

Note to requester: The attachments are immediately following this email.

From: Moyer, Carol
Sent: Tue, 30 Jan 2018 14:59:09 +0000
To: Warren, Brenett
Cc: Frankl, Istvan;Hull, Amy;Hiser, Matthew
Subject: FW: Poster 6 has wrong information: QTE Comments Digital ePosters
Attachments: Consolidated ePoster Titles and Descriptions from QTE (in alpha order) as of 120417_compare.docx, NRC 1102 - AM.PDF

Hello, Bren,

Amy shared the attached email, with her NRC Form 1102 and the QTE comments. I now have a better understanding of changes that have been made during development of posters #6 and #8 since December.

Also, I am not sure that the description for #6 was ever corrected. The "wrong information" that she referred to is that the Additive description is entirely missing, and there is text (maybe an earlier draft) about Harvesting there, instead.

I will revise the Form 1102 for Poster #6 (Additive) today, so that you can send that back to QTE. They should be able, then, to reconcile the information with the poster that Amy Hull sent to them this morning.

Do you have the Form 1102 for Poster #8 (Harvesting)? The title for that poster was also shortened to fit the poster template, so the information for the program should be changed to match exactly with the final poster. If you have the Form 1102, please send it to me, and I will revise it. If you do not have it, I will try to track it down from the author.

Thank you,
Carol

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

From: Hull, Amy
Sent: Tuesday, January 30, 2018 9:37 AM
To: Moyer, Carol <Carol.Moyer@nrc.gov>
Subject: FW: Poster 6 has wrong information: QTE Comments Digital ePosters

From: RICMST Resource
Sent: Friday, December 08, 2017 12:26 PM
To: Hull, Amy <Amy.Hull@nrc.gov>

Cc: RICMST Resource <RICMST.Resource@nrc.gov>

Subject: FW: Poster 6 has wrong information: QTE Comments Digital ePosters

Good Afternoon Amy,

Please review the edited recommendations from QTE. Indicate whether or not you accept their recommended changes.

Thanks,

Brenett (Bren) U. Warren

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



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From: Warren, Brenett

Sent: Thursday, December 07, 2017 12:55 PM

To: QTE Resource <QTE.Resource@nrc.gov>

Cc: RICMST Resource <RICMST.Resource@nrc.gov>

Subject: FW: Poster 6 has wrong information: QTE Comments Digital ePosters

Importance: High

Jay this just in. Amy indicated the wrong information for her eposter. Please do a Level 1 review.

Thanks,

Brenett (Bren) U. Warren

Program Specialist
Information Technology and Infrastructure Services Branch
Program Management, Policy Development and Analysis
Office of Nuclear Reactor Regulation
NRR/DMPS/RISB
Location: O13D5
301-415-3114

Brenett.Warren@nrc.gov



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From: Hull, Amy

Sent: Thursday, December 07, 2017 11:44 AM

To: Warren, Brenett <Brenett.Warren@nrc.gov>; RICMST Resource <RICMST.Resource@nrc.gov>

Cc: Oberson, Greg <Greg.Oberson@nrc.gov>; Moyer, Carol <Carol.Moyer@nrc.gov>; Hiser, Matthew <Matthew.Hiser@nrc.gov>

Subject: Poster 6 has wrong information: QTE Comments Digital ePosters

Importance: High

Hi Brenett,

Please correct the following ---

6 RES—Evaluation of Additive Manufacturing of Metallic Parts via Direct Metal Laser Melting
Recent plans to shut down a number of nuclear power plants provide opportunities for harvesting components that were exposed to light-water reactor environments. Harvesting can provide highly representative aged materials for research and, in some cases, may be the only practical source of representative aged materials to address high-priority issues. Harvesting can be expensive and time consuming, which makes it essential to focus on technical needs with the highest importance and to cooperate with multiple organizations whenever possible to optimally leverage resources. The NRC is interested in engaging with other organizations to prioritize data needs for harvesting, identify areas of common interest, and develop a database for sources of materials for harvesting.

-

It should read---

6 RES—Evaluation of Additive Manufacturing of Metallic Parts via Direct Metal Laser Melting

The NRC has been informed that Additively Manufactured (AM) parts are being considered for applications in the operating fleet as early as calendar year 2018. The first industry alert in June 2017 concerned using the DMLM method to manufacture parts for reactor components. A subsequent scoping study by RES staff provided 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. This poster also discusses the emergence and harmonization of relevant codes & standards activities.

This poster will give an overview of NRC findings and preliminary recommendations related to additive manufacturing via DMLM.

From: Moyer, Carol
Sent: Wednesday, December 06, 2017 6:13 PM
To: Hull, Amy <Amy.Hull@nrc.gov>
Subject: FW: QTE Comments Digital ePosters
Importance: High

Amy,
Have you had a chance to look at this mark-up of the RIC poster abstracts? There is a title for a poster on AM, but the text is about harvesting. (There is also one on harvesting, about harvesting – so it's not as simple as 2 descriptions being swapped.) Your text on the AM poster seems to have been lost.

Carol

From: Oberson, Greg
Sent: Monday, December 04, 2017 2:32 PM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>; Hull, Amy <Amy.Hull@nrc.gov>; Moyer, Carol <Carol.Moyer@nrc.gov>
Subject: FW: QTE Comments Digital ePosters

Hello,
Please respond to the action.

Thanks,
Greg

From: RICMST Resource
Sent: Monday, December 04, 2017 11:34 AM
To:
Subject: QTE Comments Digital ePosters

We have received the attached comments and recommendations from QTE for each Digital ePoster title and description. Please scroll down and review the comments for your eposter. If you accept all of the recommended changes please send an email to RICMST.Resource@nrc.gov to that effect. However, if you choose not to accept the changes let us know that also. Please respond by 12:00 noon on December 6, 2017. You can refer to your eposter by the number located in front of the title.

If you have further questions please contact Bren Warren at 301-415-3114 or via email at RICMST.Resource@nrc.gov or Brenett.Warren@nrc.gov.

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



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Digital Presentations (ePosters) —grouped(Grouped in alpha-orderAlphabetical Order)

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6 RES—Evaluation of Additive Manufacturing of Metallic Parts via Direct Metal Laser Melting

Recent plans to shut down a number of nuclear power plants (NPPs) provide opportunities for harvesting components that were exposed to light-water reactor (LWR) environments. Harvesting can provide highly representative aged materials for research and, in some cases, may be the only practical source of representative aged materials to address high-priority issues. Harvesting can be expensive and time-consuming, which makes it essential to focus on technical needs with the highest importance and to cooperate with multiple organizations whenever possible to optimally leverage resources. The NRC is interested in engaging with other organizations to prioritize data needs for harvesting, identify areas of common interest, and develop a database for sources of materials for harvesting.

>>>>>>

8 RES—Harvesting of Aged Materials from Operating and Decommissioning Nuclear Power Plants

In the U.S. nuclear industry today, there are some nuclear power plants (NPPs) that are prematurely ceasing operation, while other plant operators are making plans to extend operating lifespans through subsequent license renewal (SLR) from 60 to 80 years. Extending plant operation raises technical issues that may require further research on aging mechanisms to reduce uncertainties associated with material performance. Decommissioning plants provide opportunities for harvesting components that have been aged in representative light-water reactor (LWR) environments.

The 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. The work will identify criteria to consider when prioritizing the data needs for harvesting. The NRC is interested in engaging with other organizations to prioritize data needs for harvesting, to share information about harvested materials and those that may become available, and to identify areas of common interest. The poster will give an overview of NRC findings and recommendations related to harvesting of components and material specimens from operating nuclear power plants NPPs and those undergoing decommissioning.

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RIC PROPOSED DIGITAL PRESENTATION
SUBMISSION FORM☐ Original Submission
☒ Updated Submission

Description: A graphical presentation of research results, the status of standards development, the status of safety or security issues, or other topics of major interest to the agency, interested parties and/or the public.

Standard Setup: Standard setup consists of one 46" monitor (screen size 40" width x 22.5" height) mounted on a floor stand; one USB media player; one remote control; one small table and one chair.

- **Digital Presentation (Single-slide):** Format is a one-slide PowerPoint. Word limit is 400-500. Limit of 5-6 large photos, images, or diagrams.
- **Digital Presentation (Multi-slide):** Format is a multi-slide PowerPoint. Word limit is 400-500 per slide. Limit of 5-6 large photos, images, or diagrams per slide.

Submitting Office(s): Enter office acronym, if a joint session, enter lead office followed by supporting office.

RES

Title: Title should be relatively short, yet creative and appealing to the audience.

Evaluation of Additive Manufacturing of Metallic Parts via Direct Metal Laser Melting (DMLM)

Description: Description should be innovative, succinct, and include key elements such as purpose, learning objectives, focus areas, and/or take-away messages.

The NRC has been informed that Additively Manufactured (AM) parts are being considered for applications in the operating fleet as early as calendar year 2018. The first industry alert in June 2017 concerned using the DMLM method to manufacture parts for reactor components. A subsequent scoping study by RES staff provided 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. This poster also discusses the emergence and harmonization of relevant codes & standards activities.

This poster will give an overview of NRC findings and preliminary recommendations related to additive manufacturing via DMLM.

Presenter(s): If known, for each presenter, enter first and last name, position, division title and organization. If possible, list names in the order they will be presenting.

No.	First and Last Name	Position Title	Division Title	Office/Organization (NRC) (Acronyms)	Organization/Agency (Non-NRC)	Add (+) Remove (-)
1	Amy Hull	Senior Materials Engineer	Division of Engineering	RES		<input type="checkbox"/> + <input type="checkbox"/> -
2	Thomas Herrity	Reactor Operations Engineer	Division of Construction Inspection & Operational Programs	NRO		<input type="checkbox"/> + <input type="checkbox"/> -
3	Carol Moyer	Senior Materials Engineer	Division of Engineering	RES		<input type="checkbox"/> + <input type="checkbox"/> -

Topic Submitted By: If the names of the Presenter(s) are not known, enter a point of contact, Name and contact information, for the topic submission.

Please submit the completed form, via e-mail, by the following date:

Due Date:

11/27/2017

Note to requester: The attachment is immediately following this email.

From: Moyer, Carol
Sent: Wed, 6 Dec 2017 23:12:40 +0000
To: Hull, Amy
Subject: FW: QTE Comments Digital ePosters
Attachments: Consolidated ePoster Titles and Descriptions from QTE (in alpha order) as of 120417_compare.docx
Importance: High

Amy,
Have you had a chance to look at this mark-up of the RIC poster abstracts? There is a title for a poster on AM, but the text is about harvesting. (There is also one on harvesting, about harvesting – so it's not as simple as 2 descriptions being swapped.) Your text on the AM poster seems to have been lost.

Carol

From: Oberson, Greg
Sent: Monday, December 04, 2017 2:32 PM
To: Hiser, Matthew <Matthew.Hiser@nrc.gov>; Hull, Amy <Amy.Hull@nrc.gov>; Moyer, Carol <Carol.Moyer@nrc.gov>
Subject: FW: QTE Comments Digital ePosters

Hello,
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Thanks,
Greg

From: RICMST Resource
Sent: Monday, December 04, 2017 11:34 AM
To:
Subject: QTE Comments Digital ePosters

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If you have further questions please contact Bren Warren at 301-415-3114 or via email at RICMST.Resource@nrc.gov or Brenett.Warren@nrc.gov.

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



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Digital Presentations (ePosters) —grouped(Grouped in alpha-orderAlphabetical Order)

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6 RES—Evaluation of Additive Manufacturing of Metallic Parts via Direct Metal Laser Melting

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Non Responsive Record



Non Responsive Record



Non Responsive Record



Non Responsive Record

Note to requester: Portions of the attachment, which is immediately following this email, is redacted under FOIA Exemption B5, Deliberative Process Privilege.

From: Moyer, Carol
Sent: Wed, 18 Oct 2017 13:13:32 +0000
To: Seber, Dogan
Subject: FW: REQUEST FOR HELP - Response to SLR UNR
Attachments: Response to User Need Request NRR-2017-006 (002).response BT comments abh (IF) EMF.docx

Here is an updated version, w/ some numbers from Jake. Note that Tom put FTE as "prior years," which I think is OK.

From: Focht, Eric
Sent: Tuesday, October 17, 2017 3:26 PM
To: Moyer, Carol <Carol.Moyer@nrc.gov>
Subject: RE: REQUEST FOR HELP - Response to SLR UNR

Carol,

Here is what I have so far. Hopefully, Mita will be able to respond either tonight or early tomorrow.

-Eric

From: Moyer, Carol
Sent: Tuesday, October 17, 2017 1:56 PM
To: Focht, Eric <Eric.Focht@nrc.gov>
Subject: RE: REQUEST FOR HELP - Response to SLR UNR

I had one of the POC names wrong & one missing, oops.

From: Moyer, Carol
Sent: Tuesday, October 17, 2017 1:55 PM
To: Focht, Eric <Eric.Focht@nrc.gov>
Subject: REQUEST FOR HELP - Response to SLR UNR
Importance: High

Hi Eric,

I have a bunch of things piled up that Steve wants today. He suggested I ask some of the other branch members for help, if needed, and guess what – you're the only other one here. 😊

One thing in particular is a request to run down the level of effort for User Need Requests that fall under the SLR umbrella. There is a table (on page 6 of the attached "Response to User Need..." document) that includes entries for FTE and contract \$, for each of the technical areas of focus. But three of them are blank.

