DE/ICEEB – Ian Jung  
RES/DE/SGSEB – Dogan Seber  
NRR/DLR/RARB – Dennis Morey  
NRR/DLR/RASB – Brian Wittick  
NRR/DLR/RSRG – Steve Bloom  
NRR/DE/EPNB – Dave Alley  
NRR/DE/EVIB – Dave Rudland  
NRR/DE/EEEEB – Jake Zimmerman

Dear RES and NRR BCs:

RES is hosting a workshop on ex-plant materials harvesting at NRC headquarters on March 7-8, 2017. The scope includes any materials that could benefit from harvesting, including metallic, electrical, and concrete components. I have attached the agenda and workshop introduction slides that cover meeting logistics, motivation, approach, expected outcome, and session expectations.

This workshop includes about two dozen external participants, including representatives from DOE and EPRI as well as international research organizations in Japan, Europe, and Canada. Unfortunately, there is limited space available for NRC staff in the room. We have reached out to selected staff in RES and NRR to participate in the room to ensure we can fully support the workshop topics. A webinar will be available to allow additional NRC staff to observe and participate: <https://attendee.gotowebinar.com/register/6076202901971284226>.

If you have any questions or need additional information about the workshop, please contact myself or Matt Hiser on my staff.

Sincerely,  
Steve Frankl

***Matthew Hiser***

Materials Engineer

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Division of Engineering | Corrosion and Metallurgy Branch

Phone: 301-415-2454 | Office: TWFN 10D62

[Matthew.Hiser@nrc.gov](mailto:Matthew.Hiser@nrc.gov)

Workshop Attendees

	Name	Organization
<b>Japan</b>	Taku Arai	CRIEPI
	Sadao Higuchi	CRIEPI
	Kazunobu Sakamoto	JNRA
	Yasuhiro Chimi	JAEA
<b>Europe</b>	Uwe Jendrich	GRS
	Rachid Chaouadi	SCK-CEN
	Guy Roussel	Bel V
<b>Canada</b>	Daniel Tello	CNSC
	Désiré Ndomba	CNSC
	Karen Huynh	AECL
<b>US industry</b>	Gerry van Noordennen	Energy
	Bill Zipp	Dominion
	Arzu Alpan	Westinghouse
<b>EPRI</b>	Sherry Bernhoft	EPRI
	Robin Dyle	EPRI
	Jean Smith	EPRI
	Al Ahluwalia	EPRI
<b>DOE</b>	Tom Rosseel	ORNL
	Rich Reister	DOE
	Keith Leonard	ORNL
	Mikhail A. Sokolov	ORNL
	John Wagner	INL
	John Jackson	INL
	Pradeep Ramuhalli	PNNL
<b>NRC</b>	Pat Purtscher, RES/DE/CMB	NRC
	Rob Tregoning, RES/DE	NRC
	Matt Hiser, RES/DE/CMB	NRC
	Mita Sircar, RES/DE/SGSEB	NRC
	Tom Koshy, RES/DE/ICEEB	NRC
	NRR/DE metals	NRC
	NRR/DLR metals	NRC
	NRR concrete	NRC

Note to requester:  
Attachments are  
immediately following.

**From:** Hiser, Matthew  
**Sent:** Thu, 23 Feb 2017 19:22:32 +0000  
**To:** Frankl, Istvan  
**Cc:** Tregoning, Robert; Purtscher, Patrick  
**Subject:** RE: Harvesting Announcement Email  
**Attachments:** Harvesting Workshop Draft Agenda.docx, Ex-Plant Materials Harvesting Workshop.pptx

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# Ex-Plant Materials Harvesting Workshop Draft Agenda

