

Note to requester: The attachments are immediately following.

From: Hiser, Matthew
Sent: Friday, January 26, 2018 8:57 AM
To: Tregoning, Robert; Audrain, Margaret
Subject: FW: Requesting DE Management Review/Approval for the CMB RIC Posters
Attachments: RIC Poster on Harvesting.pptx; RIC Poster on AM.pptx

Importance: High

FYI – latest status of RIC poster...

From: Frankl, Istvan
Sent: Wednesday, January 24, 2018 4:08 PM
To: Thomas, Brian <Brian.Thomas@nrc.gov>; Regan, Christopher <Christopher.Regan@nrc.gov>
Cc: Moyer, Carol <Carol.Moyer@nrc.gov>; Hull, Amy <Amy.Hull@nrc.gov>; Hiser, Matthew <Matthew.Hiser@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: Requesting DE Management Review/Approval for the CMB RIC Posters
Importance: High

Brian and Chris,

I have attached the two CMB RIC posters for your review and approval.

Thanks,

Steve

From: Hiser, Matthew
Sent: Wednesday, January 24, 2018 9:45 AM
To: Frankl, Istvan <Istvan.Frankl@nrc.gov>
Cc: Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: FW: Gentle Reminder for Presentation Submissions to OGC/QTE
Importance: High

Hi Steve,

I have put the harvesting poster info into the RIC template. This is largely the same information that was used for the PLiM meeting late last year. Please review and send on to division management for approval if you approve.

Thanks!
Matt

Matthew Hiser

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

From: RICMST Resource

Sent: Wednesday, January 24, 2018 8:09 AM

To: Bernardo, Robert <Robert.Bernardo@nrc.gov>; Hall, Victor <Victor.Hall@nrc.gov>; Wilson, Joshua <Joshua.Wilson@nrc.gov>; Jones, Heather <Heather.Jones@nrc.gov>; Bridge, Joanna <Joanna.Bridge@nrc.gov>; Mendiola, Mary <Mary.Mendiola@nrc.gov>; Zuberi, Sardar <Sardar.Zuberi@nrc.gov>; Dembek, Stephen <Stephen.Dembek@nrc.gov>; Yadav, Priya <Priya.Yadav@nrc.gov>; Gifford, Ian <Ian.Gifford@nrc.gov>; Smith, Todd <Todd.Smith@nrc.gov>; Orf, Tracy <Tracy.Orf@nrc.gov>; Cruz, Holly <Holly.Cruz@nrc.gov>; Morey, Dennis <Dennis.Morey@nrc.gov>; Oberson, Greg <Greg.Oberson@nrc.gov>; Hull, Amy <Amy.Hull@nrc.gov>; Savoy, Joanne <Joanne.Savoy@nrc.gov>; Ralph, Melissa <Melissa.Ralph@nrc.gov>; King, Shannon <Shannon.King@nrc.gov>; Hiser, Matthew <Matthew.Hiser@nrc.gov>; Armstrong, Kenneth <Kenneth.Armstrong@nrc.gov>
Cc: RICMST Resource <RICMST.Resource@nrc.gov>; Kipfer, Lorna <Lorna.Kipfer@nrc.gov>
Subject: Gentle Reminder for Presentation Submissions to OGC/QTE
Importance: High

Good Morning ePoster and Digital Presenters,

This is a gentle reminder to do the following:

- Obtain managerial approval for your ePoster and Digital Presentation
- If your poster has been selected for OGC Review please submit and cc RICMST.Resource@nrc.gov
- Submit your poster to QTE for Level 1 review (note all ePosters and Digital Presentations should be submitted to QTE for final reviews)

Refer to ePoster and Digital Presentation Flowchart for further guidance (also attached). It is important that you adhere to the due dates as close as possible. If you are unable to meet this deadline please contact me as soon as possible via email Brenett.warren@nrc.gov or call me at 415-3114.

Once again thank you,

Brenett (Bren) U. Warren

Program Specialist
Office of Nuclear Reactor Regulation
NRR/DMPS/RISB
Location: O13D5
301-415-3114
Brenett.Warren@nrc.gov



Follow us on Twitter @nrcgov_ric

Follow us on Twitter @nrcgov_ric



Review of Additive Manufacturing by Direct Metal Laser Melting

A. Hull, T. Herrity, and C. Moyer, U.S. Nuclear Regulatory Commission (NRC)

Background and Motivation

The NRC has been informed that Additively Manufactured (AM) parts are being considered for applications in the operating fleet within a few years. The first industry alert in June 2017 concerned using the direct metal laser melting (DMLM) method to manufacture parts for reactor components. A subsequent scoping study by RES staff is providing more insight into the technical issues that must be addressed to assure reliability of specific DMLM-produced components accepted by NRC, including design, precursor materials, finished material properties, structural integrity, nondestructive evaluation, and quality assurance.

One of the activities in this scoping study was to host a Nov 28-29 public meeting "Additive Manufacturing for Reactor Materials and Components" at NRC Headquarters. Presentations from the 28 speakers from American and international industry, EPRI, NEI, DoD facilities, DOE and National Laboratories, ASME, ASTM, ANSI, FAA, NASA, and NIST are available in ADAMS (ML17338A880).



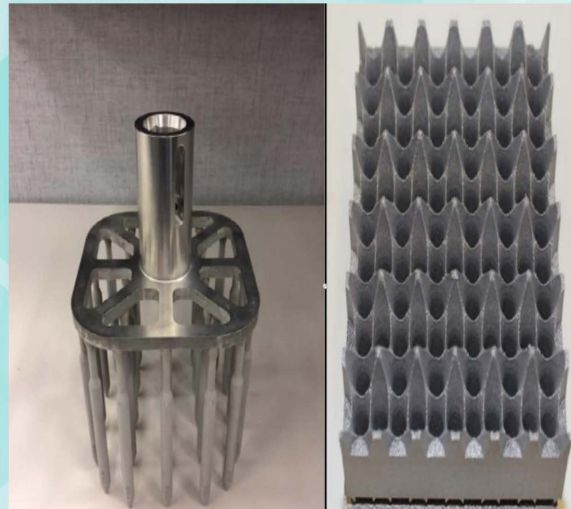
DMLM Showcase at GE-H Advanced Manufacturing Works, Greenville, SC.
C. Moyer photograph, Dec. 11, 2017

Current Activities

NRC has recently undertaken an effort, to develop a strategic approach to creating an agency action plan to address additive manufacturing for reactor materials and components (AM-RMC). Economic challenges and limited budgets have restricted the resources available to support new research, including those related to advanced manufacturing. Given this constrained budget environment, aligning interests and leveraging with other organizations is important to allow maximum benefit for future research programs

The strategic approach is to focus on topic areas of interest identified at the AM-RMC Public Meeting.

- ❖ Quality of AM materials and components for NPPs
- ❖ Codes and standards aspects of AM
- ❖ Properties and structural performance
- ❖ Service performance / aging degradation



Westinghouse's DMLM Examples: thimble plugging device,
advanced debris filtering bottom nozzle, Bill Cleary, Presentation at
Public Meeting AM-RMC, Nov. 28, 2017.

Path Forward

The NRC is evaluating additive manufacturing within the framework of other advanced manufacturing technologies. Additive Manufacturing has been identified as an area of potential future utilization by the nuclear industry – "when" and "how many" are the questions.

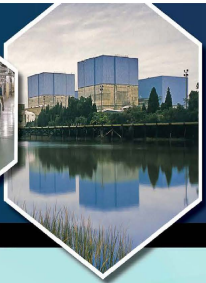
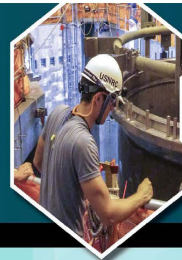
NRC interest areas include the quality, properties, and structural performance of AM parts, including their inspectability. The service performance and aging degradation of AM parts are critical. It will be essential to make a comparison of performance of parts from AM and conventional manufacturing process

Challenges to be addressed include limited understanding of acceptable ranges of variation for key manufacturing parameters; limited understanding of key failure mechanisms and material anomalies; lack of industry databases, and lack of industry specifications and standards.

Codes and standards aspects of AM is a key to successful implementation.



SDOs involved with AM Standardization, J. McCabe, Presentation at
Public Meeting AM-RMC, Nov. 29, 2017



Harvesting of Aged Materials from Nuclear Power Plants

M. Hiser^a, P. Purtscher^a, P. Ramuhalli^b, A. B. Hull^a, and R. Tregoning^a; ^aU.S. Nuclear Regulatory Commission (NRC), ^bPacific Northwest National Laboratory (PNNL)

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.



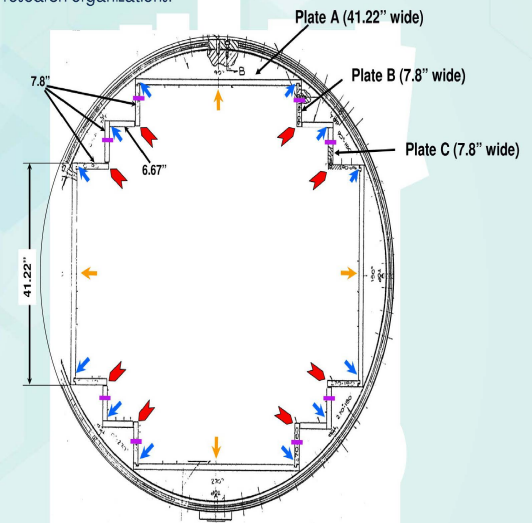
Lifting operation for irradiated materials transport cask

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.



Example of reactor internals harvesting plan

Subject: Harvesting Prioritization
Location: Kenn's office

Note to requester: The attached Excel file, "Harvesting Needs Prioritization" is immediately following.

Start: Wed 10/3/2018 2:00 PM
End: Wed 10/3/2018 2:30 PM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Hiser, Matthew
Required Attendees Miller, Kenneth A



Latest spreadsheet attached. Please let me know if you have any questions.

Thanks!
Matt

Criteria Title	Description	Scoring Guidance
Criticalness of Technical Gap Addressed	Harvesting to address critical gaps should be prioritized over less essential technical gaps	<p>H = high risk significance / little to no available data MH = Medium-high risk significance / limited data available M = Moderate risk significance / some data available ML = low to moderate risk significance / sufficient data available for regulatory decisions L = Low risk significance / large amount of data available</p> <p>H = High MH = Medium-high M = Medium ML = Medium-low L = Low</p>
Importance of Harvested Materials over Laboratory Aging	Key considerations are the ease of laboratory replication of aging mechanism and unique field aspects of the aging mechanism. Degradation mechanisms that are harder to replicate with simulated aging conditions would be of higher priority for harvesting. For example, simultaneous thermal and irradiation conditions are difficult to replicate outside of the plant environment. Alternatively, accelerated aging may not be feasible for a mechanism sensitive to dose rate. These two degradation mechanisms may be best evaluated using harvested materials. For unique field aspects, legacy materials (e.g., fabrication methods, composition) that are no longer available, but may play an important role in a potential degradation mechanism, would have a higher priority than harvesting materials that can be obtained from other sources with representative properties.	<p>H = Nearly impossible to replicate service environment / critically important to use harvested materials MH = Challenging to replicate service environment / important to use harvested materials M = Possible with some limitations to replicate service environment / moderately important to use harvested materials ML = Not challenging to replicate service environment / less important to use harvested materials L = Very easy to replicate service environment / not important to use harvested materials</p> <p>H = All plants MH = All PWRs M = All BWRs or most PWRs ML = ~10-15 plants L = <5 plants</p>
Applicability to US Operating Fleet	There is greater value in developing knowledge to address an issue that may be applicable to a larger number of plants compared to one that may only affect a relatively small number of plants.	<p>H = No or very limited inspection methods available / low confidence in AMPs MH = Limited inspection methods available / low-to-moderate confidence in AMPs M = Some inspection methods available / moderate confidence in AMPs ML = Good inspection methods available / medium-high confidence in AMPs L = Effective, well-accepted inspection methods exist / high confidence in AMPs</p>
Regulatory Considerations Related to Inspections and AMPs	If mature inspection methods exist and are easy to apply to monitor degradation, harvesting may be less valuable. If inspection methods do not exist, harvesting may be essential to ensure confidence in the assessment of age-related degradation in that particular component. The less confidence that NRC staff has in the effectiveness of the relevant AMP, the higher priority for harvesting.	<p>H = Highly irradiated (>5 dpa) MH = Lightly irradiated / contaminated M = Minimal contamination or high effort unirradiated ML = Unirradiated, moderate effort expected L = Unirradiated, low effort expected</p>
Harvesting cost and complexity	Activities with higher costs and complexity are less attractive than similar activities with lower costs and that are simpler to execute. For example, harvesting unirradiated concrete or electrical cables is less expensive and less complex than harvesting from the RPV internals or the RPV.	
Timeliness of results	The ability of a potential harvesting program to provide timely results to support either a technical or regulatory need is important. Having high confidence that results will be timely increases the priority.	
Availability of materials for harvesting	The availability of materials to harvest for a particular data need is clearly essential and increases the priority.	

	Basic Info		Technical Criteria										Cost / Complexity		Project Specific	
Need Description	Purpose / Testing Planned	Technical Knowledge Gained	Criticalness of Technical Gap Addressed		Importance of Harvested Materials over Laboratory Aging		Applicability to US Operating Fleet		Regulatory Considerations Related to Inspections and AMPs		Score Average	Basis for Technical Priority			Timeliness of results	Availability of materials for harvesting
RPV			Score	Comment	Score	Comment	Score	Comment	Score	Comment			Score	Comment		
RPV - High fluence & high shift vessel with well-established unirradiated properties	Measure fluence, toughness, & chemistry as a function of through-thickness position	Through thickness section to validate fluence & attenuation models	M	This work has been done before but the additional work should focus on higher fluences to verify that the attenuation trends expected are maintained.	MH	There are not many studies that irradiate 6 to 9 inches of steel so, from that standpoint, getting specimens from an RPV are important for studying attenuation	M	While the information should be generically applicable, if, for some reason, the results are only applicable to "high fluence" materials/locations, this might result in less relevance to lower fluence plants (including BWRs).	ML	The attenuation models have the least amount of supporting information compared to other aspects related to RPV embrittlement. However, studies to date have validated the conservatism of existing attenuation models used in regulatory applications.	M	The attenuation study is slightly more important to me, just because there are fewer such studies that have been done. Being able to confirm expected trends at higher fluence levels would therefore be useful.	MH	Material is irradiated which will affect all aspects of specimen preparation and testing. Further, taking specimens at several through-thickness locations will increase cost.	The results would be timely if they are developed before 2024 or so to coincide with the additional information being collected from industry surveillance programs.	Other than Zion materials, I'm not aware of other RPVs that are available for harvesting.
RPV - Samples from virtually any vessel	Enable measurement of both the Charpy transition curve and master curve transition temperature T0	Provides data supporting evolution from the use of correlative (Charpy-based) to direct measurement (fracture toughness-based) approaches	M	I believe that enough data has been developed from both test and surveillance specimens such that the link is well-established. I will say that there is	ML	The only real advantage in my mind for having vessel material for this study is that there are no questions about the representativeness of any lead-factor irradiation compared to the actual vessel irradiation.	MH	Any information developed should be generically applicable	ML	We have as good a confidence in RPV embrittlement than virtually any other degradation that we study. The only real issue is making sure that our understanding remains applicable at the highest expected fluences.	M - ML	While it's always useful to have more data, especially on RPV materials, I feel that our models already have a good technical basis.	MH	Material is irradiated which will affect all aspects of specimen preparation and testing.	The results would be timely if they are developed before 2024 or so to coincide with the additional information	Other than Zion materials, I'm not aware of other RPVs that are available for harvesting.