Steve asked that I confirm what's there, and also fill in the blanks. There may be info to answer this in the UNR Responses (the relevant UNRs and responses are referenced in the table). But if the info is not there, then the answer should come from each responsible branch chief:

IAD: Steve Frankl (UNRs and responses attached)

RPV: Raj Iyengar

Cables: Tom Koshy (Darrell Murdock)

Concrete - ASR: Dogan Seber (Jake Philip, Jose Pires?)

Concrete – Irradiation: Dogan Seber (Mita Sircar, Jose Pires?)

Do you have some time this afternoon to help me by seeking this data? I would really appreciate your help!

Thank you,
Carol

From: Frankl, Istvan

Sent: Saturday, October 14, 2017 12:07 AM

To: Hull, Amy <Amy.Hull@nrc.gov>; Moyer, Carol <Carol.Moyer@nrc.gov>

Subject: ACTION: Revised Draft Response to SLR UNR

Importance: High

Thanks, Amy.

I have attached my revisions with comments. Did you resolve the issue with the different document versions? I am assuming you used the version that Brian reviewed. Please confirm.

Carol,

Since Amy is out next week on training, please try to resolve my comments and have the final draft ready for my review **by COB Tuesday**, so that the package can be returned to management for concurrence and approval on Wednesday. (Please note that we may get additional comments from Brian and the RES FO, and I don't want to request another extension.)

Thanks,

Steve

From: Hull, Amy

Sent: Friday, October 06, 2017 2:35 PM

To: Frankl, Istvan <Istvan.Frankl@nrc.gov>

Cc: Moyer, Carol <Carol.Moyer@nrc.gov>

Subject: my suggested changes: question -- package in ADAMS for SLR UNR

This gives you an idea of what I am thinking.

From: Frankl, Istvan

Sent: Friday, October 06, 2017 1:34 PM

To: Hull, Amy <Amy.Hull@nrc.gov>

Subject: RE: can you send me the most recent version please?: question -- package in ADAMS for SLR UNR

Great!

At least you will be able to document your ideas/thoughts on this now.

Steve

From: Hull, Amy

Sent: Friday, October 06, 2017 1:32 PM

To: Frankl, Istvan <Istvan.Frankl@nrc.gov>

Subject: RE: can you send me the most recent version please?: question -- package in ADAMS for SLR UNR

OK. I will do that and send to you. Then we can incorporate it into the correct file next Weds.

From: Frankl, Istvan

Sent: Friday, October 06, 2017 1:29 PM

To: Hull, Amy <Amy.Hull@nrc.gov>

Subject: RE: can you send me the most recent version please?: question -- package in ADAMS for SLR UNR

Thanks for the update, Amy.

My recommendation would be for you to draft the text that addresses Brian's generic comments now and then insert it in the final version once you get it from the AAs.

Steve

From: Hull, Amy

Sent: Friday, October 06, 2017 12:43 PM

To: Frankl, Istvan <Istvan.Frankl@nrc.gov>

Subject: RE: can you send me the most recent version please?: question -- package in ADAMS for SLR UNR

Cassandra sent me a version – 9/22 - that predates the version that Brian gave me, and I think predates the version you signed off on (your signature is 9/25). I guess I will wait until Weds when

(b)(6)

From: Frankl, Istvan

Sent: Friday, October 06, 2017 12:16 PM

To: Hull, Amy <Amy.Hull@nrc.gov>

Subject: RE: can you send me the most recent version please?: question -- package in ADAMS for SLR UNR

Interesting....

This can mean that the final version was not uploaded or has a different ML#. You may need to wait for the AAs to sort this out.

Thanks,

Steve

From: Hull, Amy
Sent: Friday, October 06, 2017 12:12 PM
To: Frankl, Istvan <Istvan.Frankl@nrc.gov>
Subject: RE: can you send me the most recent version please?: question -- package in ADAMS for SLR UNR

You did explain to me earlier and I understand all that. The problem is that I tried to get it out of ADAMS using, ADAMS # per 9/25/2017 concurrence page, and it is still today the old version from Aug. See attached.

From: Frankl, Istvan
Sent: Friday, October 06, 2017 12:08 PM
To: Hull, Amy <Amy.Hull@nrc.gov>
Subject: RE: can you send me the most recent version please?: question -- package in ADAMS for SLR UNR

Amy,

The version that needs to be updated is the one that Brian reviewed. That version should be in ADAMS (and not the G: drive) and should be considered the "last" version. (You may or may not have owner rights.)

As explained earlier, the AAs control the revision of files in ADAMS once the concurrence package is submitted to management for review/approval. Once you get and update the final version (with track changes enabled), please send it to me for review and then to the AAs, so that they can do the final formatting, the uploading to ADAMS and re-submitting the concurrence package to DE management.

Thanks,

Steve

From: Hull, Amy
Sent: Friday, October 06, 2017 11:54 AM
To: Savoy (RES), Steven <Steven.Savoy2@nrc.gov>
Cc: Moyer, Carol <Carol.Moyer@nrc.gov>; Frankl, Istvan <Istvan.Frankl@nrc.gov>
Subject: FW: can you send me the most recent version please?: question -- package in ADAMS for SLR UNR

Steven,

(b)(6) [REDACTED] I am implementing changes in the version that Brian gave back to me last Friday but I have been working on an old document – not a smart thing to do.

Please will you help me find the most recent version? I tried to find it in ADAMS and Gdrive but had no luck.

Thanks,
Amy

From: Hull, Amy
Sent: Friday, October 06, 2017 11:33 AM
To: Vera, Graciela <Graciela.Vera@nrc.gov>; Moyer, Carol <Carol.Moyer@nrc.gov>
Subject: can you send me the most recent version please?: question -- package in ADAMS for SLR UNR

From: Vera, Graciela
Sent: Friday, September 29, 2017 5:57 AM
To: Moyer, Carol <Carol.Moyer@nrc.gov>
Cc: Hull, Amy <Amy.Hull@nrc.gov>
Subject: RE: question -- package in ADAMS for SLR UNR

Hi,

I got it. What was the last new version that you sent to Cassandra?

WE have fours versions in ADAMS; 2 versions from August and 2 versions this month.

I will be here to help before I get off at 1:40pm today.

Thanks

Graciela Vera

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

From: Moyer, Carol
Sent: Thursday, September 28, 2017 5:04 PM
To: Cole, Cassandra <Cassandra.Cole@nrc.gov>; Vera, Graciela <Graciela.Vera@nrc.gov>; Savoy (RES), Steven <Steven.Savoy2@nrc.gov>

Cc: Hull, Amy <Amy.Hull@nrc.gov>

Subject: FW: question -- package in ADAMS for SLR UNR

Importance: High

Hi Cassandra,

On Monday morning (9/25), CMB submitted a User Need Response memo & enclosure for Brian's signature. You logged it for his concurrence (confirmation attached). The UNR package was an update to a prior version (addressing some NRR comments on our draft response), so we asked that the same ML number be assigned.

What is in ADAMS now at that ML# is the August version of the documents, NOT the Sept. 25 version. Can you please check this, and find out what happened? We want to make sure Brian is reviewing the latest version, and that the 9/25 version was not lost. If the newer version was assigned a different number, please let us know what that number is, so we can share it with our NRR customers.

Thank you,
Carol Moyer & Amy Hull

From: Hull, Amy

Sent: Thursday, September 28, 2017 4:22 PM

To: Moyer, Carol <Carol.Moyer@nrc.gov>

Subject: question -- package in ADAMS for SLR UNR still old - - this should have new documents??? - do we have duplicate packages?

Package Name: RESPONSE TO USER NEED REQUEST FOR RESEARCH ASSISTANCE ON
POTENTIAL SIGNIFICANT TECHNICAL ISSUES DURING THE SUBSEQUENT PERIOD
OF EXTENDED OPERATION: NRR-2017-006

Accession Number: ML17227A483

Package Properties

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	Name	Accession Number	Official Record?	Availability	Document Date	ADAMS Date Added
	SLR UNR response 08-14-2017 cln (002).docx	ML17227A484	No	Non-Publicly Available	Aug 15, 2017 3:00 PM	
	Response to User Need Request NRR-2017-006.docx	ML17227A485	No	Non-Publicly Available	Aug 15, 2017 3:00 PM	

There are 2 Documents in this Package

Page 1 of 1

Reorder

<https://adamsxt.nrc.gov/AdamsXT/packagecontent/packageContent.faces?id={355A2500-E6F3-4E19-A8D8-C627FDDE9FFB}&objectStoreName=MainLibrary&wld=1506629912784>

Response to User Need Request NRR-2017-006
Research Assistance on Potential Significant Technical Issues during
the Subsequent Period of Extended Operation

Task 1

RES staff will continue to hold and participate in NRC/industry workshops on the status of domestic and international research activities to address and evaluate the status of aging degradation issues identified in the SRM on SECY 14-0016 and in the GALL-SLR report (NUREG-2191). The critical degradation issues are addressed further in the Note to Commissioners Assistants "Status Report on Progress of Ongoing Staff Activities to Assess Regulatory Considerations for Power Reactor Subsequent License Renewal" ([ML15160A592](#)).

RES will facilitate a minimum of two domestic and international activities (such as, a workshop, conference, symposium, or meeting), one tentatively planned for spring 2019 on mechanical components and one tentatively planned for summer 2020 on concrete and cables-related issues. In establishing the exact date for these meetings, consideration will be given to the availability of new information on the relevant technical topics. These meetings will address:

- the state of knowledge on the technical issues requested in the SRM on SECY 14-0016,
- ongoing research on materials degradation issues and related aging management as discussed in the GALL-SLR report, and
- any new operating experience from the initial license renewal period (or the long-term operation (LTO) period for international plants).

RES will specifically target these activities toward the resolution of technical issues for effective aging management of systems, structures, and components (SSCs) during the SLR period.

The deliverables will include the two international activities (a workshop, conference, symposium or meeting) and summary reports on the research insights and knowledge gained on the four major issues identified in the SRM on SECY 14-0016 for SLR. RES will prepare and will provide to NRR drafts of the agenda, list of invited presenters, and workshop announcement. RES will plan for a workshop announcement and agenda scope to be made public six months before each workshop. RES will document the information from each of these activities in a NUREG/CP report, if appropriate, or by other sufficient means, including, at a minimum, a summary of the activity with all relevant contributions (presentations or technical articles, for example) and research insights and knowledge, to be provided within 6 months after each meeting.

Materials Issues for Mechanical Components – As part of the requested workshop/conference/ symposium/ meeting on materials issues for mechanical components, tentatively planned for spring 2019, the NRC staff will coordinate a session, or sessions, concerning reactor vessel embrittlement and the degradation of reactor internals due to irradiation during the SLR period. The staff will seek participation from the NRC staff, the regulated US industry, and representatives from the international industry and regulators. RES will document the product of these sessions (presentations and/or papers) as described above.

Concrete, Containment and Electrical Cable Issues – RES will also hold an NRC/industry workshop with international participation (tentatively planned for summer 2020) on the state of knowledge for the technical issues in concrete, containment, and cable degradation identified in the SRM on SECY 14-0016 and in the GALL-SLR report. The workshop will help RES secure information on research insights and knowledge from the industry, other domestic institutions working on nuclear safety, and from relevant international experts and institutions. Given that cables and concrete issues involve different technical disciplines and expertise, and that research to address some of these issues is still active, RES will plan for a three-day workshop that may include breakout sessions for specific technical topics and items of interest. RES will

Enclosure

document the results of the workshop as described above. Task 1 will continue until the completion of the deliverables from this activity, tentatively scheduled for late summer 2020.

Task 2

RES staff will continue to develop and implement a long-term strategy for obtaining information on materials degradation from decommissioned NPPs, as well as from ex-plant components from operating plants. RES will execute the work through a 4-step process, described in paragraphs 2.A -2.D of the UNR.

Under a long-term research project preceding the current request from NRR, RES pursued a strategic approach to ex-plant harvesting through two coordinated activities: technical issue prioritization and a workshop on ex-plant material harvesting.

In the first activity, RES, with contractor support from Pacific Northwest National Laboratory (PNNL), developed an approach to prioritize technical issues best addressed by harvesting. The criteria for prioritizing harvesting data needs will be described in the anticipated TLR, expected by the end of 2017 "Criteria and Planning Guidance for ExPlant Harvesting to Support Subsequent License Renewal." The deliverable will provided criteria to assess the need for harvesting to address a particular technical issue. The report will then apply these criteria to assess four representative technical issues: electrical cable degradation, embrittlement of cast austenitic stainless steel (CASS), cracking of dissimilar metal welds, and irradiation-assisted degradation (IAD) of stainless steel. This report will also cover the background on the need for harvesting, and past harvesting efforts and experience. The purpose of this report is to serve as a foundation for NRC staff to prioritize technical issues best addressed by harvesting. The initial technical letter report (TLR) for this research is expected to be published in September, 2017, as a PNNL document. This TLR will be reviewed by NRR and RES staff to determine any follow-on work by RES and the final publication type.

In the second activity preceding UNR NRR-2017-006, RES closely collaborated with the Department of Energy (DOE) and Electric Power Research Institute (EPRI) to host a workshop on ex-plant materials harvesting on March 7-8, 2017. The purpose of this workshop was to engage with various stakeholders involved in the harvesting process to discuss all aspects of harvesting, including motivation for harvesting, data needs best addressed by harvesting, sources of materials for harvesting, lessons learned from past harvesting efforts, and future harvesting program planning. The workshop was designed to discuss past harvesting experience and lessons learned and seek leveraging and cooperation with other interested research organizations. Insights from the workshop are integrated into the database and harvesting planning efforts. The database will be developed consistent with the prioritization criteria from PNNL to identify which sources to focus on. The workshop was well-attended by representatives from DOE, EPRI, the U.S. industry, and international research organizations. Key insights from the workshop included the need for a clearly defined objective to justify the level of effort, and the benefit of early planning and engagement with the plant from which materials will be harvested. The workshop summary report will be distributed among meeting participants and is expected to be finalized by September, 2017. RES will be pursuing further engagement with interested workshop participants on two outstanding workshop action items: identifying data needs for harvesting and initially creating a 'sources of materials' information tool/database. This is discussed further under Subtask 2.B.