Tuesday, March 7

Session	Time	Organization	Speaker	Presentation Title
Intro	8:00	NRC		Welcome and Introduction to Workshop
1	8:15 – 8:45	EPRI	Sherry Bernhoft	
		DOE	Rich Reister	
		NRC	Robert Tregoning	NRC Perspective on Motivation for Harvesting
		GRS	Uwe Jendrich	
		CRIEPI	Taku Arai	
	8:45 – 9:45	DISCUSSION		
9:45-10:00		BREAK		
2	10:00 – 10:20	PNNL (for NRC)	Pradeep Ramuhalli	Data Needs Best Addressed By Harvesting
	10:20 – 10:30	NRC	Matthew Hiser	High-Priority Data Needs for Harvesting
	10:30 – 10:55	DOE	Keith Leonard	LWRS Program Perspective on the Technical Needs for Harvesting
	10:55 – 11:20	SCK-CEN	Rachid Chaouadi	Review of past RPV sampling test programs and perspective for long term operation
	11:20 – 11:45	Westinghouse	Arzu Alpan	Importance of Harvesting to Evaluate Radiation Effects on Concrete Properties
	11:45 – 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 – 1:45	PNNL (for NRC)	Pradeep Ramuhalli	Technical Information Needed for Informed Harvesting Decisions
	1:45 – 2:30	DISCUSSION		
	2:30 – 3:00	Action Items and Next Steps		
	3:00 – 4:00	EPRI	Sherry Bernhoft	Closing Thoughts
		DOE	Rich Reister	
		NRC	Robert Tregoning	
		ALL		

# Ex-Plant Materials Harvesting Workshop

March 7-8, 2017

USNRC HQ

Rockville, MD, USA

# Meeting Logistics

- Workshop will be held at NRC's Three White Flint North building
  - Directly adjacent to the White Flint Metro station
  - Nearest hotel within walking distance: Bethesda North Marriott Hotel & Conference Center
- Workshop is a non-public meeting to encourage open discussion
  - Presentations and meeting summary will be distributed among meeting participants only
- GoToMeeting webinar will be available to support additional attendees
  - Webinar attendees will be primarily observers
    - Limited opportunities for webinar attendee participation in discussion if time allows
  - Discussion will be recorded through GoToMeeting software to aid capturing discussion in meeting summary

# Motivation

- With plants shutting down both in the U.S. and internationally, there are increasing opportunities to harvest components from decommissioning plants
  - Past harvesting efforts generally more reactive as opportunities arose, rather than proactively planned
- Ex-plant materials may be valuable because they have been exposed to actual in-service plant operating conditions
  - Can reduce the uncertainty associated with the applicability of the aging conditions
- Insights from research on harvested materials can address technical data needs identified for extended plant operation
- Lessons learned from past harvesting programs can help improve future harvesting efforts
  - Challenges encountered in previous programs can be shared and mitigated or avoided in future programs

# Approach

- Domestic and international researchers, industry, regulators, and decommissioning companies' discuss benefits and challenges with ex-plant harvesting
  - Encourage sharing of lessons learned as well as areas of common interest
- Workshop consists of topical sessions with short presentations and significant time for open discussion
  - Goal is to maximize engagement among meeting participants
- Scope includes any materials aging issue that could benefit from harvesting, including metals, cables, and concrete

# Expected Outcome

- Participants become better informed and aware of the benefits and challenges associated with ex-plant harvesting
- Discussions help identify areas of common interest for harvesting to address technical data needs
- Presentations and discussions provide the starting point for a “database” of harvested materials and future harvesting opportunities
- Contacts are made among research organizations to allow for further discussion of specific harvesting projects
- Workshop summary documenting discussion will be distributed among participants

# Session Expectations

- Session 1 Motivation for Harvesting
  - Perspective from panel participants on their organizations' interest in and motivation for harvesting
  - Brief (5-10 minute) presentation from each panel member followed by general discussion
- Session 2 Technical Data Needs for Harvesting
  - Presenters share high-priority data needs that may be best addressed by harvesting
    - Where does harvesting hold particular value compared to other sources of technical data
  - 15-20 minute presentations followed by open discussion of technical data needs for harvesting

# Session Expectations

- Session 3 Sources of Materials
  - Information on previously harvested materials and future harvesting opportunities
    - Materials located at research and vendor facilities
    - Decommissioning plants that may allow for future harvesting
  - Short 5-10 minute presentations followed by open discussion
  - Starting point for potential database of previously harvested materials and future harvesting opportunities
- Session 4 Harvesting Experience: Lessons Learned and Practical Aspects
  - Improving future efforts with lessons learned from past programs
    - Pitfalls to avoid and strategies to improve likelihood of success
  - Practical perspective from non-researchers on how harvesting interfaces with the decommissioning process
  - International decommissioning and harvesting experience
  - 20-30 minute presentations followed by open discussion

# Session Expectations

- Session 5 Future Harvesting Program Planning
  - Technical and logistical information needed when planning a specific harvesting program
  - Perspective from panel participants on the workshop
  - Next steps and actions from workshop
  - Potential areas of common interest for future harvesting programs
  - Brief (5-10 minute) presentation from each panel member followed by general discussion