	Basic Info		Technical Criteria								Cost / Complexity		Project Specific			
Need Description	Purpose / Testing Planned	Technical Knowledge Gained	Criticalness of Technical Gap Addressed	Importance of Harvested Materials over Laboratory Aging		Applicability to US Operating Fleet		Regulatory Considerations Related to Inspections and AMPs		Score Average			Basis for Technical Priority	Timeliness of results	Availability of materials for harvesting	
RPV			Score	Comment	Score	Comment	Score	Comment	Score	Comment	Score	Comment				
RPV - High fluence & high shift vessel with well-established unirradiated properties	Measure fluence, toughness, & chemistry as a function of through-thickness position	Through thickness section to validate fluence & attenuation models	MH	Score is MH within the belline. Change to H beyond the belline	MH	Again change to H outside of belline	MH		#N/A	embrittlement is not inspected for			MH	Both	Attenuation formula has been used for years. Inside the belline it's accepted and believed conservative, and it is probably true. Greater impact associated with harvested data outside of belline.	
RPV - Samples from virtually any vessel	Enable measurement of both the Charpy transition curve and master curve transition temperature T0	Provides data supporting evolution from the use of correlative (Charpy-based) to direct measurement (fracture toughness-based) approaches	MH		MH		H		#N/A	embrittlement is not inspected for			MH		Very limited ex-plant data exists worldwide (perhaps 6 plants) to compare to surveillance data. Those data that do exist compare reasonably well, &/or have explainable reasons for disagreement. We have little physical reason to expect differences between ex-plant (harvested) data and surveillance data ... but (as noted) we have not checked in that many cases.	

	Basic Info		Technical Criteria								Cost / Complexity		Project Specific			
Need Description	Purpose / Testing Planned	Technical Knowledge Gained	Criticalness of Technical Gap Addressed		Importance of Harvested Materials over Laboratory Aging		Applicability to US Operating Fleet		Regulatory Considerations Related to Inspections and AMPs				Score Average	Basis for Technical Priority	Timeliness of results	Availability of materials for harvesting
METALS			Score	Comment	Score	Comment	Score	Comment	Score	Comment			Score	Comment		
High fluence reactor internals	Void swelling, mechanical properties, IASCC	Likely extent of void swelling in PWRs during extended operation and impact on cracking	M	Fills data gap for extended plant operation	MH	Laboratory replication very difficult to impossible to achieve fluences with representative irradiation conditions	MH	Applicable to high-fluence components in most PWRs	MH	EPRI performing R&D on NDE for void swelling; MRP 227 uses primarily visual testing, which could detect void swelling once fairly significant	3.75	Significance of void swelling at higher fluences is uncertain, and inspections may detect onset of significant degradation	VH	Very high cost for highly irradiated internals		TBD
Higher fluence SS welds (>2 dpa)	Fracture toughness, IASCC, and microstructure	CGR and FT properties for irradiated SS weld and HAZ materials to inform inspection scope and interval and flaw evaluation	H	Little to no data exists on SS welds above 2 dpa	M	Fluence levels may be achieved by test reactor irradiation (e.g. further irradiation of Zorita welds), but would be most representative with ex-plant materials.	MH	Applicable to most PWRs	MH	MRP-227 requires visual inspections, which can be followed by volumetric to size flaws. However, lack of data above 2 dpa creates uncertainty on assumptions for CGR and FT in flaw evaluation.	4	Inspections are required, but lack of data above 2 dpa creates uncertainty on assumptions for CGR and FT in flaw evaluation.	H	High cost for irradiated components		
Thermally aged unirradiated CASS	Fracture toughness and microstructure	Fracture toughness data in real conditions to compare to accelerated aging data	MH	Validate accelerated aging data	H	Purpose of work would be to provide real-world validation of accelerated aging in lab testing	M	Most applicable to a subset of PWRs	H	No ISI method available to measure loss of FT	4.25	Would greatly increase confidence in large set of accelerated aging data with testing of unirradiated materials	M	Moderate cost for contaminated, but not irradiated, primary stem components		
Moderate fluence (1-2 dpa) CASS	Fracture toughness and microstructure	Fracture toughness data near limit requiring further evaluation	ML	Confirm regulatory position	MH	May be possible, but difficult to replicate long-term aging and irradiation effects	M	Most applicable to a subset of PWRs	H	No ISI method available to measure loss of FT	3.5	Would increase confidence in regulatory position	H	High cost for irradiated components		
Metallic components with known flaws	NDE and destructive examination	Determine whether SCC mitigation methods are effective at preventing SCC; effectiveness of NDE at detection and sizing	MH	Validate NDE and mitigation method effectiveness	MH	Purpose of work would be to provide real-world validation of lab testing	H	Applicable to all plants	ML	Purpose of this work is to assess inspection and mitigation method effectiveness	3.75	Increase confidence in NDE and mitigation methods	M	Moderate cost for contaminated, but not irradiated, primary stem components		
Metallic components with limiting fatigue life	NDE and destructive examination	Determine whether fatigue flaws are present in high usage locations	MH	Validate fatigue life methodologies	ML	Purpose of work would be to provide real-world validation of lab testing	H	Applicable to all plants	ML	Fatigue calculations inform sampling inspections of limiting fatigue locations	3.25	Increase confidence in fatigue life calculations	M	Moderate cost for contaminated, but not irradiated, primary stem components		

[illegible]

	Basic Info		Technical Criteria										Cost / Complexity		Project Specific	
Need Description	Purpose / Testing Planned	Technical Knowledge Gained	Criticalness of Technical Gap Addressed		Importance of Harvested Materials over Laboratory Aging		Applicability to US Operating Fleet		Regulatory Considerations Related to Inspections and AMPs		Score Average	Basis for Priority	Cost / Complexity		Timeliness of results	Availability of materials for harvesting
CONCRETE			Score	Comment	Score	Comment	Score	Comment	Score	Comment			Score	Comment		
Structures exposed to high radiation	Degradation of concrete due to irradiation, attenuation of radiation through concrete.	Physical and mechanical degradation data under service environment. Level of irradiation (neutron, gamma, temperature) through the concrete and depth of irradiation damage. Aggregate expansion, cracking of concrete, differential response of components of concrete, i.e., aggregate, mortar, and rebar/steel embeds and degradation under thermo-hydro-radio-mechanical environment due to radiation. Conduct NDEs.	H	Confirm regulatory position. Data available from 1970's are not representative of light water reactor (LWR) environments. Recent limited number of data available from NRAJ are representative of LWR environment. Validate accelerated aging data. Currently no data available from service irradiated concrete. Real world validation of test data and benchmarking of degradation models. Conduct NDEs.	H	Harvesting is of high importance because no data available from service irradiated concrete, inaccessible for inspection, limited lab test data, small scale lab test specimen.	M	Most PWRs	H	New aging mechanism added for further evaluation in SLR-GALL and SLR-SRP. No inspection method and data available.	4.5	Very limited data, new aging mechanism added in SLR-GALL, SLR-SRP. No inspection method and OE not available because location inaccessible. Safety significance for RPV support structures are critical.	M	Moderate cost for moderate level of irradiation on concrete.		TBD
Post-tensioned structures	Degradation of post-tensioning (PT) system.	In-situ internal degradation, delamination, adjustment of prestress force and interaction with insitu degradation.	MH	Investigate and verify knowledge related to degradation modes under sustained multi axial prestressing force without radial rebar, internal degradation, degradation of prestressing system including anchorage, NDE methods.	MH	Real world validation of lab testing, bench marking of numerical modelling, potential failure modes, applicable NDEs. Critical information from failed post-tensioned containmet.	MH	About 37% US NPPs containment is post-tensioned. Also there are a few post-tensioned/prestressed SFP.	H	Concrete internal condition is not part of ISI. Limited condition monitoring for tendon. Detensioning and retensioning of tendons of aged containment. Effective NDE for PT containment structure not available.	4.25	Improve confidence on numerical modelling, potential failure modes, degradations, and NDEs. Collect critical information from failed post-tensioned containmet.	L	Unirradiated		TBD
Corrosion of reinforcing steel, tendon, liner, embedment	Degradation of concrete from Alkali-Silica-Reaction (ASR)	Ongoing research is providing understanding of the concrete material damage mechanisms and the characterization of that damage as well as of its implications to structural performance. The knowledge gained is primarily derived from laboratory testing together with visual observations of field structures.	MH	To study in-situ effects of ASR concrete degradation and comparison with understanding developed from laboratory testing. To investigate possibility of combined aging effects such as ASR and reinforcement corrosion.	M	The knowledge gained from the current research is primarily derived from controlled laboratory testing involving controlled aging environments at constant environemnts, homogeneous aging and single aging mechanism.	H	One plant severely affected by ASR in the US. Because ASR is a slow evolving chemical mechanism of the concrete itself and all plants have safety-related concrete structures, monitoring for ASR is part of concrete magement programs for all concrete structures for long term oeprations.	M	Monitoring for manifestation of ASR is part of aging management programs for concrete structures. For structures with ASR more complex aging management plans would monitor the progression of ASR, concrete cracking, structural deformations and, if needed, involve coring and testing of samples. Study of in-situ conditions would support implementation of more effective aging management plans.	3.75	Inform adjsutements to aging management programs. Enhanced understanding of the possibility of combined degradation effects in the field. Assess homogeneity of damage in real structures.	L	Unirradiated		An international cooperative research program is being initiated under the auspices to the CSNI. The program will test concrete samples harvested from a decommissioned nuclear power plant in Canada extensively affected by ASR. The NRC plans to participate in this program, which is likely to provide timely results.

Subject: Harvesting Prioritization
Location: HQ-TWFN-10A73-8p

Start: Mon 7/9/2018 3:00 PM
End: Mon 7/9/2018 3:30 PM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Hiser, Matthew
Required Attendees: Koshy, Thomas; Sircar, Madhumita
Resources: HQ-TWFN-10A73-8p

Hi Tom and Mita,

I'd like to follow up with you guys this afternoon on progress to prioritizing technical needs for harvesting in the electrical and concrete areas.

Thanks!
Matt

Subject: Harvesting Prioritization Follow-up
Location: Huddle room T10D40

Start: Mon 9/10/2018 10:30 AM
End: Mon 9/10/2018 11:00 AM

Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Hiser, Matthew

Required AttendeesSircar, Madhumita

Note to requester: The attachment is immediately following.

From: Hiser, Matthew
Sent: Fri, 31 Aug 2018 13:32:44 +0000
To: Kirk, Mark;Gordon, Matthew;Tregoning, Robert
Cc: Purtscher, Patrick;Audrain, Margaret
Subject: Harvesting prioritization for RPV
Attachments: Harvesting Needs Prioritization 8-31-18.xlsx

Hi Mark, Matt, and Rob,

We would like to request your input as the RPV technical experts on the prioritization of harvesting opportunities for RPV materials. I have attached a template of the prioritization of harvesting needs in the non-RPV metals area. Can you follow that template (check the scoring guidance on the first sheet) to provide input for the RPV technical area?

Ideally, it would be good if we could receive your input in the next two weeks by September 14. We're hoping to pull all of the input from the different areas into a broader harvesting draft deliverable to share with NRR for feedback by October.

Please me know if you have any 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

Criteria Title	Description	Scoring Guidance
Criticalness of Technical Gap Addressed	Harvesting to address critical gaps should be prioritized over less essential technical gaps	<p>H = high risk significance / little to no available data MH = Medium-high risk significance / limited data available M = Moderate risk significance / some data available ML = low to moderate risk significance / sufficient data available for regulatory decisions L = Low risk significance / large amount of data available</p> <p>H = High MH = Medium-high M = Medium ML = Medium-low L = Low</p>
Importance of Harvested Materials over Laboratory Aging	Key considerations are the ease of laboratory replication of aging mechanism and unique field aspects of the aging mechanism. Degradation mechanisms that are harder to replicate with simulated aging conditions would be of higher priority for harvesting. For example, simultaneous thermal and irradiation conditions are difficult to replicate outside of the plant environment. Alternatively, accelerated aging may not be feasible for a mechanism sensitive to dose rate. These two degradation mechanisms may be best evaluated using harvested materials. For unique field aspects, legacy materials (e.g., fabrication methods, composition) that are no longer available, but may play an important role in a potential degradation mechanism, would have a higher priority than harvesting materials that can be obtained from other sources with representative properties.	<p>H = Nearly impossible to replicate service environment / critically important to use harvested materials MH = Challenging to replicate service environment / important to use harvested materials M = Possible with some limitations to replicate service environment / moderately important to use harvested materials ML = Not challenging to replicate service environment / less important to use harvested materials L = Very easy to replicate service environment / not important to use harvested materials</p> <p>H = All plants MH = All PWRs M = All BWRs or most PWRs ML = ~10-15 plants L = <5 plants</p>
Applicability to US Operating Fleet	There is greater value in developing knowledge to address an issue that may be applicable to a larger number of plants compared to one that may only affect a relatively small number of plants.	<p>H = No or very limited inspection methods available / low confidence in AMPs MH = Limited inspection methods available / low-to-moderate confidence in AMPs M = Some inspection methods available / moderate confidence in AMPs ML = Good inspection methods available / medium-high confidence in AMPs L = Effective, well-accepted inspection methods exist / high confidence in AMPs</p>
Regulatory Considerations Related to Inspections and AMPs	If mature inspection methods exist and are easy to apply to monitor degradation, harvesting may be less valuable. If inspection methods do not exist, harvesting may be essential to ensure confidence in the assessment of age-related degradation in that particular component. The less confidence that NRC staff has in the effectiveness of the relevant AMP, the higher priority for harvesting.	<p>H = Highly irradiated (>5 dpa) MH = Lightly irradiated / contaminated M = Minimal contamination or high effort unirradiated ML = Unirradiated, moderate effort expected L = Unirradiated, low effort expected</p>
Harvesting cost and complexity	Activities with higher costs and complexity are less attractive than similar activities with lower costs and that are simpler to execute. For example, harvesting unirradiated concrete or electrical cables is less expensive and less complex than harvesting from the RPV internals or the RPV.	
Timeliness of results	The ability of a potential harvesting program to provide timely results to support either a technical or regulatory need is important. Having high confidence that results will be timely increases the priority.	
Availability of materials for harvesting	The availability of materials to harvest for a particular data need is clearly essential and increases the priority.	