Subtask 2.A.

Moving forward, RES will work internally to evaluate how the four significant issues identified for SLR in the SRM on SECY-14-0016 may be best addressed by harvesting. RES will initially develop an Excel spreadsheet (precursor to the information tool/database) that identifies and prioritizes the materials, components, and operating conditions needed to best address the significant issues. The work in this task includes collecting and inputting information on materials needed and the sources of materials expected to be available.

RES will apply the criteria developed with PNNL described above to the issues for SLR, and will document the outcome of the analysis in an 'information tool/database' (based on Microsoft products such as Access or Excel), as described above, which will identify and prioritize the materials, components, and environmental conditions that should be pursued for harvesting. The intent is for this information tool/database to be a living document that can evolve and be updated to reflect the latest operating experience and research, so that users may understand which data needs can be best addressed by harvesting. The purpose of the database is to have a systematic approach to harvesting materials and prioritize limited resources on the best values for harvesting. The database is not an end unto itself, but the means to do the highest priority harvesting for the best technical value.

As a specific example, RES will develop a process to evaluate harvested concrete samples, and will follow through with implementing the process as concrete materials become available from additional plants. The scope of the harvesting strategy includes: structures exposed to high radiation (typically bio-shield structures of certain PWR designs); alkali silica reaction (ASR)-affected structures; post-tensioned structures with emphasis on pre-stressed concrete containment vessels (PCCVs); corrosion of pre-stressing tendons, liners, reinforcing steel, and embedments; and concrete cores from PWR spent fuel pool or transfer canals (for boric acid effects).

Based on information gleaned from discussions with international counterparts on the potential for harvesting and testing of concrete, RES will provide in the information tool the possibilities for this activity and document testing priorities as applicable. As an example, RES has engaged in discussions with the Canadian Nuclear Safety Commission (CNSC) about possibilities for harvesting concrete from a decommissioned plant in Canada extensively affected by ASR. RES also will document the process to evaluate concrete samples from nuclear power plants and their suitability for harvesting. Concurrently, RES will pursue domestic and international partnerships for cooperative cost sharing on the retrieval and testing of concrete samples.

In addition to irradiation effects on concrete materials, RES will continue research on IAD of stainless steel. RES will seek potential sources of reactor pressure vessel internals that may become available for harvesting, to evaluate their utility for regulatory research being conducted under UNR NRR-2017-001.

RES will continue to evaluate the SLR-significant issue of cable aging using harvested cables. The goal will be to expand on the selection of cable types harvested as part of the existing similar effort under UNRs NRR-2011-014 and NRR-2016-012 to include more cable types (insulation types and medium voltage level cables) and to evaluate the aging effects on power cables at different voltage levels.

Subtask 2.B.

In parallel with the information tool/database activity, RES will develop an effective process to evaluate the applicability of materials available for harvesting. Based on past experience and

insights from the harvesting workshop, the greatest challenge in this area is expected to be acquiring sufficient information from NPPs to make an informed decision on harvesting. In many cases, this information may not exist, or it may be challenging to find in plant records. RES will work internally and with other interested organizations to identify the best approach to gather the relevant information and use it to inform which harvesting opportunities should be pursued. A TLR documenting the information tool/database with prioritized technical issues and a process to identify suitable sources of materials will be targeted for completion by July, 2018.

Subtasks 2.C. and 2.D.

Implementation of the evaluation process developed in Subtask 2.B. will be pursued in Subtasks 2.C. and 2.D., as requested in the UNR. RES will evaluate potentially-available components from plants performing component replacements or entering decommissioning (Subtask 2.C). If other nuclear facilities present opportunities for material harvesting, RES will assist in evaluating the value of such components (Subtask 2.D). RES will remain in close contact with NRR on the latest developments as this process is implemented.

The evaluation process will identify confirmatory needs that harvested samples can effectively address, will consider decommissioned plants in the U.S. and abroad, and will leverage resources to the greatest extent possible for domestic and international cooperative research opportunities, as stipulated in Subtask 2.E, which is closely integrated with Task 3. Through their national and international contacts, RES staff will maintain alertness for harvesting opportunities relating to various critical areas, such as reactor vessel embrittlement. Information on these opportunities will be retained in the information tool/database.

Task 3

RES staff pursues domestic and international partnerships to share expertise, capabilities and resources related to aging management research for LTO. These exchanges are critical for the regulatory evaluation of industry research used to justify the adequacy of their aging management programs (AMPs), as well as for independent confirmatory research. RES will continue to cultivate emerging domestic and international partnerships and will continue to develop existing partnerships, as well as other suitable opportunities that may emerge to address aging degradation issues. A majority of these partnerships will build upon already existing partnerships with the view of supporting assessment of the status of the research and operating experience in relation to SLR needs as well as implementation of a long-term strategy for the use of harvesting of ex-plant materials and components. The following illustrates some of those key partnerships and specific planned activities.

The DOE Light Water Reactor Sustainability (LWRS) and the EPRI LTO programs support most of the domestic research on aging management in NPPs. RES maintains separate collaborative research agreements with each of these organizations to exchange technical information. These exchanges are essential for the review and assessment of the technical bases for the viability of LTOs. RES staff have frequent technical exchange meetings with DOE and EPRI staff. These meetings have focused on irradiation effects on concrete, ASR effects, aging management, and supporting technologies like non-destructive examination (NDE).

RES is a participant in several multi-national cooperative research programs, including the International Forum on Reactor Aging Management (IFRAM), and many others. The RES Office Director signed a multilateral 4-year memorandum of understanding (MOU) for IFRAM in 2015. IFRAM is envisioned to be a network of research organizations, industry groups, regulatory

bodies, and academic institutions involved in reactor aging management research, regulation, education and training, as well as nonprofit research institutes having academic and industrial links enabling appropriate exchange of information addressing issues of NPP SSC aging management. The small effort and contract funding to operate the IFRAM program will be funded by this User Need Request. Other international collaborations pursued by RES are also expected to benefit this work, although resources to support those initiatives are tracked separately.

In relation to concrete irradiation, NRC is exploring opportunities to harvest irradiated concrete from decommissioned NPPs worldwide to study irradiation effects under in-service conditions (in coordination with Subtask 2.E). RES and Oak Ridge National Laboratory (ORNL) submitted white papers to the OECD Halden Reactor Project (HRP) proposing research on irradiation effects on the steel-concrete bond, and on creep effects on irradiation damage. RES is also collaborating with HRP on IAD under the auspices of UNR NRR-2017-001 Task 2. These results will inform Task 4 of UNR NRR-2017-006.

RES is working to finalize a bilateral agreement with IRSN, France for exchange of technical information on the effects of ASR on the performance of nuclear concrete. IRSN is conducting a 10-15 year research project focused on studying the long-term performance of concrete affected by ASR, Delayed Ettringite Formation, corrosion and carbonation of nuclear concrete. RES will build upon its ongoing collaboration with DOE/EPRI on ASR and irradiation effects on concrete, and will continue to participate in OECD/NEA/CSNI activities that develop and assess expertise in the modeling of ASR affected concrete structures.

Through their national and international contacts, and through codes and standards development activities, the RES staff will maintain alertness for partnerships to share expertise, capabilities, and resources in all areas of concern, perhaps especially reactor vessel embrittlement. Information on these opportunities will be communicated to NRR in a timely manner as outlined in the deliverables.

RES will evaluate products and reports from these organizations that may be provided to NRC in support of generic or plant-specific issues. RES will provide to cognizant NRR staff and management trip reports, summaries, papers, presentations, reports and other information from interactions with *domestic and international organizations as a result of this activity. These products will be provided in a timely manner and this effort will continue until the closure of this UNR. Relevant findings from recent interactions, status and future plans will be discussed as a standing agenda item during appropriate interface meetings between RES/DE, NRR/DMLR and NRR/DE. A report (or slides) for presentation at appropriate Director/Deputy Director interface meetings will be provided 5 days before the meeting.*

Task 4

This UNR (NRR-2017-006) serves as an "umbrella" under which other SLR-focused technical UNRs are coordinated, providing an umbrella under which SLR-focused technical UNRs are put in context. These technical UNRs supported are shown in Table 1 below.

Table 1. SLR-Related Technical UNRs Coordinated/Integrated by UNR NRR-2017-006

UNR #	UNR Title	Comments	
NRR-2017-001 ML16300A303 ✓ RES Response to NRR-2017-001 ML17110A202 ✓	Request for Assistance to Evaluate Irradiation-Assisted Degradation of Rx Vessel Internals (b)(5) (b)(5) (b)(5) (b)(5)	This UNR is based on a previous UNR NRR-2012-008 and updates the regulatory research project on void swelling and clarifies current what projects RES is currently involved with and what future projects that are being considered. A third task was added to this UNR for have RES to perform confirmatory evaluation and support ASME code case on new EPRI IASCC crack growth rate curves. (b)(5) Funding Contract: FY17: _____ FY18: _____, and FY19: _____ (b)(5) FTEs: FY17: _____ FY18: _____ and FY19: _____ (b)(5)	Commented [IF1]: Why are some UNRs highlighted on this page? Commented [IF2]: Please double-check by FY. Commented [IF3]: Same as above
NRR-2014-007 ML14126A818 ✓ RES Response to NRR-2014-007 ML14212A127 (package) ✓	Reactor Pressure Vessel Integrity Issues (b)(5) (b)(5) (b)(5)	This UNR superseded UNR NRR-2007-001 and includes 6 tasks: (1) Appendix H in process by NRR, NRO, and RES staff; rulemaking funded in FY17 and team in place to finalize rulemaking effort, (2) updating the tech bases for Appendix G, (3) examination and analysis of irradiated reactor vessel material, (4) providing emergent technical assistance, (5) maintaining database and documentation, and (6) performing/ documenting a tech evaluation on irradiation damage mechanisms and potential revisions to 10 CFR, part 50 App. G of RG 1.99 "Radiation Embrittlement of Reactor Vessel Materials" Rev 2. (b)(5) Funding Contract \$: _____ (b)(5) (b)(5) (b)(5) FY15 - _____ FY16 - _____ FY17 - _____ FY18 - _____ FTEs: FY16 - _____ FY17 - _____ FY18 - _____ (b)(5)	Commented [IF4]: Same as above Commented [IF5]: Same as above
NRR-2011-014 ML11307A205 ✓ RES Response to NRR-2011-014 ML11335A169 ✓ Amendment to NRR-2011-014 (NRR-2016-012) ML16096A221 ✓	Assessment of Cable Condition Monitoring Amendment to UNR for Assessment of Electrical Cable Condition Monitoring (b)(5) (b)(5) (b)(5)	NRR/DMLR's focus on this UNR is to assess and evaluate condition monitoring methods on electrical cables subjected to accelerated aging under normal and accident conditions. Accelerated aging of the cable samples is expected to commence toward the end of FY2017. The amendment extends the cable testing period up to 80 years (up from 60 years in the previous UNR). (b)(5) (b)(5) (b)(5) (b)(5) Funding: _____ Prior FY total: _____ FY18 - _____ FY19 - _____ FY20 - _____ FTEs: Prior FY total - _____ FY18 - _____ FY19 - _____ FY20 - _____ (b)(5) (b)(5) (b)(5) (b)(5)	Commented [IF6]: Please add \$s and FTEs by fiscal year.
NRR-2012-004 ML12109A324 ✓ RES Response to NRR-2012-004 ML12152A107 ✓	Alkali-Silica Reaction (ASR) Research (b)(5) (b)(5) (b)(5) (b)(5)	The objective of this UNR is to develop technical bases for regulatory guidance for evaluating ASR-affected concrete structures, primarily focusing on impact on the structural capacity under design basis loads through its service life, including PEO, and its aging management. The research at NIST includes obtaining data on highly instrumented concrete block specimens to monitor the progression of ASR and assess its impact on in-situ mechanical properties, conducting destructive testing to assess structural impact including seismic response, evaluating numerical modeling methods, and material aspects for determining the state and rate of ASR. (b)(5) Funding: FY14 - _____ FY15 - _____ FY16 - _____ FY17 - _____ FTEs: FY14 - _____ FY15 - _____ FY16 - _____ FY17 - _____	(b)(5) (b)(5) (b)(5) Commented [IF7]: Same as above. (b)(5)
NRR-2015-007 ML15076A217 ✓ RES Response to NRR-2015-007 ML15229A100 ✓	Effects of Irradiation on Concrete Structures (b)(5)	The purpose of this UNR is to develop technical bases for regulatory guidance to evaluate radiation effects on concrete structures close to reactors. The focus of related regulatory research is to evaluate the impact on structural capacity under design basis loads for service life up to 80 years and develop aging management strategy. The project includes reviewing EPRI and DOE reports by ANL (contract awarded in Jan 2016), harvesting the materials from the decommissioned Jose Cabrera NPP in Zorita, Spain (b)(5) Funding: _____ FTEs: _____	Commented [IF8]: Same as above.