[illegible]

	Basic Info		Technical Criteria										Cost / Complexity		Project Specific	
Need Description	Purpose / Testing Planned	Technical Knowledge Gained	Criticalness of Technical Gap Addressed		Importance of Harvested Materials over Laboratory Aging		Applicability to US Operating Fleet		Regulatory Considerations Related to Inspections and AMPs		Score Average	Basis for Technical Priority			Timeliness of results	Availability of materials for harvesting
METALS			Score	Comment	Score	Comment	Score	Comment	Score	Comment			Score	Comment		
High fluence reactor internals	Void swelling, mechanical properties, IASCC	Likely extent of void swelling in PWRs during extended operation and impact on cracking	M	Fills data gap for extended plant operation	MH	Laboratory replication very difficult to impossible to achieve fluences with representative irradiation conditions	MH	Applicable to high-fluence components in most PWRs	MH	EPRI performing R&D on NDE for void swelling; MRP 227 uses primarily visual testing, which could detect void swelling once fairly significant	3.75	Significance of void swelling at higher fluences is uncertain, and inspections may detect onset of significant degradation	VH	Very high cost for highly irradiated internals		TBD
Thermally aged unirradiated CASS	Fracture toughness and microstructure	Fracture toughness data in real conditions to compare to accelerated aging data	MH	Validate accelerated aging data	H	Purpose of work would be to provide real-world validation of accelerated aging in lab testing	M	Most applicable to a subset of PWRs	H	No ISI method available to measure loss of FT	4.25	Would greatly increase confidence in large set of accelerated aging data with testing of unirradiated materials	M	Moderate cost for contaminated, but not irradiated, primary stem components		
Moderate fluence (1-2 dpa) CASS	Fracture toughness and microstructure	Fracture toughness data near limit requiring further evaluation	ML	Confirm regulatory position	MH	May be possible, but difficult to replicate long-term aging and irradiation effects	M	Most applicable to a subset of PWRs	H	No ISI method available to measure loss of FT	3.5	Would increase confidence in regulatory position	H	High cost for irradiated components		
Metallic components with known flaws	NDE and destructive examination	Determine whether SCC mitigation methods are effective at preventing SCC; effectiveness of NDE at detection and sizing	MH	Validate NDE and mitigation method effectiveness	MH	Purpose of work would be to provide real-world validation of lab testing	H	Applicable to all plants	ML	Purpose of this work is to assess inspection and mitigation method effectiveness	3.75	Increase confidence in NDE and mitigation methods	M	Moderate cost for contaminated, but not irradiated, primary stem components		
Metallic components with limiting fatigue life	NDE and destructive examination	Determine whether fatigue flaws are present in high usage locations	MH	Validate fatigue life methodologies	ML	Purpose of work would be to provide real-world validation of lab testing	H	Applicable to all plants	ML	Fatigue calculations inform sampling inspections of limiting fatigue locations	3.25	Increase confidence in fatigue life calculations	M	Moderate cost for contaminated, but not irradiated, primary stem components		

[illegible]

[illegible]

Subject: Harvesting Prioritization Status
Location: HQ-TWFFN-10A73-8p

Start: Tue 9/4/2018 9:00 AM
End: Tue 9/4/2018 9:30 AM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Hiser, Matthew
Required Attendees Miller, Kenneth A
Resources: HQ-TWFFN-10A73-8p

From: Hiser, Matthew
Sent: Thu, 18 Feb 2016 18:57:43 +0000
To: Obodoako, Aloysius;Hull, Amy;Tregoning, Robert
Subject: Harvesting Project Transition

Summary from meeting this morning:

Rob and Matt briefed Aloysius on background of harvesting project, as well as contract information and next steps:

- COR transfer – once Aloysius has COR training
- UNR development with NRR
- New working group rep for EVIB (work with BC Jack McHale)
- Call with PNNL on latest status and follow-up with working group meeting

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

Subject: Harvesting Status
Location: 10th floor huddle rm

Start: Thu 8/2/2018 9:00 AM
End: Thu 8/2/2018 10:00 AM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Hiser, Matthew

Required AttendeesAudrain, Margaret; Purtscher, Patrick

Sorry – I ended up in a briefing with BC and division managers that ran long. Can you guys do Thursday morning?

Topics:

- PNNL Report
- Meg's PNNL Visit / Boneyard
- Matt's upcoming PNNL Visit
- Harvesting "supply" spreadsheets
- Harvesting needs prioritization

Subject: Harvesting Update
Location: HQ-TWFN-10A73-8p

Start: Thu 8/30/2018 9:00 AM
End: Thu 8/30/2018 10:00 AM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Hiser, Matthew
Required Attendees Tregoning, Robert; Audrain, Margaret; Purtscher, Patrick
Resources: HQ-TWFN-10A73-8p

Align on status of:

- PNNL report
- Harvesting needs prioritization
- Inventory: boneyard and decommissioning plants

Subject: Harvesting Update
Location: HQ-OWFN-09B02-12p

Note to requester: The attachments are immediately following.

Start: Mon 9/19/2016 9:00 AM
End: Mon 9/19/2016 10:30 AM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Hiser, Matthew

Required Attendees: Collins, Jay; Cumblidge, Stephen; Tregoning, Robert; Frankl, Istvan; Purtscher, Patrick; Litkett, Bernard; Poehler, Jeffrey; Oberson, Greg; Hardies, Robert; Karwoski, Kenneth

Optional Attendees: Rudland, David

Resources: HQ-OWFN-09B02-12p

Placeholder for meeting to discuss ex-plant harvesting path forward.

Topics:

- Draft PNNL report on harvesting prioritization
- Public workshop in March 2017
- Information gathering from decommissioning plants



Harvesting PNNL Report
Workshop Plan... Summary Harvest...

Ex-Plant Materials Harvesting Workshop

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.

Approach:

- NRC staff host 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.
- Format will include sessions with time for presentations and open discussion of different aspects of ex-plant materials harvesting.
- Views and insights from domestic and international regulators, researchers, industry, and decommissioning companies' experience will be encouraged.

Intended Outcome:

- NRC staff and stakeholders are better informed of the benefits and challenges associated with ex-plant harvesting.
- Contacts are made with domestic and international utilities and researchers to allow for further discussion of specific cooperative research projects that may address technical data gaps associated with materials degradation that can be best addressed through ex-plant harvesting.

Potential Dates:

- March 9-10, 2017 – Thursday/Friday before RIC
- March 16-17, 2017 – Thursday/Friday of RIC week
- March 20-21, 2017 – Monday/Tuesday after RIC

Discussion Topics:

- Harvesting decision-making / prioritization
 - Technical data needs best addressed by harvesting
 - Technical information needed in advance of harvesting
- Sources of materials:
 - Decommissioning reactors
 - Operating reactors – replaced or failed 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

PNNL Report Summary

- “Criteria and Planning Guidance for Ex-Plant Harvesting to Support Subsequent License Renewal”
 - Intended to be applicable to primary system metals, cables, and concrete
- Discusses criteria for prioritizing harvesting projects
 - When is harvesting most beneficial to justify cost?
 - Examples:
 - Ease of laboratory replication of material and environment combination
 - Applicability of harvested material for addressing critical gaps

PNNL Report Summary

- Assesses harvesting priority for example materials degradation issues:
 - Dissimilar metal welds
 - Cable aging
 - CASS
 - High fluence internals: baffle bolts, plate, welds
- Proposes general harvesting plan based on lessons learned from past harvesting experience
 - Information needed in advance (environment, material info, etc.)
 - Working with decommissioning process

Note to requester: Attachment
is immediately following.

From: Hiser, Matthew
Sent: Fri, 14 Sep 2018 18:36:02 +0000
To: Purtscher, Patrick;Audrain, Margaret
Cc: Tregoning, Robert
Subject: Harvesting Update
Attachments: Harvesting Needs Prioritization compiled 9-14-18.xlsx

Hi Meg and Pat,

I just wanted to share with you guys the progress on the harvesting prioritization spreadsheet (attached). I've gotten good input for concrete and have a couple versions (one from Rob and one from Mark Kirk) for RPV. I'm still waiting on electrical input from Kenn Miller. I also added higher fluence SS welds on the "Metals" tab of the spreadsheet.

Feel free to take a look for consistency checks. Hopefully, we'll have electrical/RPV nailed down in the next couple weeks.

Also, Meg, were you going to compile/harmonize the inputs from ANL, PNNL, and Battelle?

Thanks!
Matt

Criteria Title	Description	Scoring Guidance
Criticalness of Technical Gap Addressed	Harvesting to address critical gaps should be prioritized over less essential technical gaps	<p>H = high risk significance / little to no available data MH = Medium-high risk significance / limited data available M = Moderate risk significance / some data available ML = low to moderate risk significance / sufficient data available for regulatory decisions L = Low risk significance / large amount of data available</p> <p>H = High MH = Medium-high M = Medium ML = Medium-low L = Low</p>
Importance of Harvested Materials over Laboratory Aging	Key considerations are the ease of laboratory replication of aging mechanism and unique field aspects of the aging mechanism. Degradation mechanisms that are harder to replicate with simulated aging conditions would be of higher priority for harvesting. For example, simultaneous thermal and irradiation conditions are difficult to replicate outside of the plant environment. Alternatively, accelerated aging may not be feasible for a mechanism sensitive to dose rate. These two degradation mechanisms may be best evaluated using harvested materials. For unique field aspects, legacy materials (e.g., fabrication methods, composition) that are no longer available, but may play an important role in a potential degradation mechanism, would have a higher priority than harvesting materials that can be obtained from other sources with representative properties.	<p>H = Nearly impossible to replicate service environment / critically important to use harvested materials MH = Challenging to replicate service environment / important to use harvested materials M = Possible with some limitations to replicate service environment / moderately important to use harvested materials ML = Not challenging to replicate service environment / less important to use harvested materials L = Very easy to replicate service environment / not important to use harvested materials</p> <p>H = All plants MH = All PWRs M = All BWRs or most PWRs ML = ~10-15 plants L = <5 plants</p>
Applicability to US Operating Fleet	There is greater value in developing knowledge to address an issue that may be applicable to a larger number of plants compared to one that may only affect a relatively small number of plants.	<p>H = No or very limited inspection methods available / low confidence in AMPs MH = Limited inspection methods available / low-to-moderate confidence in AMPs M = Some inspection methods available / moderate confidence in AMPs ML = Good inspection methods available / medium-high confidence in AMPs L = Effective, well-accepted inspection methods exist / high confidence in AMPs</p>
Regulatory Considerations Related to Inspections and AMPs	If mature inspection methods exist and are easy to apply to monitor degradation, harvesting may be less valuable. If inspection methods do not exist, harvesting may be essential to ensure confidence in the assessment of age-related degradation in that particular component. The less confidence that NRC staff has in the effectiveness of the relevant AMP, the higher priority for harvesting.	<p>H = Highly irradiated (>5 dpa) MH = Lightly irradiated / contaminated M = Minimal contamination or high effort unirradiated ML = Unirradiated, moderate effort expected L = Unirradiated, low effort expected</p>
Harvesting cost and complexity	Activities with higher costs and complexity are less attractive than similar activities with lower costs and that are simpler to execute. For example, harvesting unirradiated concrete or electrical cables is less expensive and less complex than harvesting from the RPV internals or the RPV.	
Timeliness of results	The ability of a potential harvesting program to provide timely results to support either a technical or regulatory need is important. Having high confidence that results will be timely increases the priority.	
Availability of materials for harvesting	The availability of materials to harvest for a particular data need is clearly essential and increases the priority.	

	Basic Info		Technical Criteria									Cost / Complexity		Project Specific		
Need Description	Purpose / Testing Planned	Technical Knowledge Gained	Criticalness of Technical Gap Addressed		Importance of Harvested Materials over Laboratory Aging		Applicability to US Operating Fleet		Regulatory Considerations Related to Inspections and AMPs		Score Average	Basis for Technical Priority	Cost / Complexity		Timeliness of results	Availability of materials for harvesting
RPV			Score	Comment	Score	Comment	Score	Comment	Score	Comment			Score	Comment		
RPV - High fluence & high shift vessel with well-established unirradiated properties	Measure fluence, toughness, & chemistry as a function of through-thickness position	Through thickness section to validate fluence & attenuation models	M	This work has been done before but the additional work should focus on higher fluences to verify that the attenuation trends expected are maintained.	MH	There are not many studies that irradiate 6 to 9 inches of steel so, from that standpoint, getting specimens from an RPV are important for studying attenuation	M	While the information should be generically applicable, if, for some reason, the results are only applicable to "high fluence" materials/locations, this might result in less relevance to lower fluence plants (including BWRs).	ML	The attenuation models have the least amount of supporting information compared to other aspects related to RPV embrittlement. However, studies to date have validated the conservatism of existing attenuation models used in regulatory applications.	M	The attenuation study is slightly more important to me, just because there are fewer such studies that have been done. Being able to confirm expected trends at higher fluence levels would therefore be useful.	MH	Material is irradiated which will affect all aspects of specimen preparation and testing. Further, taking specimens at several through-thickness locations will increase cost.	The results would be timely if they are developed before 2024 or so to coincide with the additional information being collected from industry surveillance programs.	Other than Zion materials, I'm not aware of other RPVs that are available for harvesting.
RPV - Samples from virtually any vessel	Enable measurement of both the Charpy transition curve and master curve transition temperature T0	Provides data supporting evolution from the use of correlative (Charpy-based) to direct measurement (fracture toughness-based) approaches	M	I believe that enough data has been developed from both test and surveillance specimens such that the link is well-established. I will say that there is	ML	The only real advantage in my mind for having vessel material for this study is that there are no questions about the representativeness of any lead-factor irradiation compared to the actual vessel irradiation.	MH	Any information developed should be generically applicable	ML	We have as good a confidence in RPV embrittlement than virtually any other degradation that we study. The only real issue is making sure that our understanding remains applicable at the highest expected fluences.	M - ML	While it's always useful to have more data, especially on RPV materials, I feel that our models already have a good technical basis.	MH	Material is irradiated which will affect all aspects of specimen preparation and testing.	The results would be timely if they are developed before 2024 or so to coincide with the additional information	Other than Zion materials, I'm not aware of other RPVs that are available for harvesting.