RES staff will document the review of the technical issues germane to the review of SLR applications. This will include, but may not be limited to, a summary of products from Tasks 1, 2, and 3 on the status of research results in support of the Commission's direction to the staff.

RES will prepare a document annually summarizing the products from the three tasks above and discussing the accomplishments of RES and national and international partners in addressing the major technical issues in the SRM. This annual report will be at a sufficiently high level to be used to support briefings for the Commission or Advisory Committee on Reactor Safeguards, Commission Assistants' Notes, reporting to the public and interested stakeholders, or other requests for briefings on SLR. This annual report will be provided in the first quarter of each calendar year, beginning in the first quarter of calendar year 2018, discussing the research activities supporting SLR during the previous year.

(b)(5) Based on the latest assessment of projected needs in this area, RES proposes that the estimate of [REDACTED] year for this task be adjusted once the scope of work and the required level of RES staff involvement is better understood after the first SLR application is received in early FY18. Technical assistance products and SME support will be provided to NRR in a timely manner, and this effort shall continue until the closure of this UNR.

Task 5 (Optional)

Under this optional task, NRR may call upon RES to provide independent confirmatory analyses and expert technical assistance with the review of anticipated SLR applications with potentially significant issues, such as those needing plant-specific gap analyses. Building upon the extensive work previously done under UNR NRR 2014-001, RES staff will continue to be available to provide confirmatory analyses and expert technical assistance with the review of the technical documents to be submitted with SLR applications. RES will be available to support tighter SLR application review schedules as well as the review of plant-specific gap analyses expected with the first applications. RES subject matter experts (SMEs) will be available to participate in technical discussions, independent reviews, development of technical bases, and support of meetings with internal and external stakeholders.

As an example, the staff will continue to be available to review operational equipment failures to assess the trend in critical risk-significant electrical equipment. There are concerns with aging effects (including cyclic aging) and design life of other electrical components, such as breakers and relays, which would need further evaluation to assess their continued service life by exploring other monitoring techniques not generally covered under surveillance tests. Such analyses could complement work in Task 2, whereby critical electrical components can also be harvested and evaluated. These SLR-related studies are being pursued independently of this UNR, and the work is being tracked through existing communication between RES and NRR staff.

Deliverables and Schedules

RES staff will participate in periodic meetings with NRR staff and management to discuss the latest developments and information from industry and NRC-supported research, as well as collaborative research, particularly insights that may impact regulatory decisions or aging management guidance. Staff-level interactions are expected to be as frequent as needed.

RES agrees with the deliverables proposed by NRR, with some adjustments to the schedule

based on expected project completion dates. RES staff will closely coordinate with NRR staff and adjust the schedules for deliverables as needed to support effective regulatory decision making.

The deliverables and schedules for UNR NRR-2017-006 are shown in the following table.

Schedule and Resources for the Various Tasks Period of Performance (FY 18-21)				
Task Number	Task Description	Completion Date	FTE	Contract \$ (b)(5)
1	Hold NRC/industry workshops (est. 2018, 2020) and prepare NUREG/CP and summary reports on four SRM topics	FY 21	(b)(5) /year	(b)(5) for FY 18 and FY 21
Total (Task 1)			(b)(5)	(b)(5)
2	Develop a strategy for harvesting Ex-Plant materials/components		(b)(5)	(b)(5)
2.A.	Develop an information tool/database	FY 18	(b)(5)	(b)(5)
2.B.	Develop a process to evaluate plant components	FY 18	(b)(5)	(b)(5)
2.C.	Use the process from 2.B. to evaluate the suitability of plant components	FY 19	(b)(5)	(b)(5)
2.D.	Continue to implement the process from 2.B. as components become available from additional plants	Ongoing (FY 20-21)	(b)(5) /year (Total (b)(5))	(b)(5)
2.E.	Pursue partnerships for cooperative cost-sharing on retrieval and testing of ex-plant materials	Ongoing (FY18-FY21)	Included in Task 3, below	(b)(5)
Total (Task 2)			(b)(5)	(b)(5)
3	Participate in relevant domestic and international activities (e.g., IFRAM, IAEA, DOE LWRS, EPRI LTO, codes & standards)	FY 18-21	(b)(5) /year (Total (b)(5))	(b)(5) (total for 4 years IFRAM dues)
4	Develop documentation evaluating significant technical issues germane to the review of SLR applications	FY 18-21	(b)(5) /year (Total (b)(5))	(b)(5)
5 (optional)	Provide technical assistance to NRR for reviewing SLR applications.	FY 18-21	To be funded if needed	To be funded if needed
Total (Tasks 1-4, over 4 years)			(b)(5)	(b)(5)

Note to requester: Portions of this record are redacted under FOIA Exemption B5, Deliberative Process Privilege.

From: Hiser, Matthew
Sent: Wed, 13 Apr 2016 12:15:19 +0000
To: Shaffer, Sarah
Subject: FW: RES-16-0295

FYI – just got your message this morning (WAH yesterday). Steve is out Wed-Fri at a meeting in Pittsburgh, but he said he'd be checking email in the evening.

Thanks!
Matt

From: Hiser, Matthew
Sent: Wednesday, April 13, 2016 8:14 AM
To: Frankl, Istvan <Istvan.Frankl@nrc.gov>
Subject: RES-16-0295

Hi Steve,

I had discussed with you on Friday about RES-16-0295, which is for a \$20K incremental funding of the harvesting project at PNNL. However, there is only [REDACTED] remaining to the ceiling on this (b)(5) contract, so Sarah recommended just going ahead and funding this the ceiling [REDACTED] instead of (b)(5) \$20K). That makes sense to me and now that we have our full budget, we should have the necessary funds.

If that's OK with you, I will resubmit the REQ for [REDACTED] (b)(5)

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: Portions of the attachment, which is immediately following this email, is redacted under FOIA Exemption B5, Deliberative Process Privilege.

From: Hiser, Matthew
Sent: Thu, 14 Sep 2017 14:54:15 +0000
To: Tregoning, Robert;Purtscher, Patrick
Subject: FW: Task 2 comments from Dave Rudland: UNR from DLR to RES
Attachments: Response to User Need Request NRR-2017-006-dr.docx

FYI – I may try to set a quick meeting with Dave to help explain the harvesting task in the SLR UNR...

From: Hull, Amy
Sent: Thursday, September 14, 2017 10:05 AM
To: Hiser, Matthew ; Purtscher, Patrick
Cc: Moyer, Carol
Subject: Task 2 comments from Dave Rudland: UNR from DLR to RES

Matt,
As discussed this morning.

From: Rudland, David
Sent: Friday, August 18, 2017 1:52 PM
To: Brady, Bennett <Bennett.Brady@nrc.gov>; Alley, David <David.Alley@nrc.gov>
Cc: Stuchell, Sheldon <Sheldon.Stuchell@nrc.gov>
Subject: RE: UNR from DLR to RES

Bennett

I have not read the request, but I did read the response, and I have several questions and comments that are shown in the attached. Let me know if you need clarification or additional information.

Thanks
Dave

David L. Rudland, Ph.D.
Chief, Vessels and Internals Integrity Branch
Division of Engineering
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Mail Stop: OWFN-11F01
11555 Rockville Pike
Rockville, MD 20852-2738
Office: (301) 415-1896
Cell:
Email: david.rudland@nrc.gov

(b)(6)

From: Brady, Bennett

Sent: Thursday, August 17, 2017 3:45 PM

To: Rudland, David <David.Rudland@nrc.gov>; Alley, David <David.Alley@nrc.gov>

Cc: Stuchell, Sheldon <Sheldon.Stuchell@nrc.gov>

Subject: UNR from DLR to RES

Dave and Dave,

In May, DLR sent a user need request to RES for research assistance in technical issues during the subsequent license renewal period. Attached are the attachment to the May 8 DLR UNR, the RES memo in response to the UNR, and the attachment to the RES response memo. We met today to discuss the RES response. We will be asking them to provide more detail on the products to be provided, the timeline, the needs and uses of the products, particularly on the Task 2.

Would you please review the "Response to User Need Request NRR 2017-006" and provide us your comments on the response, the usefulness of the products and what more information you would need in the UNR? Please give me your response in an email or redline/strikeout of the document by COB Thursday, August 24.

Thank you,

Bennett

Bennett M. Brady

Senior Project Manager

Division of License Renewal

Office of Nuclear Reactor Regulation

O 11 – D8

301-415-2981

Response to User Need Request NRR-2017-006
Research Assistance on Potential Significant Technical Issues during
the Subsequent Period of Extended Operation

Task 1

RES staff will continue to hold and participate in NRC/industry workshops on the status of domestic and international research activities to address and evaluate the status of aging degradation issues identified in the SRM on SECY 14-0016 and in the GALL-SLR report (NUREG-2191). The critical degradation issues are addressed further in the Note to Commissioners Assistants "Status Report on Progress of Ongoing Staff Activities to Assess Regulatory Considerations for Power Reactor Subsequent License Renewal" ([ML15160A592](#)).

RES will facilitate a minimum of two domestic and international activities (either a workshop, conference, symposium, or meeting), one in early autumn 2018 on mechanical issues and one in late spring 2020 on concrete and cables issues. These meetings will address the state of knowledge on the technical issues requested in the SRM on SECY 14-0016, ongoing research on materials degradation issues and related aging management as discussed in the GALL-SLR, and any new operating experience from the initial license renewal period (or the long-term operation (LTO) period for international plants). RES will specifically target these activities toward the resolution of technical issues for effective aging management of systems, structures, and components (SSCs) during the SLR period.

The deliverables will include the two international activities (a workshop, conference, symposium or meeting) and summary reports on the research insights and knowledge gained on the four major issues identified in the SRM on SECY 14-0016 for SLR. Prior to the meetings, RES will provide a draft agenda with specific topics for the meeting and the proposed presenters. RES will document the information from each of these activities in a NUREG/CP report, if appropriate, or by other sufficient means, including, at a minimum, a summary of the activity with all relevant contributions (presentations or technical articles, for example) and research insights and knowledge, to be provided within 6 months after each meeting.

Mechanical Issues – As part of the requested autumn 2018 workshop/ conference/ symposium/ meeting on mechanical issues, the NRC staff will coordinate a session, or sessions, concerning issues associated with reactor vessel embrittlement during the SLR period. The staff will seek participation from the NRC staff, the regulated US industry, and representatives from the international industry and regulators. RES will document the product of these sessions (presentations and/or papers) as described above.

Concrete, Containment and Electrical Cables Issues – RES will also hold an NRC/industry workshop with international participation in the third quarter of FY20 (spring of 2020) on the state of knowledge for the technical issues in concrete, containment, and cable degradation identified in the SRM on SECY 14-0016 and in the GALL-SLR report. The workshop will help RES secure information on research insights and knowledge from the industry, other domestic institutions working on nuclear safety, and from relevant international experts and institutions. Given that cables and concrete issues involve different technical disciplines and expertise, and that research to address some of these issues is still active, RES will plan for a three-day workshop that may include breakout sessions for specific issues and items of interest. RES will prepare and will provide to NRR drafts of the agenda, list of invited presenters, and workshop announcement. RES will plan for a workshop announcement and agenda scope to be made public six months before the workshop. RES will document the results of the workshop as described above. Task 1 will continue until the completion of the deliverables from this activity, tentatively scheduled for late spring 2020.

Commented [RD1]: This is in my area. From reading this, I'm not sure the purpose of the workshop. Is it to discuss things we already know, unknown things, or what. What are the goals of the workshop? What do we expect to learn? We already know the plans on embrittlement predictions, late blooming phases, etc. I'm not sure we are going to learn one year from now, anything we don't already know.

The other thing is this is a materials issue and not a mechanical issue

Enclosure

Task 2

RES staff will continue to develop and implement a long-term strategy for obtaining information on materials degradation from decommissioned NPPs, as well as from ex-plant components from operating plants. RES will execute the work through a 4-step process, 2.A -2.D as stipulated on page 4 of the UNR.

Under a long-term research project preceding the current request from NRR, RES pursued a strategic approach to ex-plant harvesting through two coordinated activities: technical issue prioritization and a workshop on ex-plant material harvesting.

- In the first activity, RES, with contractor support from Pacific Northwest National Laboratory (PNNL), developed an approach to prioritize technical issues best addressed by harvesting. The deliverable provided criteria to assess the need for harvesting to address a particular technical issue. The report then applied these criteria to assess four representative technical issues: electrical cable degradation, embrittlement of cast austenitic stainless steel (CASS), cracking of dissimilar metal welds, and irradiation-assisted degradation (IAD) of stainless steel. This report also covered the background on the need for harvesting, and past harvesting efforts and experience. The purpose of this report was to serve as a foundation for NRC staff to prioritize technical issues best addressed by harvesting. The initial technical letter report (TLR) for this research is expected to be published in September, 2017, as a PNNL document. This TLR will be reviewed by NRR and RES staff to determine any follow-on work by RES and the final publication type.
- In the second activity preceding UNR NRR-2017-006, RES closely collaborated with the Department of Energy (DOE) and Electric Power Research Institute (EPRI) to host a workshop on ex-plant materials harvesting on March 7-8, 2017. The purpose of this workshop was to engage with various stakeholders involved in the harvesting process to discuss all aspects of harvesting, including motivation for harvesting, data needs best addressed by harvesting, sources of materials for harvesting, lessons learned from past harvesting efforts, and future harvesting program planning. The workshop was well-attended by representatives from DOE, EPRI, the U.S. industry, and international research organizations. Key insights from the workshop included the need for a clearly defined objective to justify the level of effort, and the benefit of early planning and engagement with the plant from which materials will be harvested. The workshop summary report will be distributed among meeting participants and is expected to be finalized by September, 2017. RES will be pursuing further engagement with interested workshop participants on two outstanding workshop action items: identifying data needs for harvesting and initially creating a 'sources of materials' information tool/database. This is discussed further under Subtask 2.B.

Subtask 2.A.

Moving forward, RES will work internally to evaluate how the four significant issues identified for SLR in the SRM on SECY-14-0016 may be best addressed by harvesting. RES will initially

Commented [RD2]: I've read this task several times, and I'm not sure what the outcome of this task will be... sounds like a database of needs + process on how to choose which materials to harvest

I see nothing in this write-up on what the intended uses are for this product. From my perspective, I can see this as a tool to confirm fluence estimates on the vessel and internals, and material properties at those fluences. I'm sure there are other uses.

develop an Excel spreadsheet (precursor to the information tool/database) that identifies and prioritizes the materials, components, and operating conditions needed to best address the significant issues.

RES will apply the criteria developed with PNNL described above to the issues for SLR, and will document the outcome of the analysis in an 'information tool/database' (based on Microsoft products such as Access or Excel), as described above, which will identify and prioritize the materials, components, and environmental conditions that should be pursued for harvesting. The intent is for this information tool/database to be a living document that can evolve and be updated to reflect the latest operating experience and research, so that users may understand which data needs can be best addressed by harvesting.

As an example, RES will develop a process to evaluate concrete samples harvested from decommissioned plants, and will follow through with implementing the process as concrete materials become available from additional plants. The scope of the harvesting strategy includes: structures exposed to high radiation (typically bio-shield structures of certain PWR designs); alkali silica reaction (ASR)-affected structures; post-tensioned structures with emphasis on pre-stressed concrete containment vessels (PCCVs); corrosion of pre-stressing tendons, liners, reinforcing steel, and embedments; and concrete cores from PWR spent fuel pool or transfer canals (for boric acid effects).

Based on information gleaned from discussions with international counterparts on the potential for harvesting and testing of concrete from decommissioned reactors, RES will provide in the information tool the possibilities for this activity and document testing priorities as applicable. As an example, RES has engaged in discussions with the Canadian Nuclear Safety Commission (CNSC) about possibilities for harvesting concrete from a decommissioned plant in Canada extensively affected by ASR. RES also will document the process to evaluate concrete samples from nuclear power plants and their suitability for harvesting. Concurrently, RES will pursue domestic and international partnerships for cooperative cost sharing on the retrieval and testing of concrete samples.

In addition to irradiation effects on concrete materials, RES will continue research on IAD of stainless steel. RES will seek potential sources of reactor pressure vessel internals that may become available for harvesting, to evaluate their utility for regulatory research being conducted under UNR NRR-2017-001.

RES will continue to evaluate the SLR-significant issue of cable aging utilizing harvested cables. The goal will be to expand on the selection of cable types harvested as part of the existing similar effort under UNRs NRR-2011-014 and NRR-2016-012 to include more cable types (insulation types and medium voltage level cables) and the aging effects on power cables at different voltage levels.

Subtask 2.B.

In parallel with the information tool/database activity, RES will develop an effective process to evaluate the applicability of materials available for harvesting. Based on past experience and insights from the harvesting workshop, the greatest challenge in this area is expected to be acquiring sufficient information from NPPs to make an informed decision on harvesting. In

Commented [RD3]: Is this database of material available for harvesting or what we want for harvesting

Are we tracking where we can harvest materials and does this flow into the database somehow?

Commented [RD4]: Not sure I understand the difference between the two databases. The preceding paragraph says basically the same thing as this paragraph... an Excel (or Access) database "that identifies and prioritizes the materials, components, and operating conditions" needed (or pursued)

Commented [RD5]: How is this an example of the databased discussed

Commented [RD6]: How does this fit into the database?

many cases, this information may not exist, or it may be challenging to find in plant records. RES will work internally and with other interested organizations to identify the best approach to gather the relevant information and use it to inform which harvesting opportunities should be pursued. A TLR documenting the information tool/database with prioritized technical issues and a process to identify suitable sources of materials will be targeted for completion by July, 2018.

Commented [RD7]: Not sure what they are going to do here or how they will do it.

Subtasks 2.C. and 2.D.

Implementation of the evaluation process developed in Subtask 2.B. will be pursued in Subtasks 2.C. and 2.D., as requested in the UNR. RES will evaluate potentially-available components from plants performing component replacements or entering decommissioning (Subtask 2.C). If other nuclear facilities present opportunities for material harvesting, RES will assist in evaluating the value of such components (Subtask 2.D). RES will remain in close contact with NRR on the latest developments as this process is implemented.

The evaluation process will identify confirmatory needs that harvested samples can effectively address, will consider decommissioned plants in the U.S. and abroad, and will leverage resources to the greatest extent possible for domestic and international cooperative research opportunities, as stipulated in Subtask 2.E, which is closely integrated with Task 3. Through their national and international contacts, RES staff will maintain alertness for harvesting opportunities relating to various critical areas, such as reactor vessel embrittlement. Information on these opportunities will be retained in the information tool/database.

Commented [RD8]: Should there be a plan for aggressive pursuit, or just maintaining awareness

Task 3

RES staff pursues domestic and international partnerships to share expertise, capabilities and resources related to aging management research for LTO. These exchanges are critical for the regulatory evaluation of industry research used to justify the adequacy of their aging management programs (AMPs), as well as for independent confirmatory research. RES will continue to cultivate emerging domestic and international partnerships and will continue to develop existing partnerships, as well as other suitable opportunities that may emerge to address aging degradation issues. A majority of these partnerships will build upon already existing partnerships with the view of supporting assessment of the status of the research and operating experience in relation to SLR needs as well as implementation of a long-term strategy for the use of harvesting of ex-plant materials and components. The following illustrates some of those key partnerships and specific planned activities.

The DOE Light Water Reactor Sustainability (LWRS) and the EPRI LTO programs support most of the domestic research on aging management in NPPs. RES maintains separate collaborative research agreements with each of these organizations to exchange technical information. These exchanges are essential for the review and assessment of the technical bases for the viability of LTOs. RES staff have frequent technical exchange meetings with DOE and EPRI staff. These meetings have focused on irradiation effects on concrete, ASR effects, aging management, and supporting technologies like non-destructive examination (NDE).

RES is a participant in several multi-national cooperative research programs, including the OECD Halden Reactor Project (HRP), the International Forum on Reactor Aging Management

(IFRAM), and many others. For example, the RES Office Director signed a multilateral 4-year memorandum of understanding (MOU) for IFRAM in 2015. IFRAM is envisioned to be a network of research organizations, industry groups, regulatory bodies, and academic institutions involved in reactor aging management research, regulation, education and training, as well as nonprofit research institutes having academic and industrial links enabling appropriate exchange of information addressing issues of NPP SSC aging management.

In relation to concrete irradiation, NRC is exploring opportunities to harvest irradiated concrete from decommissioned NPPs worldwide to study irradiation effects under in-service conditions (in coordination with Subtask 2.E). RES and Oak Ridge National Laboratory (ORNL) submitted white papers to the HRP proposing research on irradiation effects on the steel-concrete bond, and on creep effects on irradiation damage. RES is also collaborating with HRP on IAD under the auspices of UNR NRR-2017-001 Task 2. These results will inform Task 4 of UNR NRR-2017-006.

RES is working to finalize a bilateral agreement with IRSN, France for exchange of technical information on the effects of ASR on the performance of nuclear concrete. IRSN is conducting a 10-15 year research project focused on studying the long-term performance of concrete affected by ASR, Delayed Ettringite Formation, corrosion and carbonation of nuclear concrete. RES will build upon its ongoing collaboration with DOE/EPRI on ASR and irradiation effects on concrete, and will continue to participate in OECD/NEA/CSNI activities that develop and assess expertise in the modeling of ASR affected concrete structures.

Through their national and international contacts, and through codes and standards development activities, the RES staff will maintain alertness for partnerships to share expertise, capabilities, and resources in all areas of concern, perhaps especially reactor vessel embrittlement. Information on these opportunities will be communicated to NRR in a timely manner as outlined in the deliverables.

RES will evaluate products and reports from these organizations that may be provided to NRC in support of generic or plant-specific issues. RES will provide to cognizant NRR staff and management trip reports, summaries, papers, presentations, reports and other information from interactions with domestic and international organizations as a result of this activity. These products will be provided in a timely manner and this effort will continue until the closure of this UNR. Relevant findings from recent interactions, status and future plans will be discussed as a standing agenda item during appropriate interface meetings between RES/DE, NRR/DMLR and NRR/DE. A report (or slides) for presentation at appropriate Director/Deputy Director interface meetings will be provided 5 days before the meeting.

Task 4

RES staff will document the review of the technical issues germane to the review of SLR applications. This will include, but may not be limited to, a summary of products from Tasks 1, 2, and 3 on the status of research results in support of the Commission's direction to the staff. Task 4 also allows for NRR to call upon RES to provide independent confirmatory analyses and expert technical assistance with the review of anticipated SLR applications with potentially significant issues, such as those needing plant-specific gap analyses.

RES will also prepare a document annually summarizing the products from the three tasks

above and discussing the accomplishments of RES and national and international partners in addressing the major technical issues in the SRM. This annual report will be at a sufficiently high level to be used to support briefings for the Commission or Advisory Committee on Reactor Safeguards, Commission Assistants' Notes, reporting to the public and interested stakeholders, or other requests for briefings on SLR. This annual report will be provided in the first quarter of each calendar year, beginning in the first quarter of calendar year 2018, discussing the research activities supporting SLR during the previous year.

Building upon the extensive work previously done under UNR NRR 2014-001, RES staff will continue to be available to provide confirmatory analyses and expert technical assistance with the review of the technical documents to be submitted with SLR applications. RES will be available to support tighter SLR application review schedules as well as the review of plant-specific gap analyses expected with the first applications. RES subject matter experts (SMEs) will be available to participate in technical discussions, independent reviews, development of technical bases, and support of meetings with internal and external stakeholders.

As an example, the staff will continue to be available to review operational equipment failures to assess the trend in critical risk-significant electrical equipment. There are concerns with aging effects (including cyclic aging) and design life of other electrical components such as breakers and relays which would need further evaluation to assess its continued service life by exploring other monitoring techniques not generally covered under surveillance tests. Such analyses could complement work in Task 2, whereby critical electrical components can also be harvested and evaluated.

(b)(5) Based on the latest assessment of projected needs in this area, RES proposes that the estimate of [REDACTED] year for this task be adjusted once the scope of work and the required level of RES staff involvement is better understood after the first SLR application is received in early FY18. Technical assistance products and SME support will be provided to NRR in a timely manner, and this effort shall continue until the closure of this UNR.

Deliverables and Schedules

RES staff will participate in periodic meetings with NRR staff and management to discuss the latest developments and information from industry and NRC-supported research, particularly insights that may impact regulatory decisions or aging management guidance. Staff-level interactions are expected to be as frequent as needed.

RES agrees with the deliverables proposed by NRR, with some adjustments to the schedule based on expected project completion dates. RES staff will closely coordinate with NRR staff and adjust the schedules for deliverables as needed to support effective regulatory decision making.

The deliverables and schedules for UNR NRR-2017-006 are shown in the following table.

Schedule and Resources for the Various Tasks Period of Performance (FY 18-21)				
Task Number	Task Description	Completion Date	FTE	Contract \$ (b)(5)
1	Hold NRC/industry workshops (est. 2018, 2020) and prepare NUREG/CP and summary reports on four SRM topics	FY 21	(b)(5) year	for FY 18 and FY 21 (b)(5)
Total (Task 1)			(b)(5)	(b)(5)
2	Develop a strategy for harvesting materials/components from decommissioned plants			
2.A.	Develop an information tool/database	FY 18	(b)(5)	(b)(5)
2.B.	Develop a process to evaluate plant components	FY 18	(b)(5)	
2.C.	Use the process from 2.B. to evaluate the suitability of plant components	FY 19	(b)(5)	
2.D.	Continue to implement the process from 2.B. as components become available from additional plants	Ongoing (FY 20-21)	(b)(5) year (Total (b)(5))	
2.E.	Pursue partnerships for cooperative cost-sharing on retrieval and testing of ex-plant materials	Ongoing (FY18-FY21)	Included in Task 3, below	
Total (Task 2)			(b)(5)	(b)(5)
3	Participate in relevant domestic and international activities (e.g., IFRAM, IAEA, DOE LWRS, EPRI LTO, codes & standards)	FY 18-21	(b)(5) year (Total (b)(5))	(b)(5) (total for 4 years IFRAM dues)
4	Develop documentation evaluating significant technical issues germane to the review of SLR applications	FY 18-21	(b)(5) year (Total (b)(5))	
Total (Tasks 1-4, over 4 years)			(b)(5)	(b)(5)

Note to requester: The attachments are immediately following this email. Portions of the attachments are redacted under FOIA Exemption 3, Federal statute 41 U.S.C. §253b(m)(1) to protect contractor proposal information that has not been set forth or incorporated by reference into the final contract.

From: Purtscher, Patrick
Sent: Thu, 21 Jul 2016 11:20:01 -0400
To: Purtscher, Patrick
Subject: FW: Harvesting Docs
Attachments: NRC-HQ-60-15-T-0023F Mod 1-12-16.docx, Supp Info PNNL Mod 1-13-16.docx, Task Order NRC-HQ-60-15-T-0023 PNNL Technical Proposal 9-4-15.pdf

Bruce watson

From: Hiser, Matthew
Sent: Tuesday, June 07, 2016 3:11 PM
To: Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: Harvesting Docs

Hi Pat,

Here is mod document as well as the proposal from PNNL back in September.