	Basic Info		Technical Criteria								Cost / Complexity		Project Specific			
Need Description	Purpose / Testing Planned	Technical Knowledge Gained	Criticalness of Technical Gap Addressed	Importance of Harvested Materials over Laboratory Aging		Applicability to US Operating Fleet		Regulatory Considerations Related to Inspections and AMPs		Score Average			Basis for Technical Priority	Timeliness of results	Availability of materials for harvesting	
RPV			Score	Comment	Score	Comment	Score	Comment	Score	Comment	Score	Comment				
RPV - High fluence & high shift vessel with well-established unirradiated properties	Measure fluence, toughness, & chemistry as a function of through-thickness position	Through thickness section to validate fluence & attenuation models	MH	Score is MH within the belline. Change to H beyond the belline	MH	Again change to H outside of belline	MH		#N/A	embrittlement is not inspected for			MH	Both	Attenuation formula has been used for years. Inside the belline it's accepted and believed conservative, and it is probably true. Greater impact associated with harvested data outside of belline.	
RPV - Samples from virtually any vessel	Enable measurement of both the Charpy transition curve and master curve transition temperature T0	Provides data supporting evolution from the use of correlative (Charpy-based) to direct measurement (fracture toughness-based) approaches	MH		MH		H		#N/A	embrittlement is not inspected for			MH		Very limited ex-plant data exists worldwide (perhaps 6 plants) to compare to surveillance data. Those data do exist compare reasonably well, &/or have explainable reasons for disagreement. We have little physical reason to expect differences between ex-plant (harvested) data and surveillance data ... but (as noted) we have not checked in that many cases.	

	Basic Info		Technical Criteria										Cost / Complexity		Project Specific	
Need Description	Purpose / Testing Planned	Technical Knowledge Gained	Criticalness of Technical Gap Addressed		Importance of Harvested Materials over Laboratory Aging		Applicability to US Operating Fleet		Regulatory Considerations Related to Inspections and AMPs		Score Average	Basis for Technical Priority			Timeliness of results	Availability of materials for harvesting
METALS			Score	Comment	Score	Comment	Score	Comment	Score	Comment			Score	Comment		
High fluence reactor internals	Void swelling, mechanical properties, IASCC	Likely extent of void swelling in PWRs during extended operation and impact on cracking	M	Fills data gap for extended plant operation	MH	Laboratory replication very difficult to impossible to achieve fluences with representative irradiation conditions	MH	Applicable to high-fluence components in most PWRs	MH	EPRI performing R&D on NDE for void swelling; MRP 227 uses primarily visual testing, which could detect void swelling once fairly significant	3.75	Significance of void swelling at higher fluences is uncertain, and inspections may detect onset of significant degradation	VH	Very high cost for highly irradiated internals		TBD
Higher fluence SS welds (>2 dpa)	Fracture toughness, IASCC, and microstructure	CGR and FT properties for irradiated SS weld and HAZ materials to inform inspection scope and interval and flaw evaluation	H	Little to no data exists on SS welds above 2 dpa	M	Fluence levels may be achieved by test reactor irradiation (e.g. further irradiation of Zorita welds), but would be most representative with ex-plant materials.	MH	Applicable to most PWRs	MH	MRP-227 requires visual inspections, which can be followed by volumetric to size flaws. However, lack of data above 2 dpa creates uncertainty on assumptions for CGR and FT in flaw evaluation.	4	Inspections are required, but lack of data above 2 dpa creates uncertainty on assumptions for CGR and FT in flaw evaluation.	H	High cost for irradiated components		
Thermally aged unirradiated CASS	Fracture toughness and microstructure	Fracture toughness data in real conditions to compare to accelerated aging data	MH	Validate accelerated aging data	H	Purpose of work would be to provide real-world validation of accelerated aging in lab testing	M	Most applicable to a subset of PWRs	H	No ISI method available to measure loss of FT	4.25	Would greatly increase confidence in large set of accelerated aging data with testing of unirradiated materials	M	Moderate cost for contaminated, but not irradiated, primary stem components		
Moderate fluence (1-2 dpa) CASS	Fracture toughness and microstructure	Fracture toughness data near limit requiring further evaluation	ML	Confirm regulatory position	MH	May be possible, but difficult to replicate long-term aging and irradiation effects	M	Most applicable to a subset of PWRs	H	No ISI method available to measure loss of FT	3.5	Would increase confidence in regulatory position	H	High cost for irradiated components		
Metallic components with known flaws	NDE and destructive examination	Determine whether SCC mitigation methods are effective at preventing SCC; effectiveness of NDE at detection and sizing	MH	Validate NDE and mitigation method effectiveness	MH	Purpose of work would be to provide real-world validation of lab testing	H	Applicable to all plants	ML	Purpose of this work is to assess inspection and mitigation method effectiveness	3.75	Increase confidence in NDE and mitigation methods	M	Moderate cost for contaminated, but not irradiated, primary stem components		
Metallic components with limiting fatigue life	NDE and destructive examination	Determine whether fatigue flaws are present in high usage locations	MH	Validate fatigue life methodologies	ML	Purpose of work would be to provide real-world validation of lab testing	H	Applicable to all plants	ML	Fatigue calculations inform sampling inspections of limiting fatigue locations	3.25	Increase confidence in fatigue life calculations	M	Moderate cost for contaminated, but not irradiated, primary stem components		

[illegible]

	Basic Info		Technical Criteria										Cost / Complexity		Project Specific	
Need Description	Purpose / Testing Planned	Technical Knowledge Gained	Criticalness of Technical Gap Addressed		Importance of Harvested Materials over Laboratory Aging		Applicability to US Operating Fleet		Regulatory Considerations Related to Inspections and AMPs		Score Average	Basis for Priority	Cost / Complexity		Timeliness of results	Availability of materials for harvesting
CONCRETE			Score	Comment	Score	Comment	Score	Comment	Score	Comment			Score	Comment		
Structures exposed to high radiation	Degradation of concrete due to irradiation, attenuation of radiation through concrete.	Physical and mechanical degradation data under service environment. Level of irradiation (neutron, gamma, temperature) through the concrete and depth of irradiation damage. Aggregate expansion, cracking of concrete, differential response of components of concrete, i.e., aggregate, mortar, and rebar/steel embeds and degradation under thermo-hydro-radio-mechanical environment due to radiation. Conduct NDEs.	H	Confirm regulatory position. Data available from 1970's are not representative of light water reactor (LWR) environments. Recent limited number of data available from NRAJ are representative of LWR environment. Validate accelerated aging data. Currently no data available from service irradiated concrete. Real world validation of test data and benchmarking of degradation models. Conduct NDEs.	H	Harvesting is of high importance because no data available from service irradiated concrete, inaccessible for inspection, limited lab test data, small scale lab test specimen.	M	Most PWRs	H	New aging mechanism added for further evaluation in SLR-GALL and SLR-SRP. No inspection method and data available.	4.5	Very limited data, new aging mechanism added in SLR-GALL, SLR-SRP. No inspection method and OE not available because location inaccessible. Safety significance for RPV support structures are critical.	M	Moderate cost for moderate level of irradiation on concrete.		TBD
Post-tensioned structures	Degradation of post-tensioning (PT) system.	In-situ internal degradation, delamination, adjustment of prestress force and interaction with insitu degradation.	MH	Investigate and verify knowledge related to degradation modes under sustained multi axial prestressing force without radial rebar, internal degradation, degradation of prestressing system including anchorage, NDE methods.	MH	Real world validation of lab testing, bench marking of numerical modelling, potential failure modes, applicable NDEs. Critical information from failed post-tensioned containmet.	MH	About 37% US NPPs containment is post-tensioned. Also there are a few post-tensioned/prestressed SFP.	H	Concrete internal condition is not part of ISI. Limited condition monitoring for tendon. Detensioning and retensioning of tendons of aged containment. Effective NDE for PT containment structure not available.	4.25	Improve confidence on numerical modelling, potential failure modes, degradations, and NDEs. Collect critical information from failed post-tensioned containmet.	L	Unirradiated		TBD
Corrosion of reinforcing steel, tendon, liner, embedment	Degradation of concrete from Alkali-Silica-Reaction (ASR)	Ongoing research is providing understanding of the concrete material damage mechanisms and the characterization of that damage as well as of its implications to structural performance. The knowledge gained is primarily derived from laboratory testing together with visual observations of field structures.	MH	To study in-situ effects of ASR concrete degradation and comparison with understanding developed from laboratory testing. To investigate possibility of combined aging effects such as ASR and reinforcement corrosion.	M	The knowledge gained from the current research is primarily derived from controlled laboratory testing involving controlled aging environments at constant environemnts, homogeneous aging and single aging mechanism.	H	One plant severely affected by ASR in the US. Because ASR is a slow evolving chemical mechanism of the concrete itself and all plants have safety-related concrete structures, monitoring for ASR is part of concrete magement programs for all concrete structures for long term oeprations.	M	Monitoring for manifestation of ASR is part of aging management programs for concrete structures. For structures with ASR more complex aging management plans would monitor the progression of ASR, concrete cracking, structural deformations and, if needed, involve coring and testing of samples. Study of in-situ conditions would support implementation of more effective aging management plans.	3.75	Inform adjsutements to aging management programs. Enhanced understanding of the possibility of combined degradation effects in the field. Assess homogeneity of damage in real structures.	L	Unirradiated		An international cooperative research program is being initiated under the auspices to the CSNI. The program will test concrete samples harvested from a decommissioned nuclear power plant in Canada extensively affected by ASR. The NRC plans to participate in this program, which is likely to provide timely results.

Note to requester: The attachments are immediately following. This email was included within another email string in the 7th interim response, but without its attachments.

From: Tregoning, Robert
Sent: Thu, 15 Dec 2016 15:54:02 -0500
To: Bernhoft, Sherry [sbernhoft@epri.com] (sbernhoft@epri.com); Reister, Richard
Cc: Hiser, Matthew; Purtscher, Patrick; Dyle, Robin
Subject: Harvesting Workshop
Attachments: Harvesting Workshop Announcement.docx, Workshop Agenda 12-12-16.docx

Sherry/Rich:

I wanted to thank you again for the discussion that we had last week on the harvesting workshop agenda. I think it was productive and I appreciate the perspective you both brought. I've attached an announcement for the workshop that we're planning to use to solicit participants. Also, we've revised the agenda substantially based on the feedback you both provided. I think it captures the issues you had and I personally think that this is a better model to follow for the workshop.

I'd like to ask you both for two things prior to leaving for the holidays.

1. Could you provide me with any additional changes to the workshop agenda that you recommend? Just mark-up and send back the attached agenda. I'll consolidate and address any remaining suggestions from you both.
2. Could you provide me with a POC for coordinating each of the 5 workshop sessions? The idea is for the POCs to work together for planning each session. Here are the POCs from the NRC:
 - a. Session 1 – Rob Tregoning
 - b. Session 2 – Matt Hiser
 - c. Session 3 – Pat Purtscher
 - d. Session 4 – Matt Hiser
 - e. Session 5 – Rob Tregoning

We're hoping to get the planning teams in place before Christmas so that we can hit the ground running in early January to line up all the speakers.

Thanks again for your help. If I don't talk to you beforehand, I hope both you and your families have a Happy Holidays and a Prosperous New Year.

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

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:

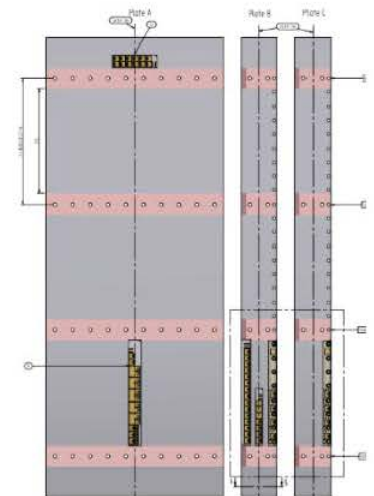
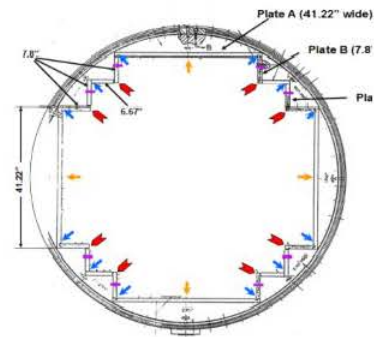
- For NRC staff and interested stakeholders to have greater awareness and knowledge of the benefits and challenges associated with ex-plant harvesting.
- Facilitate contacts and communication to enable specific cooperative ex-plant harvesting programs to be initiated.

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
Matthew Hiser, Matthew.Hiser@nrc.gov
Patrick Purtscher, Patrick.Purtscher@nrc.gov



be

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: The attachments are immediately following.

From: Hiser, Matthew
Sent: Wed, 22 Feb 2017 13:35:36 +0000
To: Sircar, Madhumita; Koshy, Thomas
Subject: Harvesting Workshop
Attachments: NRC Technical Data Needs for Harvesting.pptx, NRC Perspective on Harvesting Experience and Lessons Learned.pptx, Sources of Materials.pptx

Hi Mita and Tom,

Just to follow up from our discussions yesterday, I've attached the slides for the 3 presentations in Sessions 2-4 of the workshop. The slides are fairly brief and intended to quickly lay out our ideas and input, but leave plenty of time for discussion.

For data needs and sources of materials, please fill in any additional input you have for electrical or concrete topics. For harvesting experience and lessons learned, please take a look and add any additional insights you think we should include in our presentation.