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

STATEMENT OF WORK

NRC Agreement Number	NRC Agreement Modification Number	NRC Task Order Number (If Applicable)	NRC Task Order Modification Number (If Applicable)
NRC-HQ-25-14-D-0001	N/A	NRC-HQ-60-15-T-0023	N/A
Project Title			
Strategic Approach for Obtaining Material and Component Aging Information			
Job Code Number	B&R Number	DOE Laboratory	
		Pacific Northwest National Laboratory (PNNL)	
NRC Requisitioning Office			
Nuclear Regulatory Research (RES)			
NRC Form 187, Contract Security and Classification Requirements			
<input type="checkbox"/> Applicable <input checked="" type="checkbox"/> Not Applicable		<input type="checkbox"/> Involves Proprietary Information <input type="checkbox"/> Involves Sensitive Unclassified	
<input checked="" type="checkbox"/> Non Fee-Recoverable		<input type="checkbox"/> Fee-Recoverable (If checked, complete all applicable sections below)	
Docket Number (If Fee-Recoverable/Applicable)		Inspection Report Number (If Fee Recoverable/Applicable)	
Technical Assignment Control Number (If Fee-Recoverable/Applicable)		Technical Assignment Control Number Description (If Fee-Recoverable/Applicable)	

1.0 BACKGROUND

Regulatory Context:

The NRC has established a license renewal process that will allow nuclear power plants (NPP) to renew their licenses for an additional 20 years, via 10 CFR 54.31(d) stating that “a renewed license may be subsequently renewed.” The biggest challenges for the NRC and the industry will be addressing the major technical issues for this second “subsequent” license renewal (SLR) beyond 60 years. As summarized in SECY-14-0016, the NRC staff believe that the most significant technical issues challenging power reactor operation beyond 60 years are related to:

- Reactor pressure vessel (RPV) neutron embrittlement at high fluence
- Irradiation assisted degradation (IAD) of reactor internals and primary system components
- Concrete and containment degradation

- Electrical cable qualification and condition assessment.

Understanding the causes and control of degradation mechanisms forms the basis for developing aging management programs (AMPs) to ensure the functionality and safety margins of NPP systems, structures, and components (SSC). The resolution to these issues should provide reasonable assurance of safe operation of the components in the scope of license renewal during the subsequent period of extended operation.

Because of the cost and inefficiency of piecemeal sampling, there is a need for a strategic and systematic approach to sampling materials from SSC in decommissioning plants. The envisioned work addresses both passive and active components. In that sense, it addresses aging management of passive components under the license renewal rule, 10 CFR 54, as well as the maintenance of active components covered by the maintenance rule, 10CFR50.65, as seen in Figure 1 below.

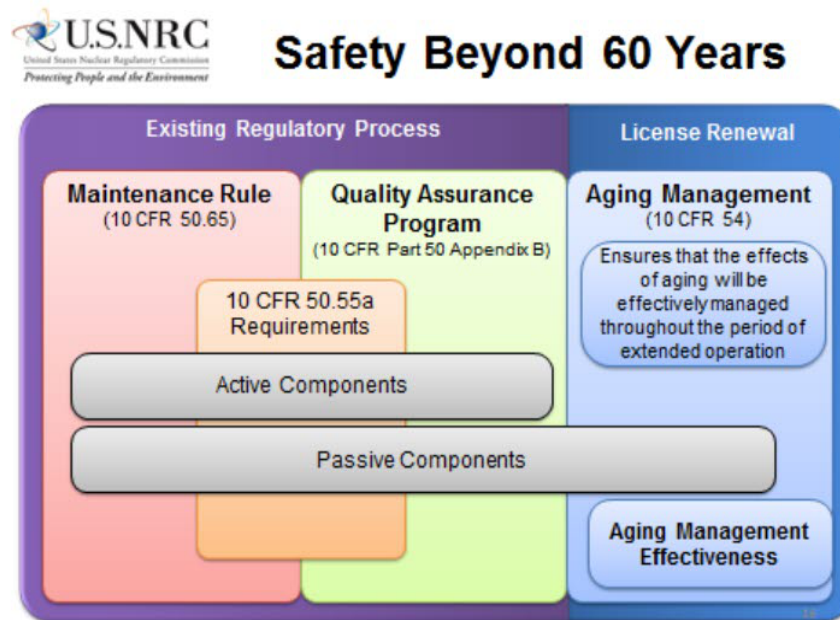


Figure 1: Relationship between aging management of active and passive components (from NRR/RES presentation to ACRS, 2014)

In the past few years, four plants have ceased operation or announced that they will cease operation: Crystal River Unit 3 (PWR), Kewaunee (PWR), San Onofre Units 2 & 3 (PWR), and Vermont Yankee (BWR). These plants comprise a range of reactor types, containments, and SSCs important to safety. The primary objective of this project is to develop a long-range strategy for obtaining information from these plants as they go through decommissioning. The focus will be on timely acquisition of experiential real-world aging-degradation information that

can significantly improve the agency's risk-informed and performance-based regulatory approach, but has been very difficult or impossible to obtain from the operating reactor fleet.

Technical Context:

Creating a roadmap for obtaining information from designated NPPs as they go through decommissioning is complementary to ongoing NRC research in developing technical information to support evaluating SLR as well as data collection and testing of ex-plant materials.

Material degradation has traditionally been managed reactively in response to events and operating experience, rather than proactively to prevent failures. For the NPPs currently entering their first license renewal period from 40-60 years, and submitting SLR applications, it is necessary to evaluate potential degradation mechanisms out to 80 years of operation. Evaluation of material properties in SSCs from actual decommissioned NPPs will provide a basis for comparison with results of laboratory tests and calculations to resolve the four issues listed above.

The proactive management of materials degradation (PMMD) information tool was originally created at PNNL for RES (POC: Amy Hull) to give an expert opinion of the possible future degradation mechanisms on a subcomponent/material specific basis (PNNL-17779)ⁱ. Combined with the LER database, the PMMD information tool allows one to not only react to past events, but to anticipate future issues. The original PMMD information tool was based on NUREG/CR-6923, "Proactive Materials Degradation Assessment (PMDA)," for the first license renewal period, so it is now appropriate to integrate information from the excel databases from the recently-published five volumes of NUREG/CR-7153, "Expanded Materials Degradation Assessment (EMDA)" for SLR. At this juncture, there is demonstrated industry interest in NPP long-term operation (LTO) and regulatory interest in SLR.

2.0 OBJECTIVES

Understanding and managing material and component degradation is a key need for the continued safe and reliable operation of NPPs, but has significant uncertainties. In many cases, the scientific basis for understanding and predicting long-term environmental degradation behavior of materials in NPPs is incomplete. A strategic approach to examination and testing of materials and components from decommissioned reactors can dramatically increase our knowledge-acquisition rate in this very important area.

There are three inter-related objectives to this work:

- (1) Develop a long-range strategy for obtaining information from decommissioned NPPs as well as providing the flexibility to get ex-plant components from operating plants as well. The focus will be on timely acquisition of experiential real-world aging-degradation information that can significantly improve the agency's risk-informed and performance-based regulatory approach, but has been very difficult or impossible to obtain from the operating reactor fleet.

- (2) Construct a strategic plan and specifications for obtaining unique and significant materials aging degradation information from diverse sources (operating experience, other nuclear facilities, other long-lived industrial plants, other materials organizations such as ASM and NACE) that will inform the NRC's age-related regulatory oversight in the future. Implementation of this plan and specifications, in cooperation with industry and DOE partners can be accomplished over time, through individual research projects as the identified plants progress through their decommissioning process. This exploratory research is expected to provide fundamental insights on reactor materials degradation and information addressing potential technical issues or identified gaps to support anticipated future NRC needs.
- (3) Update the PMMD information tool to incorporate LTO/SLR-relevant information so that it can be better used to inform prioritization in the ex-plant material strategic plan.

3.0 SCOPE OF WORK

There are a number of technical gaps that this project seeks to address. Most importantly, the current piecemeal approach can be replaced with a strategic plan that is more comprehensive, broader in scope, and more risk-informed. The strategic plan for inspections and/or testing developed in this project will be useful guidance for obtaining key measurements of degradation in a variety of areas. These measurements will be valuable on their own and will also be useful in basic research on the underlying mechanisms and modes of degradation, and for validation of modeling and simulation tools. Data and information developed from implementation of the strategic plan will also be useful in evaluating aging management and mitigation strategies proposed by the industry.

Many sources of materials degradation information will be queried, including human repositories of knowledge both within NRC and within the industry. Both the PMDA and EMDA present information in terms of component or material degradation susceptibility and currently available knowledge for degradation mitigation or prevention. A component with high degradation susceptibility/low knowledge would be the strongest candidate for proactive actions. It is necessary to be able to understand this before prioritizing ex-plant materials sampling available from a given retired NPP. Previously, under the auspices of NRC contracts (i.e., JCN N6029, N6907), PNNL used the large amount of information presented in the PMDA report to develop a web-based platform to facilitate analysis through interactive visualizations that offer intuitive ways to explore the information. PNNL shall explore the viability of adding materials degradation susceptibility data presented in the EMDA Report.

Such an information tool (Figure 2 below) is expected to save considerable staff efforts to understand and apply the PMDA and EMDA insights to regulatory review of licensee information. PNNL shall develop a web-based modified scalable reasoning system (SRS) for tracking, disposition, and resolution of critical issues, such as determining the appropriate SSC

from which to acquire cast austenitic stainless steel (CASS) material of specific composition and radiation dose.

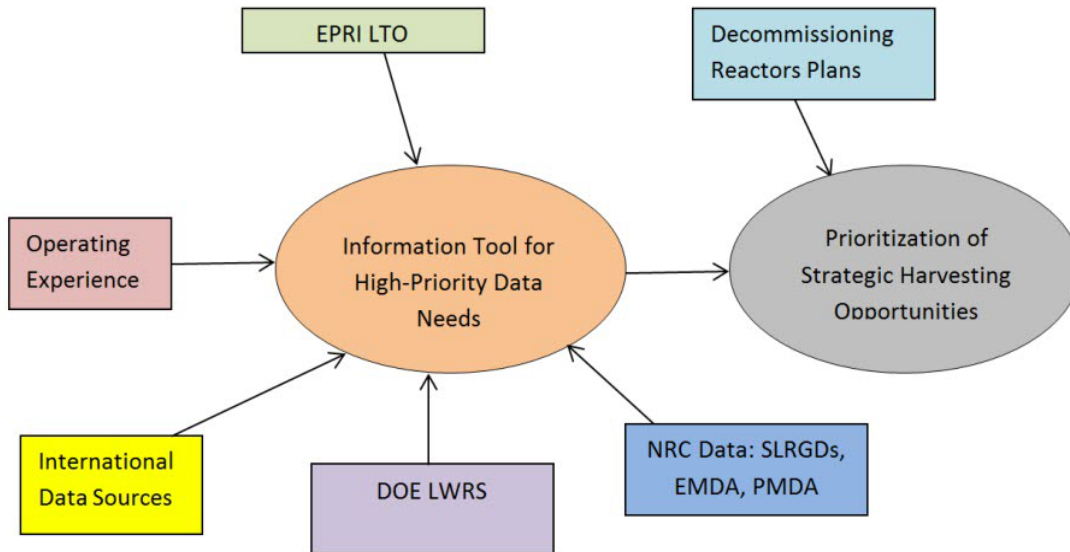


Figure 2: Pre-conceptual Architecture of prognostic tool to track and resolve critical technical issues for SLR

As shown in Figure 2 above, the information tool was originally envisioned as integrating domestic and international operating experience and experimental information as well as information from the EPRI LTO, DOE Light Water Reactor Sustainability (LWRS) program, and NRC sources such as EMDA, PMDA, and SLR guidance documents (SLRGDs) and precursors. The international data sources that might provide effective data feed include the cable aging data and knowledge (CADAK, <http://cadak.hrp.no/cadak>.) project and the Component Operational Experience, Degradation and Ageing Programme (CODAP, <http://www.oecd-neo.org/jointproj/codap.html>), both sponsored by OECD/NEA. The Atlas constructed by PNNL from the Program to Assess the Reliability of Emerging Non-destructive Technology (PARENT) and the Program to Inspect Nickel Alloy Components (PINC) Atlas is an international database containing a vast array of SCC crack morphology and NDE information. PNNL shall investigate whether this is an appropriate framework to track issue resolution associated with SLR. This is a much broader objective than just developing a strategic roadmap for harvesting SSCs.

The general tasks and their duration are described in Table 1.

Table 1: Task Description and Duration

Task	Task Title/Description	Duration (Months)
Task 1	Scoping Study and technical literature review	18
Task 2	Decision Making on Specific Confirmatory Research Needed to Address Gaps (optional)	6
Task 3	Confirmatory Research Addressing Technical Gaps (optional)	33
Task 4	Development of Independent Decision Making Tools (optional)	33

The conditional tasks shall be conducted, as detailed in Figure 3 below. A decision on further optional research outlined in Tasks 2, 3, and 4 will be made after completion of Task 1 depending on the outcome and recommendation from the conclusion of specific tasks. The overall nexus between the scoping study and other potential tasks is shown in Figure 3.

The PNNL staff shall not restrict their activities solely to these descriptions and shall be flexible in using their technical knowledge and experience in proposing additions, deletions, or deviations from the prescribed requirements as research progresses.

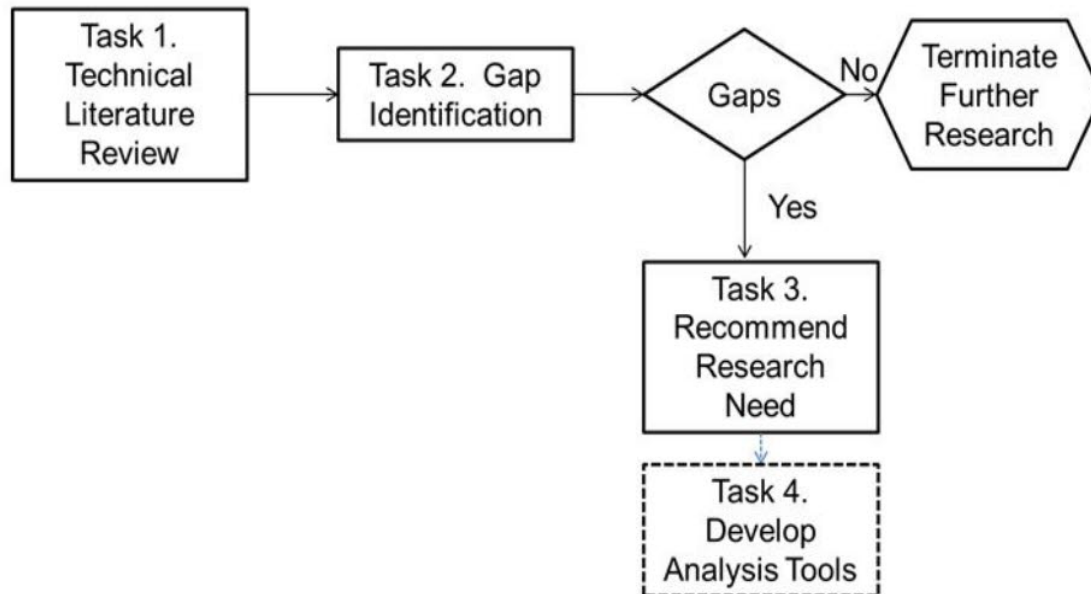


Figure 3: Schematic of the Overall Research

4.0 SPECIFIC TASKS

Task 1 is the scoping study. Tasks 2-4 are optional. NRC plans to revise the SOW for these tasks based on the outcome of Task 1. The time at which the tasks begin and end will be dependent on available information and NRC's ongoing evaluation of testing priorities. NRC staff does not require that PNNL necessarily perform the tasks be performed sequentially following the order in which they are listed. For the test matrix described in this section, nearly all subtasks will have to be tested in tandem with another subtask in order to complete the program within the requested period of performance. PNNL and the NRC CORs will continually review the testing plan during monthly status update teleconferences.

PNNL shall, in the first stage of Task 1, develop a questionnaire and help the NRC staff conduct interviews with focus groups from various technical disciplines within NRC. PNNL shall, in the second stage of Task 1, assist the NRC staff conduct one or two public workshops. PNNL shall analyze and combine the results of the first two phases into a final strategic plan in the third stage. This strategic plan will provide a prioritization of strategic harvesting opportunities. PNNL shall help the NRC staff develop the ex-plant harvesting strategic plan in cooperation with industry and other federal agencies such as DOE as well as any international counterparts that may be interested in participation.

In Tasks 2-4, PNNL may be assigned optional tasks to identify requirements to further elucidate the risk assessment of component degradation. Such research should also provide technical data and information, as necessary, to request the national codes and standards bodies (such as ASME, ASTM, or NACE) to re-examine requirements for structural materials for passive components in light water reactors (LWRs) and in assessing material degradation during service and its effect on design safety margin of components. The PNNL principal investigator (PI) for this project shall attend ASME, ASTM, or NACE Code Committee meetings, as appropriate and as approved by the COR during the course of this research. The PI shall provide adequate information to support an IAEA international cooperative research program (ICRP) on this subject to bring worldwide resources to address this research need.

The specific tasks are as follows:

Task 1 – Literature Review and Assessment of Greatest Needs in Sampling of Ex-plant Materials

NRC recently completed a research program to investigate material degradation after extended operation. To investigate aging degradation mechanisms, aging degradation effects, and the relative susceptibility to degradation, PNNL shall perform a comparison of available information.

PNNL shall conduct the Task 1 scoping study and provide all resources necessary to accomplish the subtasks and deliverables. Task 1 shall be performed in stages as shown in the Task-specific subsections below.

The activities required for this task are:

Task 1.1 – Conduct Materials Aging Degradation Literature Review

PNNL shall selectively review both domestic and international sources of technical information of generic nature with respect to anticipated material degradation in NPPs during LTO, extrapolating to 80 years of operation. The objective is to identify other issues not in PMDA/EMDA, such as related to active components or spent fuel storage systems, and to determine what is being done to address LTO issues. NRC will provide guidance on appropriate information to review.

Task 1.2 – Evaluate Availability of Ex-Plant Material and Information

PNNL shall evaluate what relevant ex-plant material is projected to be available for potential harvesting. PNNL shall work with the NRC COR to develop a questionnaire and interview the cognizant individuals at the plants who possess critical knowledge.

Task 1.3 – Develop Questionnaire and Conduct Interviews with Prospective NRC Stakeholders

PNNL shall develop a questionnaire and work with NRC staff to conduct interviews with focus groups from various technical disciplines within NRC. This would include the SLR Expert Panels for a sample of different aging management programs (AMPs) as well as other NRC technical advisory groups. PNNL shall have a comprehensive approach to all the possible stakeholders interested in harvesting materials from decommissioned plants. The objective of this initial scoping study is to assess interest in issues concerning both passive and active component degradation. The questionnaire will address, as a minimum, (1) the perceived needs for ex-plant materials, (2) the perceived utility of the existing information tool and how and where this prognostic tool should be maintained (NRC, contractor, cloud). During the early brainstorming and scoping study, PNNL shall also consider degradation of SSC materials associated with extended long-term storage of used fuel.

Task 1.4 – Develop Questionnaire and Conduct Interviews with Prospective External Stakeholders

Based on interactions with NRC staff in Task 1.3 above, PNNL shall propose a preliminary strategic approach to sampling representative ex-plant materials during one or two presentations at public workshops to further refine the concept of what would be needed in a useful interrogatory tool linking aging-degradation research objectives with available resources for ex-plant materials. The searchable information tool shall be available via an interactive web page.

Task 1.5 –Conduct Scoping Analysis on Viability of Searchable Information Tool

Task 1.5.1 PNNL shall briefly consider available approaches to creating a preliminary database that will link the highest susceptibility/lowest knowledge anticipated degradation scenarios with potential availability of ex-plant materials. As part of this subtask, PNNL shall review the status and viability of the PMMD information tool created as part of the PMMD project (conducted at PNNL under previous NRC contracts (i.e., JCN N6029, N6907). The goals of the PMMD project were to identify reactor components that could reasonably be expected to experience future degradation, estimate the susceptibility of components to various degradation mechanisms, and assess the degree of knowledge available to develop mitigative strategies. It was anticipated that this information could be used to guide regulatory actions related to license renewal and subsequent license renewal. The PMMD panel evaluated 3863 components (2203 for PWRs, 1603 for BWRs) for their susceptibility to 16 degradation mechanisms (Figure 4 below). Because of the unwieldiness of the source material, a searchable information tool (pmmd.pnl.gov) was developed to make this information usable to NRC staff and others.

Task 1.5.2 PNNL shall work with the NRC to create a proposal to develop a platform for the searchable database methodology (selected in Task 1.5.1) that can be supported within NRC.

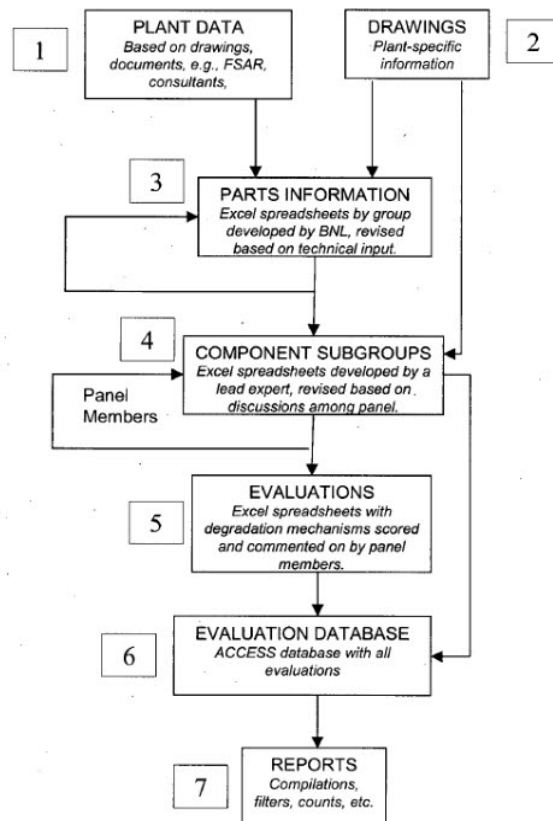


Figure 4. Flowchart for files created and used in PMMD infotool

Task 1.6 – Provide Archival Summary Document of Findings from Task 1

PNNL shall analyze and review the reports generated from the work conducted under Tasks 1.1 through 1.5 and provide a stand-alone **NUREG/Ctechnical letter report (TLR)** documenting the major findings.

Optional Task 2 – Decision Making on Specific Research Need to Address Gaps

If the Task 1 scoping study succeeds in determining previously unidentified significant knowledge gaps that need further attention, more work will be done in the context of Task 2, pending the approval from the NRC Contract Officer (CO). Thus, Task 2 is optional pending the outcome of Task 1 and requires NRC activation. The activities required for this task are:

Task 2.1 – Gap Identification

PNNL shall identify specific information and technical data gaps from the execution of Task 1 and document these gaps. In identifying the gaps, PNNL shall include an examination of the current ASME B&PV Code or other industry practices that the NRC has endorsed with respect to addressing the specific degradation mechanism in the design and the assurance of the retention of the design margin during the period of licensed reactor operation time.

Task 2.2 – Determine Significance and Disposition of Technical Gaps

PNNL shall determine whether or not there are any technical gaps from the execution of Task 2.1. If there are no gaps and if it is determined that the current ASME Code or other industry practices ensure that the design margin for components are adequate, recommend termination of further research in this topic by NRC. If specific information and technical gaps are identified then proceed to Task 3 after getting approval from the NRC Contract Officer (CO).

Optional Task 3 – Research Addressing Technical Gaps Related to Material Degradation

If critically important information and technical gaps are identified in Task 2, Task 3 is activated after getting approval from the NRC CO. Thus, Task 3 is optional pending the outcome of Task 2. The activities required for this task are:

Task 3.1 – Recommend Specific Laboratory Experimentation and Analytical Model Development

PNNL shall work with NRC subject matter experts (SMEs) to recommend specific laboratory experimentation and analytical model development, which may address the information gap identified in Task 2.1. If novel nondestructive evaluation methods (such as the next-generation acoustic emission technology which reportedly can ‘hear’ crack initiation) become available to identify progressing reactor material degradation by the time Task 3 is initiated, PNNL shall

recommend inservice inspection (ISI) technology enablers which will be suitable for detecting the material changes resulting from different stressors. PNNL shall work with NRC SMEs to recommend the need for developing tools for detection and assessment of potential degradation of the design safety margin to independently confirm the licensee's technical basis for LTO.

Task 3.2 – Review Adequacy of Existing Codes and Standards

PNNL shall conduct a review of existing applicable ASME B&PV Codes that may need to be revised as a result of Task 2.1 and PNNL shall work with NRC SMEs to engage relevant ASME Code Committees for assessing future path. PNNL shall propose other Codes and Standards that should be reviewed (such as but not limited to, ANS, ASTM, and NACE codes and standards).

Optional Task 4 – Investigate Development of Independent Decision Making Tools

Task 4 is optional pending the outcome of Tasks 1 – 3. If gaps are identified under Task 2 and appropriate research needed to inform the gaps are also identified under Task 3, NRC expects that the industry will perform the needed research and provide NRC the data for regulatory decisions.

Depending on the outcome of Tasks 2 and 3 and ensuing industry research, the decision-making tool development may be complex and truly involve multi-year, multi-disciplinary long term research. It is expected, however, that the decision making tool may include: (a) Material and component condition after different stressors; (b) Better knowledge of specific degradation and its potential for reducing the design safety margin for the components; (c) Incorporation of plant data into the various material, inspection, and structural integrity evaluation models; and (f) An integration of all these aspects into the regulatory decision making process to consider the risk contribution due to material degradation.

Specific subtasks for this task will be established later in this research. PNNL shall investigate the feasibility of developing a modern visualization confirmatory analysis research tool for aging management of safety-significant SSC degradation in NPPs. As currently envisioned, this could provide a knowledge management and strategic planning tool for conducting gap assessments and prioritizing R&D resources related to NPP LTO. This research will leverage the work previously performed by PNNL on the PMMD Information Tool, sponsored by RES.