I've also copied below the expectations we have provided to participants for each session for your reference and awareness:

- 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 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

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

Sources of Materials

Metals

- Examples of harvested materials used in NRC research programs:
 - Boral from Zion
 - SS plate and welds from Zorita
 - 304SS ranging from <1 to 50 dpa
 - SS weld up to 1 dpa
 - PWSCC
 - Alloy 600 J-groove weld from Davis-Besse
 - Alloy 600 CRD nozzle from North Anna
 - Alloy 182/82 from VC Summer
 - RPV
 - Shoreham, Midland

Electrical

Concrete

Recently Shutdown U.S. Plants

Plant	Design	Size (MWt)	Years in Operation	Shutdown Date	Notes
Kewaunee	W 2-loop	1772	39	2013	
SONGS 2/3	CE 2-loop	3438	31/30	2013	
Crystal River 3	B&W	2609	36	2013	
Vermont Yankee	BWR-4/Mark-1	1912	42	2015	
Fort Calhoun	CE 2-loop	1500	43	2016	

Planned Shutdown U.S. Plants

Plant	Design	Size (MWt)	Years in Operation	Planned Shutdown	Notes
Palisades	CE	2565	47	2018	
Pilgrim	BWR-3/Mark-1	2028	47	2019	
Oyster Creek	BWR-2/Mark-1	1930	50	2019	
Indian Point 2/3	W 4-loop	3216	48/46	2021	
Diablo Canyon 1/2	W 4-loop	3411	40	2024-5	

Additional Information from Plants

- Point of Contact
- Material information
 - Fabrication records, CMTRs
- Operating history
 - Temperature and fluence for components of interest
- Inspection records
 - Components with known flaws

NRC Perspective on Harvesting Experience and Lessons Learned

NRC Harvesting Experience

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

Previous Benefits of Harvesting

- Reduce unnecessary conservatism
 - Flaw distributions and Master Curve information came from harvested materials to support PTS rule
- Understand in-service flaws
 - Mockups for NDE qualification
 - Leak rate methodology from studying in-service flaws

Technical Lessons Learned

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

Logistical Lessons Learned

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

NRC High-Priority Data Needs for Harvesting

Metals

- Selected areas of interest for harvested materials:
 - High fluence reactor internals
 - >50 dpa 304 SS from high core outlet temp plant
 - Bounding temperature and high fluence for void swelling
 - Thermally aged unirradiated CASS
 - >30 years at ~320°C; Validate accelerated aging data
 - Moderate fluence (1-2 dpa) CASS
 - Bolster technical basis for embrittlement in this fluence range

Metals

- RPV
 - High fluence vessel with relatively high levels of minor alloying elements (Mn, P, etc.)
 - Through thickness section
 - Measure fluence, toughness, and chemistry as a function of depth
 - Validate fluence calculations
- Components with known flaws
 - Example: weld overlays over known flaws
 - Could be used for NDE evaluations or to assess effectiveness of mitigation techniques
- Components with limiting fatigue life
 - Confirm fatigue calculations are accurate by inspecting for flaws

Electrical

- Cables
 - Power cables energized and energized in normal operation
 - Cables from in containment applications
- Electrical components
 - 1E MOVs from harsh and mild environments
 - 1E Air operated valves
 - 4160 1E breakers
 - 1E Molded case breakers 480V, 250V DC, 125 VDC,
 - 1E Relays from mild environment GE – HFA, Agastat timing relays, any from Westinghouse, Potter Brumfield, Stuthers Dunn etc.,
- Other
 - Electrical penetrations
 - Batteries

Concrete

- High fluence irradiated concrete?
- ASR?
- Large sections for structural testing?

Subject: Harvesting Workshop
Location: HQ-TWFN-10A73-8p

Note to requester: The attachments are immediately following.

Start: Tue 2/14/2017 2:00 PM
End: Tue 2/14/2017 3:00 PM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Hiser, Matthew

Required Attendees Koshy, Thomas; Sircar, Madhumita; Murdock, Darrell; Jung, Ian; Seber, Dogan; Philip, Jacob; Tregoning, Robert; Purtscher, Patrick

Resources: HQ-TWFN-10A73-8p



Ex-Plant Materials Harvesting ...
Sources of Materials.pptx

You may be aware of a workshop on ex-plant materials harvesting that we are planning at NRC HQ for March 7-8. The scope of this workshop includes metals, cables/electrical, and concrete. The purpose of the workshop and expectations for each session are captured in the PP slides attached above. We are expecting participants from DOE, EPRI, and Europe, Japan, and Canada. The goal is to have generally short presentations with ample time for discussion and interaction among meeting participants.

I am preparing NRC presentations for sessions on data needs for harvesting, sources of materials, and harvesting experience/lessons learned, which can be found below. The data needs and sources of materials presentations should be very short (5-10 min), while the lessons learned/experience talk should be about 20 min. I have drafted slides for these presentations, particularly including input for metals.

The purpose of this meeting is to make you aware of the workshop and solicit input/assistance in developing these slides for electrical/cables and concrete topics.



NRC Technical Harvesting NRC Perspective
Data Needs for ... Workshop Annex... on Harvesting ...

NRC Perspective on Harvesting Experience and Lessons Learned

NRC Harvesting Experience

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

Previous Benefits of Harvesting

- Reduce unnecessary conservatism
 - Flaw distributions and Master Curve information came from harvested materials to support PTS rule
- Understand in-service flaws
 - Mockups for NDE qualification
 - Leak rate methodology from studying in-service flaws

Technical Lessons Learned

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

Logistical Lessons Learned

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

NRC High-Priority Data Needs for Harvesting

Metals

- High fluence reactor internals
 - >50 dpa 304 SS from high core outlet temp plant
 - Bounding temperature and high fluence for void swelling
- Thermally aged unirradiated CASS
 - >30 years at ~320°C; Validate accelerated aging data
- Moderate fluence (1-2 dpa) CASS
 - Bolster technical basis for embrittlement in this fluence range
- RPV
 - High fluence vessel with relatively high levels of minor alloying elements (Mn, P, etc.)
 - Through thickness section
 - Measure fluence, toughness, and chemistry as a function of depth
 - Validate fluence calculations

Metals

- Components with known flaws
 - Ex: weld overlays over known flaws
 - Could be used for:
 - NDE evaluations,
 - effectiveness of mitigation techniques
- Components with limiting fatigue life
 - Confirm fatigue calculations are accurate by inspecting for flaws

Electrical

- Cables
 - Power cables energized and energized in normal operation
 - Cables from in containment applications
- Electrical components
 - 1E MOVs from harsh and mild environments
 - 1E Air operated valves
 - 4160 1E breakers
 - 1E Molded case breakers 480V, 250V DC, 125 VDC,
 - 1E Relays from mild environment GE – HFA, Agastat timing relays, any from Westinghouse, Potter Brumfield, Stuthers Dunn etc.,

Concrete

- High fluence irradiated concrete?
- ASR?
- Large sections for structural testing?

Sources of Materials

Metals

- Boral at SRNL
- Zorita materials at ANL
 - 304SS ranging from <1 to 50 dpa
 - SS weld up to 1 dpa
- PWSCC
 - Alloy 600 J-groove weld from Davis-Besse
 - Alloy 600 CRD nozzle from North Anna
 - Alloy 182/82 from VC Summer
- RPV
 - Shoreham, Midland

Electrical

Concrete

Recently Shutdown U.S. Plants

Plant	Design	Size (MWt)	Years in Operation	Shutdown Date	Notes
Kewaunee	W 2-loop	1772	39	2013	Economics
SONGS 2/3	CE 2-loop	3438	31/30	2013	SG issues
Crystal River 3	B&W	2609	36	2013	Containment delamination
Vermont Yankee	BWR-4/Mark-1	1912	42	2015	
Fort Calhoun	CE 2-loop	1500	43	2016	Economics

Planned Shutdown U.S. Plants

Plant	Design	Size (MWt)	Years in Operation	Planned Shutdown	Notes
Palisades	CE	2565	47	2018	
Pilgrim	BWR-3/Mark-1	2028	47	2019	
Oyster Creek	BWR-2/Mark-1	1930	50	2019	
Indian Point 2/3	W 4-loop	3216	48/46	2021	
Diablo Canyon 1/2	W 4-loop	3411	40	2024-5	

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

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

Note to requester: The attachments
are immediately following.

From: Hiser, Matthew
Sent: Thu, 2 Feb 2017 15:30:22 +0000
To: Kirk, Mark
Subject: Harvesting Workshop
Attachments: Ex-Plant Materials Harvesting Workshop.pptx, Harvesting Workshop
Announcement.docx, Condensed Workshop Agenda.docx

Hi Mark,

The workshop is on March 7-8 in 3WFN 1C3. I've attached a few documents describing the workshop.

Thanks!
Matt

Matthew Hiser

Materials Engineer

US Nuclear Regulatory Commission | Office of Nuclear Regulatory Research
Division of Engineering | Corrosion and Metallurgy Branch

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

Matthew.Hiser@nrc.gov

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

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

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:

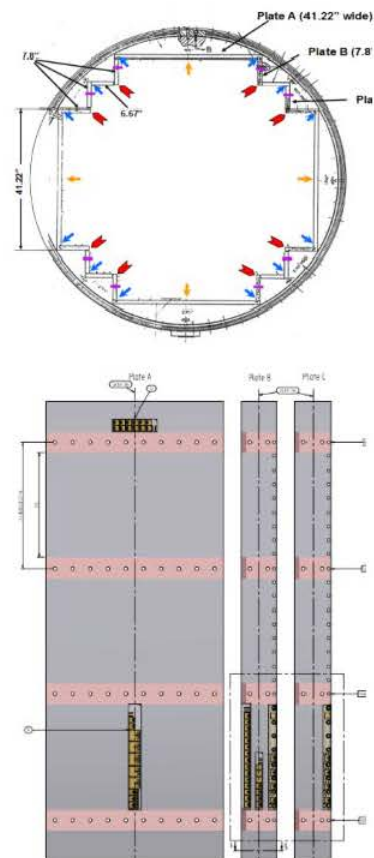
- For NRC staff and interested stakeholders to have greater awareness and knowledge of the benefits and challenges associated with ex-plant harvesting.
- Facilitate contacts and communication to enable specific cooperative ex-plant harvesting programs to be initiated.

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
Matthew Hiser, Matthew.Hiser@nrc.gov
Patrick Purtscher, Patrick.Purtscher@nrc.gov



Draft Agenda – March 7-8, 2017 Harvesting Workshop

Tuesday, March 7, 2017

Introduction

- Overview of workshop purpose and objectives

Session 1: Motivation for Harvesting

- Solicited presentations from EPRI, DOE, NRC, and international organizations followed by panel discussion

Session 2: Technical data needs best addressed by harvesting

- Solicited presentations from EPRI, DOE, NRC, and international organizations followed by open discussion

Session 3: Sources of Materials

- Solicited presentations from EPRI, DOE, NRC, and international organizations followed by open discussion

Wednesday, March 8, 2017

Session 4: Harvesting Experience: Lessons learned and practical aspects

- Solicited presentations from EPRI, DOE, NRC, U.S. utility, decommissioning companies, and international organizations followed by open discussion

Session 5: Future Harvesting Program Planning

- Solicited presentations from EPRI, DOE, NRC, and international organizations followed by open and panel discussion

Subject: Harvesting Workshop
Location: HQ-TWFN-10A73-8p

Start: Mon 1/30/2017 10:00 AM
End: Mon 1/30/2017 11:00 AM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Hiser, Matthew
Required Attendees Tregoning, Robert; Purtscher, Patrick
Resources: HQ-TWFN-10A73-8p

Discuss latest status of workshop planning.

Subject: Harvesting Workshop
Location: HQ-TWFFN-10A73-8p
Start: Mon 1/23/2017 9:00 AM
End: Mon 1/23/2017 10:00 AM
Show Time As: Tentative

Note to requester:
Attachments are immediately
following.

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Hiser, Matthew

Required Attendees Tregoning, Robert; Purtscher, Patrick

Resources: HQ-TWFFN-10A73-8p

Adding latest workshop planning document and draft workshop intro slides.

Following my call with DOE and EPRI last week and additional contacts we've made, let's look at the agenda and try to finalize speakers for each slot.



Workshop Planning 1-17-17... Harvesting Workshop intro ...

Workshop Contacts

Name	Organization	Email	Contact Through
Naoki Soneda	CRIEPI	soneda@criepi.denken.or.jp	Rob
Rachid Chaouadi	SCK-CEN	rachid.chaouadi@sckcen.be	Rob
Kazunobu Sakamoto	JNRA	kazunobu_sakamoto@nsr.go.jp	Rob
Gerry van Noordennen	Energy Solutions	gpvannoordennen@energysolutions.com	Pat/Tom R.
Chuck Tomes	Dominion	charles.a.tomes@dom.com	Matt
Sherry Bernhoft	EPRI	sbernhof@epri.com	
Robin Dyle	EPRI	rdyle@epri.com	
Jean Smith	EPRI	jmsmith@epri.com	
Al Ahluwalia	EPRI	kahluwal@epri.com	
Tom Rosseel	DOE	rosseeltm@ornl.gov	
Rich Reister	DOE	Richard.Reister@nuclear.energy.gov	
Keith Leonard	DOE	leonardk@ornl.gov	
Mikhail A. Sokolov	DOE	sokolovm@ornl.gov	
Leo Fyfeld	DOE/PNNL		
Pat Purtscher	NRC	Patrick.Purtscher@nrc.gov	
Rob Tregoning	NRC	Robert.Tregoning@nrc.gov	
Matt Hiser	NRC	Matthew.Hiser@nrc.gov	
Anders Jenssen	Studsvik	anders.jenssen@studsvik.se	Matt/Jean
Daniel Tello	CNSC	daniel.tello@canada.ca	Matt
Heather Malikowski	PWROG	Heather.Malikowski@exeloncorp.com	Matt
Jim Molkenhuth	PWROG	molkenjp@westinghouse.com	Matt
Regis Nhili	MAI	regis.nhili@edf.fr	Rob
Uwe Jendrich	GRS	Uwe.Jendrich@grs.de	Rob
Pradeep Ramuhalli	PNNL	Pradeep.Ramuhalli@pnnl.gov	

Session	NRC Lead	DOE Lead	EPRI Lead
1	Rob Tregoning	Rich Reister	Sherry Bernhoft/Robin Dyle
2	Pat Purtscher	Keith Leonard (ORNL)	Sherry Bernhoft/Robin Dyle
3	Matt Hiser	Tom Rosseel (ORNL)	Sherry Bernhoft/Robin Dyle
4	Matt Hiser	Tom Rosseel (ORNL)	Sherry Bernhoft/Robin Dyle
5	Rob Tregoning	Rich Reister	Sherry Bernhoft/Robin Dyle

NRC Presentations

Session	Topic	Speaker
1	Why our organization is interested in harvesting	Tregoning
2	Overview of data needs best addressed by harvesting	Pradeep / PNNL
3	Available materials from decommissioning plants and past harvesting programs	Hiser
4	Perspective on Harvesting Lessons Learned / Prior Experience	TBD
5	Technical information needed for informed harvesting decisions	Pradeep / PNNL
5	Perspective on future harvesting planning	Tregoning

Session	Topic	Organization	Speaker	Status
1	Why our organization is interested in harvesting	EPRI		
		DOE		
		NRC	Robert Tregoning	
		MAI or JRC		Emails exchanged
		JNRA		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		
		MAI or JRC	SCK-CEN? CNSC?	Emails exchanged
		JNRA	CRIEPI?	Emails exchanged
3	Available materials from decommissioning plants and past harvesting programs	NRC	Matt Hiser	
	Available materials from operating reactors and past harvesting programs	EPRI		
		PWROG		Email sent
	Available materials at DOE labs from past harvesting programs	DOE (ORNL?)		
	Upcoming decommissioning sites	Energy Solutions	Gerry van Noordennen	Contact through Tom R.
	International sources of materials	EdF/MAI		Emails exchanged
		Japan		Emails exchanged
		Korea		Need to work w/ Ahluwalia
4	Perspective on Harvesting Lessons Learned / Prior Experience	EPRI		
		DOE		
		NRC		
	Decommissioning process and harvesting: schedule, site-specific, timing for different components	Energy Solutions	Gerry van Noordennen	Contact through Tom R.
	Utility-Owner perspective on harvesting and decommissioning	Dominion or Exelon		Emails exchanged
	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		
		NRC	Robert Tregoning	
		MAI or JRC		Emails exchanged
		JNRA		Emails exchanged
	PANEL DISCUSSION			

	Discussion of Next Steps / Actions			
--	------------------------------------	--	--	--

Ex-Plant Materials Harvesting Workshop

March 7-8, 2017

USNRC HQ

Rockville, MD, USA

Motivation

- With plants shutting down both in the U.S. and internationally, there are increasing opportunities to harvest components from decommissioning plants.
- Ex-plant materials are valuable because they have been exposed to actual in-service plant operating conditions unlike virgin materials tested under simulated conditions in the lab
 - Reduces 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

Approach

- Two-day workshop with interested stakeholders to discuss benefits and challenges associated with ex-plant harvesting.
- Insights from domestic and international researchers, industry, regulators, and decommissioning companies' experience shared
 - Encourage sharing of lessons learned as well as areas of common interest for potential new research programs
- Topical sessions with several short presentations and significant time for open discussion
 - Goal is open discussion and engagement among all meeting participants, rather than presenter/audience mentality

Expected Outcome

- Participants are 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

Subject: Harvesting Workshop
Location: HQ-TWFN-10A73-8p

Start: Mon 1/23/2017 9:00 AM
End: Mon 1/23/2017 10:00 AM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Hiser, Matthew

Required Attendees Hiser, Matthew; Tregoning, Robert; Purtscher, Patrick

Resources: HQ-TWFN-10A73-8p

Following my call with DOE and EPRI last week and additional contacts we've made, let's look at the agenda and try to finalize speakers for each slot.

From: Hiser, Matthew
Sent: Thu, 12 Jan 2017 12:39:30 +0000
To: Tregoning, Robert;Purtscher, Patrick
Subject: Harvesting Workshop

Pat said he has to make a quick call at 8:00, so let's plan to meet at 8:15.

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

Subject: Harvesting Workshop
Location: HQ-TWFN-10A73-8p

Note to requester: Attachment is immediately following.

Start: Thu 1/12/2017 8:00 AM
End: Thu 1/12/2017 9:00 AM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Hiser, Matthew
Required Attendees Tregoning, Robert; Purtscher, Patrick
Resources: HQ-TWFN-10A73-8p

Can we move this a little earlier tomorrow since I now have a conflict at 9:00?

Here is a workshop planning document I've created with a list of contacts / expected attendees and a table laying out all the planned presentations and sessions to track confirmed speakers.



Workshop Contacts

Name	Organization	Email
Naoki Soneda	CRIEPI	soneda@criepi.denken.or.jp
Rachid Chaouadi	SCK-CEN	rachid.chaouadi@sckcen.be
Kazunobu Sakamoto	JNRA	kazunobu_sakamoto@nsr.go.jp
Gerry van Noordennen	Energy Solutions	gpvannoordennen@energysolutions.com
	Dominion	
Sherry Bernhoft	EPRI	sbernhof@epri.com
Robin Dyle	EPRI	rdyle@epri.com
Jean Smith	EPRI	jmsmith@epri.com
Al Ahluwalia	EPRI	kahluwal@epri.com
Tom Rosseel	DOE	rosseeltm@ornl.gov
Rich Reister	DOE	Richard.Reister@nuclear.energy.gov
Keith Leonard	DOE	leonardk@ornl.gov
Mikhail A. Sokolov	DOE	sokolovm@ornl.gov
Pat Purtscher	NRC	Patrick.Purtscher@nrc.gov
Rob Tregoning	NRC	Robert.Tregoning@nrc.gov
Matt Hiser	NRC	Matthew.Hiser@nrc.gov
Anders Jenssen	Studsvik	anders.jenssen@studsvik.se

Session	NRC Lead	DOE Lead	EPRI Lead
1	Rob Tregoning	Rich Reister	Sherry Bernhoft/Robin Dyle
2	Pat Purtscher	Keith Leonard (ORNL)	Sherry Bernhoft/Robin Dyle
3	Matt Hiser	Tom Rosseel (ORNL)	Sherry Bernhoft/Robin Dyle
4	Matt Hiser	Tom Rosseel (ORNL)	Sherry Bernhoft/Robin Dyle
5	Rob Tregoning	Rich Reister	Sherry Bernhoft/Robin Dyle

Session	Topic	Organization	Speaker	Status
1	Why our organization is interested in harvesting	EPRI		
		DOE		
		NRC		
		MAI or JRC		
		JNRA		
	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		
		MAI or JRC		SCK-CEN?
		JNRA		CRIEPI?
3	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?		
4	Perspective on Harvesting Lessons Learned / Prior Experience	EPRI		
		DOE		
		NRC		
	Decommissioning process and harvesting: schedule, site-specific, timing for different components	Energy Solutions	Gerry van Noordennen	
	Utility-Owner perspective on harvesting and decommissioning	Dominion?		
	International decommissioning and harvesting experience	Germany?		
5	Technical information needed for informed harvesting decisions	PNNL (for NRC)	Pradeep Ramuhalli	
	Perspective on future harvesting planning	EPRI		
		DOE		
		NRC		
		MAI or JRC		
		JNRA		
	PANEL DISCUSSION			
	Discussion of Next Steps / Actions			

Subject: Harvesting Workshop
Location: HQ-TWFN-10A73-8p

Start: Thu 1/12/2017 9:00 AM
End: Thu 1/12/2017 10:00 AM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Hiser, Matthew
Required Attendees Tregoning, Robert; Purtscher, Patrick
Resources: HQ-TWFN-10A73-8p

I'll send out a summary of where things stand based on the email traffic from over the holidays in advance of this meeting.

Subject: Harvesting Workshop
Location: Rob's office

Start: Thu 12/8/2016 1:00 PM
End: Thu 12/8/2016 2:00 PM
Show Time As: Tentative

Note to requester: The attachment is immediately following.

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Hiser, Matthew

Required Attendees Purtscher, Patrick; Tregoning, Robert

Following Rob's discussion with DOE and EPRI yesterday, let's review the newest version of the agenda and discuss next steps.



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: Why are we Interested in Harvesting? 8:15 – 10:15

- Why our organization is interested in harvesting
 - EPRI
 - DOE
 - NRC
 - MAI or JRC
 - JNRA
- DISCUSSION

BREAK 10:15 – 10:30

Session 2: Technical data needs best addressed by harvesting 10:30 – 2:45

- Overview of data needs best addressed by harvesting
 - NRC/PNNL
- Perspective on harvesting data needs
 - DOE
 - EPRI

LUNCH 12:00 – 1:00

- Perspective on harvesting data needs
 - MAI or JRC
 - JNRA
- DISCUSSION

BREAK 2:45 – 3:00

Session 3: Sources of Materials 3:00 – 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 harvesting opportunities
 - IAEA?
- DISCUSSION

Wednesday, March 8, 2017

Session 4: Lessons learned from harvesting experience

8:00 – 12:00

- 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?)
- Perspective on Harvesting Lessons Learned / Prior Experience
 - EPRI
 - DOE
 - NRC
- 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
- Perspective on future harvesting efforts
 - EPRI
 - NRC
 - DOE
 - International (France?)
- DISCUSSION of Next Steps / Actions

From: Hiser, Matthew
Sent: Wed, 23 Nov 2016 13:28:32 +0000
To: Moyer, Carol
Subject: Harvesting Workshop
Attachments: NRC Harvesting Workshop Announcement.docx

Note to requester: Attachment is immediately following.

Hi Carol,

Here's the announcement we've been using to publicize the workshop.

Please let me know if you'd like more info ☺

Thanks and happy Thanksgiving!
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

Ex-Plant Materials Harvesting Workshop

Location: NRC HQ in Rockville, MD

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

Note to requester: Attachment is immediately following.

From: Hiser, Matthew
Sent: Fri, 19 Aug 2016 20:22:32 +0000
To: Frankl, Istvan;Tregoning, Robert;Hull, Amy;Purtscher, Patrick
Subject: Harvesting Workshop
Attachments: Workshop Initial Plan.docx

Hi everyone,

Following from the meeting yesterday, I wanted to share the attached "initial plan" for the workshop, describing the purpose and objective, approach, and intended outcome, as well as potential dates and discussion topics. Please edit and/or comment freely.

I think this document could be useful for "socializing" this topic to a greater degree in NRR, in advance of a meeting of the internal steering committee on harvesting sometime next month. At that meeting we could hopefully do some significant brainstorming on what this workshop should look like and who to contact for participation.

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

Ex-Plant Materials Harvesting Workshop

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.

Approach:

- NRC staff host 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.
- Format will include sessions with time for presentations and open discussion of different aspects of ex-plant materials harvesting.
- Views and insights from regulators, researchers, industry, and decommissioning companies both domestic and international will be encouraged.

Intended Outcome:

- NRC staff and stakeholders are better informed of the benefits and challenges associated with ex-plant harvesting.
- Contacts are made with domestic and international utilities and researchers to allow for further discussion of specific cooperative research projects that may address technical data gaps associated with materials degradation that can be best addressed through ex-plant harvesting.

Potential Dates:

- March 9-10, 2017 – Thursday/Friday before RIC
- March 16-17, 2017 – Thursday/Friday of RIC week
- March 20-21, 2017 – Monday/Tuesday after RIC

Discussion Topics:

- Technical data needs best addressed by harvesting
- Lessons learned from harvesting experience
- Available materials from previous harvesting programs
- Technical information needed in advance of harvesting
- Harvesting decision-making / prioritization
- Harvesting from operating reactors – replaced or failed components
- Perspective of utility-owner and decommissioning contractor on harvesting
- Communication and coordination between decommissioning and researchers

Subject: Harvesting Workshop Agenda Brainstorming
Location: HQ-TWFFN-08C01-10p

Start: Thu 11/3/2016 1:00 PM
End: Thu 11/3/2016 2:00 PM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Note to requester: Attachment is immediately following.

Organizer: Hiser, Matthew
Required Attendees Purtscher, Patrick; Tregoning, Robert; Poehler, Jeffrey
Resources: HQ-TWFFN-08C01-10p

Hi Rob, Jeff, Pat,

I've put together an outline of an agenda for this workshop on harvesting that we are planning for March. My first cut at it is attached. I'd like to use this meeting to brainstorm how to structure the workshop and, if possible, who to ask to present and on what topics.

Rob and I were discussing trying to selectively target participants and presentations to cover the topics we'd like, rather than simply asking DOE and EPRI and others for their take on "harvesting." I think if we plan this well, we can get an interesting and substantive discussion. If not, we may just get a rehash of SLR-type talks...

Thanks!
Matt



Draft Agenda – March 7-8 Harvesting Workshop

- Session 1 Tuesday Morning: Lessons learned from harvesting experience
 - NRC Intro
 - EPRI – Zorita
 - DOE - Zion
 - International?
- Session 2 Tuesday Afternoon: Technical data needs best addressed by harvesting
 - PNNL/NRC - overview
 - EPRI/NEI – data needs, other sources from operating reactors
 - DOE – data needs, other sources from boneyards, tracking available materials
 - Belgium - RPV
 - Japan
- Session 3 Wednesday morning: Practical aspects of harvesting programs - perspective of various stakeholders in harvesting process
 - US decommissioning company
 - US utility
 - Research perspective – EPRI or DOE or international
 - Germany?
- Session 4 Wednesday Afternoon: Harvesting Decision-making - Technical information needed in advance of harvesting, cost/benefit
 - PNNL – technical info needed for harvesting
 - EPRI – cost benefit
 - DOE – Zion experience to decision-making
 - Korea – Kori decision-making
 - Switzerland - Muhleberg
 - NRC – 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: Hiser, Matthew
Sent: Thu, 1 Dec 2016 15:37:13 +0000
To: Tregoning, Robert
Subject: Harvesting Workshop Agenda
Attachments: Workshop Agenda 12-1-16.docx

Hi Rob,

I've incorporated the tweaks to the agenda that we discussed yesterday. We may want to try to schedule a meeting soon, given the rapidly approaching holidays. We should try to get aligned with DOE and EPRI before the holidays and firm up/contact the presenters. When everyone gets back in January, we'll be about 2 months from the workshop!

Thanks!
Matt

Matthew Hiser

Materials Engineer

US Nuclear Regulatory Commission | Office of Nuclear Regulatory Research

Division of Engineering | Corrosion and Metallurgy Branch

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

Matthew.Hiser@nrc.gov

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 8:10 – 8:45
 - Perspective on Harvesting Lessons Learned / Prior Experience
- DOE 8:45 – 9:20
 - Perspective on Harvesting Lessons Learned / Prior Experience
- NRC 9:20 – 9:50
 - Perspective on Harvesting Lessons Learned / Prior Experience

BREAK 9:50 – 10:05

- International (Japan?) 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
- DOE/industry 12:55 – 1:20
 - Perspective on harvesting data needs
- International 1:20 – 1:45
 - Perspective on harvesting data needs
- International 1:45 – 2:10
 - Perspective on harvesting data needs

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
- International (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 – (DOE/EPRI – joint?) 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: Future Harvesting Program Planning

- PNNL / NRC 12:45 – 1:15
 - Technical information needed for informed harvesting decisions
- EPRI/NEI 1:15 – 1:45
 - Perspective on future harvesting efforts
- NRC 1:45 – 2:15
 - Perspective on future harvesting efforts
- International (France?) 2:15 – 2:45
 - Perspective on future harvesting efforts
- DISCUSSION 2:45 – 4:00
 - Potential harvesting partnerships
 - RPV, internals, piping, concrete, cables
 - US, international opportunities

Note to requester: Attachment is immediately following.

From: Hiser, Matthew
Sent: Fri, 21 Oct 2016 13:05:22 +0000
To: Tregoning, Robert;Iyengar, Raj
Subject: Harvesting Workshop Announcement
Attachments: NRC Harvesting Workshop Announcement.docx

Hi Rob and Raj,

Please find attached the final version of the harvesting workshop announcement. If you could share this with your contacts at DOE/EPRI (Raj), and internationally (Rob), that would be great to begin to publicize this workshop and receive feedback on the preferred dates as well as those interested to present at the workshop.

Thanks!
Matt

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.
- 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

Note to requester: The attachment
is immediately following.

From: Hiser, Matthew
Sent: Fri, 9 Dec 2016 15:02:11 +0000
To: Tregoning, Robert;Purtscher, Patrick;Hiser, Allen;Poehler, Jeffrey
Subject: Harvesting Workshop Announcement
Attachments: Harvesting Workshop Announcement.docx

All:

Please find attached the final version of the workshop announcement for distribution to any parties that may be interested in participating in a discussion of ex-plant materials harvesting.

Thanks!
Matt

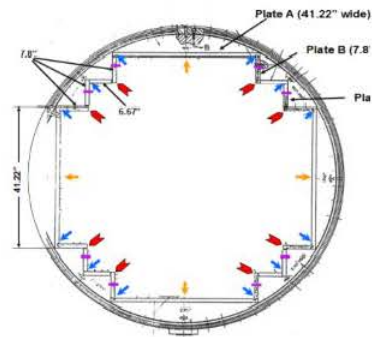
Ex-Plant Materials Harvesting Workshop

Location: NRC Headquarters in Rockville, MD, USA

Dates: March 7-8, 2017

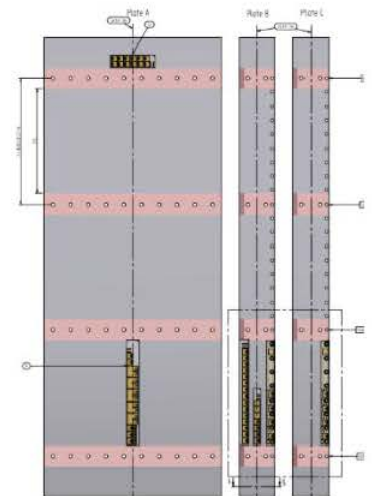
Motivation:

- 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
Matthew Hiser, Matthew.Hiser@nrc.gov
Patrick Purtscher, Patrick.Purtscher@nrc.gov

Note to requester: Attachments
are immediately following.

From: Hiser, Matthew
Sent: Mon, 23 Jan 2017 21:24:16 +0000
To: Prokofiev, Iouri; Oberson, Greg
Subject: Harvesting Workshop Info
Attachments: Condensed Workshop Agenda.docx, Harvesting Workshop Announcement.docx

Hi guys,

Here is the info on the harvesting workshop! Let me know if you have any 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

Draft Agenda – March 7-8, 2017 Harvesting Workshop

Tuesday, March 7, 2017

Introduction

- Overview of workshop purpose and objectives

Session 1: Motivation for Harvesting

- Solicited presentations from EPRI, DOE, NRC, and international organizations followed by panel discussion

Session 2: Technical data needs best addressed by harvesting

- Solicited presentations from EPRI, DOE, NRC, and international organizations followed by open discussion

Session 3: Sources of Materials

- Solicited presentations from EPRI, DOE, NRC, and international organizations followed by open discussion

Wednesday, March 8, 2017

Session 4: Harvesting Experience: Lessons learned and practical aspects

- Solicited presentations from EPRI, DOE, NRC, U.S. utility, decommissioning companies, and international organizations followed by open discussion

Session 5: Future Harvesting Program Planning

- Solicited presentations from EPRI, DOE, NRC, and international organizations followed by open and panel discussion

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:

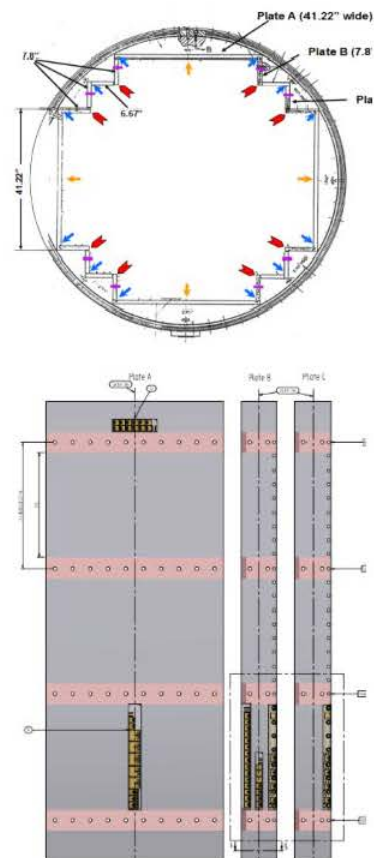
- For NRC staff and interested stakeholders to have greater awareness and knowledge of the benefits and challenges associated with ex-plant harvesting.
- Facilitate contacts and communication to enable specific cooperative ex-plant harvesting programs to be initiated.

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
Matthew Hiser, Matthew.Hiser@nrc.gov
Patrick Purtscher, Patrick.Purtscher@nrc.gov



Note to requester: The attachments are immediately following.

From: Tregoning, Robert
Sent: Tue, 20 Dec 2016 15:51:59 +0000
To: oliver.martin@ec.europa.eu
Subject: Harvesting Workshop
Attachments: Harvesting Workshop Announcement.docx, Condensed Workshop Agenda 12-12-16.docx

Oliver:

I hope that this email finds you and your family well. I just want to follow-up on an email that Olli sent out for me this week. In early March, we're hosting a materials harvesting workshop. I've attached the workshop announcement and the condensed 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

I would welcome JRC participation in the workshop. I would also welcome a presentation from JRC in one or more of the sessions outlined above.

Do you, or someone else from JRC, have interest in participating and perhaps making a presentation or two? If so, please just respond and we can start working out the arrangements.

I hope you and your family have a Happy Holidays and a prosperous New Year.

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

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:

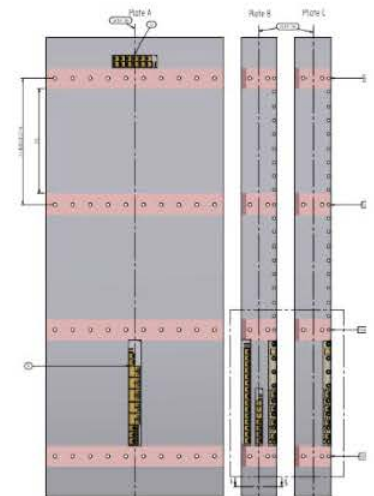
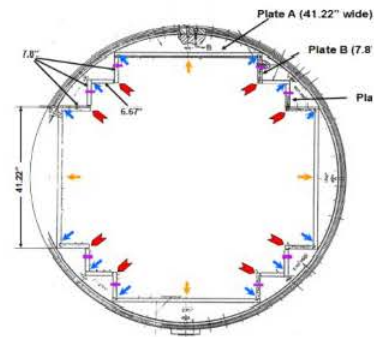
- For NRC staff and interested stakeholders to have greater awareness and knowledge of the benefits and challenges associated with ex-plant harvesting.
- Facilitate contacts and communication to enable specific cooperative ex-plant harvesting programs to be initiated.

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
Matthew Hiser, Matthew.Hiser@nrc.gov
Patrick Purtscher, Patrick.Purtscher@nrc.gov



Draft Agenda – March 7-8, 2017 Harvesting Workshop

Tuesday, March 7, 2017

Introduction

- Overview of workshop purpose and objectives

Session 1: Motivation for Harvesting

- Solicited presentations from EPRI, DOE, NRC, and international organizations followed by panel discussion

Session 2: Technical data needs best addressed by harvesting

- Solicited presentations from EPRI, DOE, NRC, and international organizations followed by open discussion

Session 3: Sources of Materials

- Solicited presentations from EPRI, DOE, NRC, and international organizations followed by open discussion

Wednesday, March 8, 2017

Session 4: Harvesting Experience: Lessons learned and practical aspects

- Solicited presentations from EPRI, DOE, NRC, U.S. utility, decommissioning companies, and international organizations followed by open discussion

Session 5: Future Harvesting Program Planning

- Solicited presentations from EPRI, DOE, NRC, and international organizations followed by open and panel discussion

Subject: Harvesting Workshop Planning
Location: HQ-TWFn-10A73-8p

Note to requester: Attachment is immediately following.

Start: Tue 2/21/2017 10:00 AM
End: Tue 2/21/2017 11:00 AM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Hiser, Matthew

Required Attendees Tregoning, Robert; Purtscher, Patrick

Resources: HQ-TWFn-10A73-8p

Agenda

- Attendees
 - NRC staff
 - INL
 - German speaker
- Room setup
- Food
 - Coffee/tea options
 - Lunch
 - TWFn and nearby restaurants
 - Dinner
- NRC slides



Workshop
Speakers & Title...

Workshop Contacts

	Name	Organization	Email	Contact
Japan	Taku Arai	CRIEPI	arait@criepi.denken.or.jp	Rob
	Sadao Higuchi	CRIEPI	higuchi@criepi.denken.or.jp	Rob
	Kazunobu Sakamoto	JNRA	kazunobu_sakamoto@nsr.go.jp	Rob
	Yasuhiro Chimi	JAEA	chimi.yasuhiro@jaea.go.jp	Rob
Europe	Uwe Jendrich	GRS	Uwe.Jendrich@grs.de	Rob
	Rachid Chaouadi	SCK-CEN	rachid.chaouadi@sckcen.be	Rob
Canada	Daniel Tello	CNSC	daniel.tello@canada.ca	Matt
	Désiré Ndomba	CNSC	desire.ndomba@canada.ca	
	Karen Huynh	AECL	khuynh@aecl.ca	
US industry	Gerry van Noordennen	Energy Solutions	gpvannoordennen@energysolutions.com	Matt
	Bill Zipp	Dominion	william.f.zipp@dom.com	Matt
	Arzu Alpan	Westinghouse	alpanfa@westinghouse.com	
EPRI	Sherry Bernhoft	EPRI	sbernhof@epri.com	
	Robin Dyle	EPRI	rdyle@epri.com	
	Jean Smith	EPRI	jmsmith@epri.com	
	Al Ahluwalia	EPRI	kahluwal@epri.com	
DOE	Tom Rosseel	ORNL	rosseeltm@ornl.gov	
	Rich Reister	DOE	Richard.Reister@nuclear.energy.gov	
	Keith Leonard	ORNL	leonardk@ornl.gov	
	Mikhail A. Sokolov	ORNL	sokolovm@ornl.gov	
	Pradeep Ramuhalli	PNNL	Pradeep.Ramuhalli@pnnl.gov	
NRC	Pat Purtscher	NRC	Patrick.Purtscher@nrc.gov	
	Rob Tregoning	NRC	Robert.Tregoning@nrc.gov	
	Matt Hiser	NRC	Matthew.Hiser@nrc.gov	
	Mita Sircar	NRC		Pat
	Tom Koshy	NRC		
		NRC		
	NRR	NRC		
	NRR	NRC		
Maybe?	Anders Jenssen	Studsvik	anders.jenssen@studsvik.se	
	Kelly Cunningham	INL	kelly.cunningham@inl.gov	

Webinar Contacts

Name	Organization	Email	Contact
Wei-Wu Chao	Taiwan AEC	wwchao@aec.gov.tw	
Keita Naito	EPRI/Chukogu	knaito@guestresearcher.epri.com	
Heather Malikowski	PWROG		
Leo Fifield	PNNL	leo.fifield@pnnl.gov	
Kelly Cunningham	INL	kelly.cunningham@inl.gov	

Session	NRC Lead	DOE Lead	EPRI Lead
1	Rob Tregoning	Rich Reister	Sherry Bernhoft/Robin Dyle
2	Pat Purtscher	Keith Leonard	Sherry Bernhoft/Robin Dyle
3	Matt Hiser	Tom Rosseel	Sherry Bernhoft/Robin Dyle
4	Matt Hiser	Tom Rosseel	Sherry Bernhoft/Robin Dyle
5	Rob Tregoning	Rich Reister	Sherry Bernhoft/Robin Dyle

NRC Presentations

Session	Topic	Speaker
1	Why our organization is interested in harvesting	Tregoning
2	Overview of data needs best addressed by harvesting	Pradeep / PNNL
3	Available materials from decommissioning plants and past	Hiser
4	Perspective on Harvesting Lessons Learned / Prior Experience	TBD
5	Technical information needed for informed harvesting decisions	Pradeep / PNNL
5	Perspective on future harvesting planning	Tregoning

Session	Topic	Organization	Speaker	Presentation Title
1	Why our organization is interested in harvesting	EPRI	Sherry Bernhoft	
		DOE	Rich Reister	
		NRC	Rob Tregoning	
		GRS?	Uwe Jendrich	
		CRIEPI	Taku Arai	
	PANEL DISCUSSION			
2	Overview of data needs best addressed by harvesting	PNNL (for NRC)	Pradeep	Data Needs Best Addressed By Harvesting
	Perspective on detailed data needs from harvesting	DOE	Keith Leonard	
		NRC	Matt Hiser	High-Priority Data Needs for Harvesting
		SCK-CEN	Rachid Chaouadi	Review of past RPV sampling test programs and
		Westinghouse	Arzu Alban	Importance of Harvesting to Evaluate Radiation
3	Available materials from decommissioning plants and	NRC	Matt Hiser	Sources of Materials: Past NRC Harvesting and
	Available materials from operating reactors and past	EPRI	Al Ahluwalia	
	Available materials at DOE labs from past harvesting	DOE	Tom Rosseel	
	Upcoming decommissioning sites	Energy Solutions	Gerry van	
	International Harvesting Opportunities	GRS?	Uwe Jendrich	
		Westinghouse?	Arzu Alban	Potential Harvesting of Concrete from Mihama
		CNSC		
4	Perspective on Harvesting Lessons Learned / Prior Experience	EPRI	Jean Smith	
		DOE	Tom Rosseel	
		NRC	Matt Hiser	NRC Perspective on Harvesting Experience and
		CRIEPI	Taku Arai	
	Decommissioning process and harvesting: schedule,	Energy Solutions	Gerry van	
	Utility-Owner perspective on harvesting and	Dominion	Bill Zipp	
5	International decommissioning and harvesting experience	Germany?		
	Technical information needed for informed harvesting	PNNL (for NRC)	Pradeep	Technical Information Needed for Informed
	Perspective on future harvesting planning	EPRI	Sherry Bernhoft	
		DOE	Rich Reister	
		NRC	Robert	
	PANEL DISCUSSION			
	Discussion of Next Steps / Actions			

Note to requester: Attachments
are immediately following.

From: Hiser, Matthew
Sent: Mon, 12 Dec 2016 19:43:41 +0000
To: Tregoning, Robert;Purtscher, Patrick
Cc: Poehler, Jeffrey;Hiser, Allen
Subject: Harvesting Workshop Plans
Attachments: Workshop Agenda 12-12-16.docx, Condensed Workshop Agenda 12-12-16.docx

Hi Rob and Pat,

Following our meeting last week, I made the appropriate updates to the workshop agenda and have attached it to this email. I have also attached a "condensed" workshop agenda that we can share with any interested attendees looking for a little more info.

We agreed that Rob will take the lead for organizing Sessions 1 and 5, Pat will take session 3, and I will take sessions 2 and 4.

Action items from that meeting are summarized below:

- Rob: send revised agenda to EPRI/DOE and ask for their leads for each session
- Rob: send announcement to CSNI and other international contacts
- Rob: contact MAI, JRC, JNRA, and IAEA for potential presentations
- Pat: contact decommissioning branch for contact at EnergySolutions for decommissioning presentation
- Matt: Contact Chuck Tomes at Dominion for U.S. utility talk

The list of international parties we think could be interested include:

- ENSI (Muhleberg in Switzerland)
- KINS/KAERI (Kori plant in Korea)
- SCK – RPV interest in Belgium
- MAI in France
- JRC in EU
- JNRA in Japan
- IAEA
- German decommissioning company

Thanks!
Matt

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

Draft Agenda – March 7-8, 2017 Harvesting Workshop

Tuesday, March 7, 2017

Introduction

- Overview of workshop purpose and objectives

Session 1: Motivation for Harvesting

- Solicited presentations from EPRI, DOE, NRC, and international organizations followed by panel discussion

Session 2: Technical data needs best addressed by harvesting

- Solicited presentations from EPRI, DOE, NRC, and international organizations followed by open discussion

Session 3: Sources of Materials

- Solicited presentations from EPRI, DOE, NRC, and international organizations followed by open discussion

Wednesday, March 8, 2017

Session 4: Harvesting Experience: Lessons learned and practical aspects

- Solicited presentations from EPRI, DOE, NRC, U.S. utility, decommissioning companies, and international organizations followed by open discussion

Session 5: Future Harvesting Program Planning

- Solicited presentations from EPRI, DOE, NRC, and international organizations followed by open and panel discussion

From: Hiser, Matthew
Sent: Wednesday, March 1, 2017 3:06 PM
To: Sircar, Madhumita; Pires, Jose; Seber, Dogan; Philip, Jacob; Ray, Sheila; Koshy, Thomas; Taylor, Gabriel; Murdock, Darrell; Kirk, Mark
Cc: Tregoning, Robert; Purtscher, Patrick
Subject: Harvesting Workshop Slides
Attachments: NRC Perspective on Harvesting Experience and Lessons Learned.pptx; NRC Technical Data Needs for Harvesting.pptx; Sources of Materials.pptx

Thank you for your input on the NRC slides for the harvesting workshop. I have incorporated all comments and input received and attached the latest version of the slides to be presented next week.

Thanks!
Matt

Sources of Materials

Metals

- Examples of harvested materials used in NRC research programs:
 - Boral from Zion
 - SS plate and welds from Zorita
 - 304SS ranging from <1 to 50 dpa; SS weld up to 1 dpa
 - PWSCC
 - Alloy 600 J-groove weld from Davis-Besse
 - Alloy 600 CRD nozzle from North Anna
 - Alloy 182/82 from VC Summer
 - RPV
 - Shoreham, Midland

Electrical

- Zion
 - 4.16kV non-segregated bus duct
 - Used in NRC / OECD High Energy Arc Fault Testing
- Bellefonte
 - 8 Electrical enclosures
 - Used in NRC very early warning fire detection testing (NUREG-2180)
 - Used in NRC heat release rate testing (NUREG/CR-7197)

Recently Shutdown U.S. Plants

Plant	Design	Size (MWt)	Years in Operation	Shutdown Date
Kewaunee	W 2-loop	1772	39	2013
SONGS 2/3	CE 2-loop	3438	31/30	2013
Crystal River 3	B&W	2609	36	2013
Vermont Yankee	BWR-4/Mark-1	1912	42	2015
Fort Calhoun	CE 2-loop	1500	43	2016

Planned Shutdown U.S. Plants

Plant	Design	Size (MWt)	Years in Operation	Planned Shutdown
Palisades	CE	2565	47	2018
Pilgrim	BWR-3/Mark-1	2028	47	2019
Oyster Creek	BWR-2/Mark-1	1930	50	2019
Indian Point 2/3	W 4-loop	3216	48/46	2021
Diablo Canyon 1/2	W 4-loop	3411	40	2024-5

Additional Information from Plants

- Point of Contact
- Drawings and plant design information
 - To understand location of components within plant
 - Size and dimensions of components
- Operating history
 - Environmental information (e.g., temperature, fluence, humidity, pressure, etc.) for components of interest
- Material information
 - Fabrication records, CMTRs
- Inspection records
 - Components with known flaws

NRC High-Priority Data Needs for Harvesting

Metals

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

Metals

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

Electrical

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

Concrete

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

NRC Perspective on Harvesting Experience and Lessons Learned

NRC Harvesting Experience

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

Previous Benefits of Harvesting

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

Technical Lessons Learned

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

Logistical Lessons Learned

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

Note to requester:
Attachment is
immediately following.

From: Tregoning, Robert
Sent: Mon, 6 Mar 2017 16:33:04 +0000
To: Frankl, Istvan
Cc: Purtscher, Patrick;Hiser, Matthew
Subject: Harvesting Workshop talking points.docx
Attachments: Harvesting Workshop talking points.docx

Steve:

Here are some talking points that Mike can use to introduce the workshop tomorrow. I think it's best if it comes through your branch so please forward it to Brian/John so that they can send it along to Mike. Let me know if you have any questions.

Cheers,

Rob

Ex-Plant Materials Harvesting Workshop

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

Workshop Approach:

- Each session will consist of solicited presentations followed by lengthy discussion and Q&A period.

From: Hiser, Matthew
Sent: Wed, 1 Mar 2017 20:35:14 +0000
To: Hiser, Matthew
Bcc: 'wwchao@aec.gov.tw'; 'knaito@guestresearcher.epri.com'; Cunningham, Kelly
A; 'Fifield, Leo S'; 'Henric.Lidberg@vattenfall.com'
Subject: Harvesting Workshop Webinar

This email provides the link to the webinar for remote participation in the harvesting workshop. Please use the link below to register and participate in the workshop next week:

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

Please let me know if you have any 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

From: Hiser, Matthew
Sent: Wednesday, February 22, 2017 1:52 PM
To: Cheruvenki, Ganesh; Poehler, Jeffrey
Cc: Rudland, David
Subject: Harvesting Workshop
Attachments: Ex-Plant Materials Harvesting Workshop.pptx

Note to requester: Attachment is immediately following.

Hi Jeff and Ganesh,

I discussed this morning with Jeff the harvesting workshop that we are hosting on March 7-8 in a couple weeks. We have about two dozen external participants coming (EPRI, DOE, Japan, Europe, Canada, etc.) to discuss ex-plant materials harvesting. I have attached the workshop introduction slides that cover meeting logistics, motivation, approach, expected outcome, and session expectations for your awareness.

To foster good discussion and due to space limitations, we are only able to accommodate about 8 or 9 NRC staff. Additional staff can participate via webinar, which will be shared in the next couple days.

The way that breaks down, we can support 1 staff from NRR/DE in the metals area to participate in the room. In workshop planning discussions here with Rob Tregoning, we thought one of you two would probably be good to participate if possible.

We will be sending an email out in the next day or two to relevant branches in NRR and RES to publicize the workshop and webinar info, but please let me know if you have any questions.

Thanks!
Matt

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

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

From: Tregoning, Robert
Sent: Thu, 3 Nov 2016 20:15:08 +0000
To: Hiser, Matthew
Subject: harvesting workshop

Matt:

Let's gin up a meeting announcement as well in the near term that we can start to circulate internationally. (b)(6) got an iGALL trip in December and he wants to circulate the announcement; I'd like to circulate it as well among my CSNI group. (b)(6) might also have (b)(6) some good international contacts for speakers so it would be good to tie him into the agenda development process during the next round of comments.

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: Tregoning, Robert
Sent: Mon, 12 Sep 2016 12:38:40 +0000
To: Hiser, Matthew
Subject: Harvesting Workshop

Matt:

I just heard from a German colleague at GRS (Juergen Sievers) and we discussed the workshop. We need to send him the initial workshop announcement. He can help us get the right decommissioning people from Germany to the workshop. So, it would be good if we could develop and circulate this preliminary announcement within the next week or two.

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: Hull, Amy
Sent: Mon, 22 May 2017 16:03:31 -0400
To: Hiser, Matthew
Cc: Frankl, Istvan
Subject: I gave you my markups today, nice work!: Synopsis on Harvesting for IAEA PLiM

From: Hiser, Matthew
Sent: Monday, May 22, 2017 2:47 PM
To: Hull, Amy <Amy.Hull@nrc.gov>; Tregoning, Robert <Robert.Tregoning@nrc.gov>; Purtscher, Patrick <Patrick.Purtscher@nrc.gov>; Moyer, Carol <Carol.Moyer@nrc.gov>
Cc: Frankl, Istvan <Istvan.Frankl@nrc.gov>
Subject: Synopsis on Harvesting for IAEA PLiM

I have attached a draft 2 page synopsis on harvesting for the IAEA PLiM conference. The plan will be for Carol to give the presentation at the conference, but we need to submit the abstract by this week if possible (deadline was last Friday).

If possible, please take a look and provide comments or edits to the abstract by Wednesday to support submission this week.

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

Note to requester: The attachments are all immediately following.

From: Hiser, Matthew
Sent: Wed, 22 Feb 2017 15:07:50 +0000
To: Nove, Carol; Kirk, Mark; Oberson, Greg; Focht, Eric
Subject: Input on Harvesting Slides
Attachments: Sources of Materials.pptx, NRC Perspective on Harvesting Experience and Lessons Learned.pptx, NRC Technical Data Needs for Harvesting.pptx, Ex-Plant Materials Harvesting Workshop.pptx

Hi Carol, Mark, Greg, and Eric,

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

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

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

Thanks!
Matt

Matthew Hiser

Materials Engineer

US Nuclear Regulatory Commission | Office of Nuclear Regulatory Research

Division of Engineering | Corrosion and Metallurgy Branch

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

Matthew.Hiser@nrc.gov

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

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

NRC Perspective on Harvesting Experience and Lessons Learned

NRC Harvesting Experience

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

Previous Benefits of Harvesting

- Reduce unnecessary conservatism
 - Flaw distributions and Master Curve information came from harvested materials to support PTS rule
- Understand in-service flaws
 - Mockups for NDE qualification
 - Leak rate methodology from studying in-service flaws

Technical Lessons Learned

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

Logistical Lessons Learned

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

NRC High-Priority Data Needs for Harvesting

Metals

- Selected areas of interest for harvested materials:
 - High fluence reactor internals
 - >50 dpa 304 SS from high core outlet temp plant
 - Bounding temperature and high fluence for void swelling
 - Thermally aged unirradiated CASS
 - >30 years at ~320°C; Validate accelerated aging data
 - Moderate fluence (1-2 dpa) CASS
 - Bolster technical basis for embrittlement in this fluence range

Metals

- RPV
 - High fluence vessel with relatively high levels of minor alloying elements (Mn, P, etc.)
 - Through thickness section
 - Measure fluence, toughness, and chemistry as a function of depth
 - Validate fluence calculations
- Components with known flaws
 - Example: weld overlays over known flaws
 - Could be used for NDE evaluations or to assess effectiveness of mitigation techniques
- Components with limiting fatigue life
 - Confirm fatigue calculations are accurate by inspecting for flaws

Electrical

- Cables
 - Power cables energized and energized in normal operation
 - Cables from in containment applications
- Electrical components
 - 1E MOVs from harsh and mild environments
 - 1E Air operated valves
 - 4160 1E breakers
 - 1E Molded case breakers 480V, 250V DC, 125 VDC,
 - 1E Relays from mild environment GE – HFA, Agastat timing relays, any from Westinghouse, Potter Brumfield, Stuthers Dunn etc.,
- Other
 - Electrical penetrations
 - Batteries

Concrete

- High fluence irradiated concrete?
- ASR?
- Large sections for structural testing?

Sources of Materials

Metals

- Examples of harvested materials used in NRC research programs:
 - Boral from Zion
 - SS plate and welds from Zorita
 - 304SS ranging from <1 to 50 dpa
 - SS weld up to 1 dpa
 - PWSCC
 - Alloy 600 J-groove weld from Davis-Besse
 - Alloy 600 CRD nozzle from North Anna
 - Alloy 182/82 from VC Summer
 - RPV
 - Shoreham, Midland

Electrical

Concrete

Recently Shutdown U.S. Plants

Plant	Design	Size (MWt)	Years in Operation	Shutdown Date	Notes
Kewaunee	W 2-loop	1772	39	2013	
SONGS 2/3	CE 2-loop	3438	31/30	2013	
Crystal River 3	B&W	2609	36	2013	
Vermont Yankee	BWR-4/Mark-1	1912	42	2015	
Fort Calhoun	CE 2-loop	1500	43	2016	

Planned Shutdown U.S. Plants

Plant	Design	Size (MWt)	Years in Operation	Planned Shutdown	Notes
Palisades	CE	2565	47	2018	
Pilgrim	BWR-3/Mark-1	2028	47	2019	
Oyster Creek	BWR-2/Mark-1	1930	50	2019	
Indian Point 2/3	W 4-loop	3216	48/46	2021	
Diablo Canyon 1/2	W 4-loop	3411	40	2024-5	

Additional Information from Plants

- Point of Contact
- Material information
 - Fabrication records, CMTRs
- Operating history
 - Temperature and fluence for components of interest
- Inspection records
 - Components with known flaws