RES/DE would benefit from a R&D gap assessment, strategic planning and knowledge management tool to enhance the tracking, disposition, resolution of technical issues that surface as industry moves towards SLR. Such a database would save staff time in addressing the degradation challenges for NPP passive components, spent fuel pools, and independent spent fuel storage installations (ISFIs). The proposed LTO issues visualization tool can incorporate, up-to-date information on critical issues associated with cable, concrete and RPV aging. Work is actively progressing on developing SLR guidance documents with unresolved technical issues arising almost on a daily basis. These could be captured by the proposed service-oriented analytic framework. The existing PMMD database containing detailed information about susceptibility, knowledge, and confidence associated with hundreds of degradation scenarios can be augmented with aging risk indices, when developed by the DOE LWRS research. This will enable a better understanding of service life projections of NPP SSC.

5.0 DELIVERABLES AND/OR MILESTONES SCHEDULE

~~Except for Task 1.6 where a draft summary NUREG/CR is stipulated, a~~All deliverables shall be in the form of technical letter reports or alternatives previously discussed and determined acceptable by the COR. Based on the detailed tasks provided in Section 4.0 of this Statement of Work, PNNL shall estimate the number of Figures/Tables or other copyrighted information from technical journals, etc. and shall incorporate this estimation in the cost proposal in addressing the SOW. PNNL shall also estimate reasonable effort by their technical editing staff in order to provide the NRC tech-edited draft final and final reports.

Task Number	Deliverable/Milestone Description <i>(include NRC acceptance criteria if applicable)</i>	Due Date <i>(if any)</i>
All	Monthly Letter Status Report (MLSR)	20 th day of each month
1.1	PNNL to provide Report 1.1. Draft TLR to NRC on Subtask (1.1) reviewing anticipated NPP LTO materials degradation and prognostics	NLT 96 months after contract award
1.1	NRC to provide comments to contractor on Report 1.1 on NPP LTO materials degradation and prognostics	NLT 1 month after receiving draft Report 1.1 from PNNL
1.1	PNNL to publish TLR Report 1.1 on materials degradation and prognostics. Deliver 12 hard copies to the NRC COR, in addition to an electronic file.	NLT 1 month after receiving NRC comments
1.2	PNNL to provide Report 1.2. Draft TLR to NRC on Subtasks (1.2- 1.4) concerning availability of ex-plant material and information, <u>and a systematic approach to harvesting ex-plant materials.</u>	NLT 128 months after contract award
1.2	NRC to provide comments to contractor on Report 1.2 concerning availability of ex-plant material and information, <u>and a systematic approach to harvesting ex-plant materials.</u>	NLT 1 month after receiving draft Report 1.2 from PNNL
1.2	PNNL to publish TLR Report 1.2 concerning availability of ex-plant material and information. Deliver 12 hard copies to the NRC COR, in addition to an electronic file.	NLT 1 month after receiving NRC comments
1.3	PNNL to provide Report 1.3 (consisting of questionnaire and interview results) to NRC on Subtask (1.3) concerning interest of prospective NRC stakeholders in a systematic approach to harvesting ex-plant materials	NLT 10 months after contract award
1.3	NRC to provide comments to contractor on Report 1.3 concerning interest of prospective NRC stakeholders in a systematic approach to harvesting ex-plant materials	NLT 1 month after receiving Report 1.3 from PNNL

1.4	PNNL to provide Report 1.4 (consisting of questionnaire and interview results) to NRC on Subtask (1.4) concerning interest of prospective external stakeholders in a systematic approach to harvesting ex-plant materials	NLT 14 months after contract award
1.4	NRC to provide comments to contractor on Report 1.4 concerning interest of prospective external stakeholders in a systematic approach to harvesting ex-plant materials	NLT 1 month after receiving Report 1.4 from PNNL
1.5.1	PNNL to provide Report 1.5.1 to NRC on Subtask (1.5.1) with suggested alternatives for creating a prognostic tool to track and resolve critical technical issues for SLR	NLT 16 months after contract award
1.5.1	NRC to provide comments to contractor on Report 1.5.1 concerning alternatives for creating a prognostic tool to track and resolve critical technical issues for SLR	NLT 1 month after receiving Report 1.5.1 from PNNL
1.63	Summary Report 1.36. Draft <u>TLRNUREG/CR</u> to NRC including information from <u>Reports Subtasks (1.1-1.5) through 1.5.2</u> . <i>(Note: At the discretion of COR, a decision may also be made to publish Summary Report 1 as a <u>NUREG/CR TLR</u> rather than as an <u>NUREG/CR TLR</u>, depending on the significance of the literature review and research assessment results).</i>	NLT 20-16 months after contract award
1.36	The Contractor will make a technical presentation to the NRC staff on Summary Report 1.36 at NRC Headquarters in Rockville, MD.	When the draft Summary Report 1.36 is delivered to NRC.
1.36	NRC to provide comments to contractor on Summary Report 1.36.	NLT 2 months after receiving draft Summary Report 1.36 from PNNL
1.36	DOE Contractor to publish Summary Report 1.63 as <u>TLRNUREG/CR</u> . Deliver 12 hard copies to the NRC COR, in addition to an electronic file.	NLT 2 months after receiving NRC comments
Task 2 is optional pending outcome of Task 1.		
2	PNNL to provide Report 2 Draft TLR to NRC based on results from Subtask (2.1) concerning technical gap identification and subtask (2.2) determination of significance and disposition of gaps	NLT 24 months after original contract award
2	NRC to provide comments to contractor on Report 2 concerning technical gap identification, significance, and disposition	NLT 1 month after receiving draft Report 2 from PNNL
2	PNNL to publish TLR Report 2 technical gap identification, significance, and disposition. Deliver 12 hard copies to the NRC COR, in addition to an electronic file.	NLT 1 month after receiving NRC comments
Task 3 is optional pending outcome of Task 2		
3.1	PNNL to provide Report 3.1 Draft TLR to NRC based on results from Subtasks (3.1 <u>and 3.2</u>) concerning specific laboratory experimentation, <u>and</u> analytical model development, <u>and adequacy of existing codes and standards for SLR</u> .	NLT 46 months after contract award

3.1	NRC to provide comments to contractor on Report 3.1 concerning specific laboratory experimentation and analytical model development	NLT 1 month after receiving draft Report 3.1 from PNNL
3.1	PNNL to publish TLR Report 3.1 concerning specific laboratory experimentation, and analytical model development, and adequacy of existing codes and standards for SLR . Deliver 12 hard copies to the NRC COR, in addition to an electronic file.	NLT 1 month after receiving NRC comments
3.2	PNNL to provide Report 3.2 Draft TLR to NRC reviewing adequacy of existing codes and standards for SLR	NLT 46 months after contract award
3.2	NRC to provide comments to contractor on Report 3.2 reviewing adequacy of existing codes and standards for SLR	NLT 1 month after receiving draft Report 3.2 from PNNL
3.2	PNNL to publish TLR Report 3.2 reviewing adequacy of existing codes and standards for SLR. Deliver 12 hard copies to the NRC COR, in addition to an electronic file.	NLT 1 month after receiving NRC comments
Task 4 is optional pending outcome of Task 1 and partially pending on Task 2 and 3.		
4	PNNL to provide Report 4 Draft TLR to NRC documenting development of prognostic tool to track and resolve critical SLR technical issues	NLT 46 months after contract award
4	NRC to provide comments to contractor on Report 4 reviewing development of prognostic tool to track and resolve critical SLR technical issues	NLT 1 month after receiving draft Report 3.2 from PNNL
4	PNNL to publish TLR Report 4 reviewing development of prognostic tool to track and resolve critical SLR technical issues R. Deliver 12 hard copies to the NRC COR, in addition to an electronic file.	NLT 1 month after receiving NRC comments

6.0 TECHNICAL AND OTHER SPECIAL QUALIFICATIONS REQUIRED

Specific qualifications for this effort include senior materials engineers and metallurgists who have in-depth knowledge of reactor pressure vessel and core internal materials subjected to irradiation and stress at elevated temperature, and effects of water chemistry on structural reactor materials. The personnel involved should have in-depth experience, knowledge, and demonstrated contributions in the areas of mechanical deformation, material degradation phenomena, such as corrosion, stress corrosion cracking and irradiation effects. The contract personnel should be well-versed in the use of nuclear power plant ASME B&PV Codes and Standards, Industry Guidance Documents, such as those of NEI, EPRI, NRC's Regulatory Guides and NRC's License Renewal Guidance Documents (such as NUREGs 1800, 1801, and 1950) Information Notice (IN), Regulatory Issue Summary (RIS), Generic Letter (GL), Generic Issue (GI) for licensing review by the NRC staff.

The contract personnel should also be aware of the safety evaluation reports (SER) written by the NRC staff on industry guidance documents, as applicable. The contract personnel should have previous experience developing appropriate software architecture for proposed R&D planning tool.

7.0 MEETINGS AND TRAVEL

The PNNL Principal Investigator and one other engineer shall visit the NRC Headquarters in Rockville, MD and present the overall research outcome to the staff and share in technical discussions. Any suggestions from the staff, as appropriate, may be considered for the final report by the PI. No other domestic or foreign travel is permitted under the initial scoping study.

8.0 REPORTING REQUIREMENTS

PNNL is responsible for structuring the deliverable to follow agency standards. The current agency standard is Microsoft Office Suite 2010. The current agency Portable Document Format (PDF) standard is Adobe Acrobat 9 Professional. Deliverables shall be submitted free of spelling and grammatical errors and conform to requirements stated in this section.

Monthly Letter Status Reports

In accordance with Management Directive 11.7, NRC Procedures for Placement and Monitoring of Work with the U.S. Department of Energy, PNNL shall electronically submit a Monthly Letter Status Report (MLSR) by the 20th day of each month to Amy Hull, the Contracting Officer Representative (COR), to Matthew Hiser and Joseph Kanney, the technical monitors, with copies to the Contracting Officer (CO) and the Office Administration/Division of Contracts to ContractsPOT.Resource@nrc.gov. If a project is a task ordering agreement, a separate MLSR shall be submitted for each task order with a summary project MLSR, even if no work has been performed during a reporting period. Once NRC has determined that all work on a task order is completed and that final costs are acceptable, a task order may be omitted from the MLSR.

MLSR should be distributed additionally to the Chief, Corrosion and Metallurgy Branch, RES, the Director, Division of Engineering, RES. Other required distribution will be communicated at the start of this research program.

The MLSR shall include the following: agreement number; task order number, if applicable; job code number; title of the project; project period of performance; task order period of performance, if applicable; COR's name, telephone number, and e-mail address; full name and address of the performing organization; principal investigator's name, telephone number, and e-mail address; and reporting period. At a minimum, the MLSR shall include the information discussed in Attachment 1. The preferred MLSR format can also be found in Attachment 1.

9.0 PERIOD OF PERFORMANCE

The period of performance for this work is September 17, 2015 – September 30, 2019.

10.0 CONTRACTING OFFICER'S REPRESENTATIVE

The COR monitors all technical aspects of the agreement/task order and assists in its administration. The COR is authorized to perform the following functions: assure that the DOE Laboratory performs the technical requirements of the agreement/task order; perform inspections necessary in connection with agreement/task order performance; maintain written and oral communications with the DOE Laboratory concerning technical aspects of the agreement/task order; issue written interpretations of technical requirements, including Government drawings, designs, specifications; monitor the DOE Laboratory's performance and notify the DOE Laboratory of any deficiencies; coordinate availability of NRC-furnished material and/or GFP; and provide site entry of DOE Laboratory personnel.

Contracting Officer's Representative

Name: Dr. Amy B. Hull
Agency: U.S. Nuclear Regulatory Commission
Office: Office of Nuclear Regulatory Research
Mail Stop: T-10D49
Washington, DC 20555-0001
E-Mail: amy.hull@nrc.gov
Phone: 301-251-7656

Alternate Contracting Officer's Representative

Name: Matthew Hiser
Agency: U.S. Nuclear Regulatory Commission
Office: Office of Nuclear Regulatory Research
Mail Stop: T-10 A36
Washington, DC 20555-0001
E-Mail: Matthew.Hiser@nrc.gov
Phone: 301-251-7601

11.0 MATERIALS REQUIRED (TYPE N/A IF NOT APPLICABLE)

N/A

12.0 NRC-FURNISHED PROPERTY/MATERIALS

PNNL will transfer NRC furnished property and materials acquired under previous contracts (i.e., JCN N6029, N6907) to this task order. NRC will provide additional information from EMDA and SLR databases.

13.0 RESEARCH QUALITY (TYPE N/A IF NOT APPLICABLE)

The quality of NRC research programs are assessed each year by the Advisory Committee on Reactor Safeguards. Within the context of their reviews of RES programs, the definition of quality research is based upon several major characteristics:

Results meet the objectives (75% of overall score)

Justification of major assumptions (12%)

Soundness of technical approach and results (52%)

Uncertainties and sensitivities addressed (11%)

Documentation of research results and methods is adequate (25% of overall score)

Clarity of presentation (16%)

Identification of major assumptions (9%)

It is the responsibility of the DOE Laboratory to ensure that these quality criteria are adequately addressed throughout the course of the research that is performed. The NRC COR shall review all research products with these criteria in mind.

**14.0 STANDARDS FOR CONTRACTORS WHO PREPARE NUREG-SERIES
MANUSCRIPTS (TYPE N/A IF NOT APPLICABLE)**

The U.S. Nuclear Regulatory Commission (NRC) began to capture most of its official records electronically on January 1, 2000. The NRC will capture each final NUREG-series publication in its native application. Therefore, please submit your final manuscript that has been approved by your NRC Project Manager in both electronic and camera-ready copy.

The final manuscript shall be of archival quality and comply with the requirements of NRC Management Directive 3.7 "NUREG-Series Publications." The document shall be technically edited consistent with NUREG-1379, Rev. 2 (May 2009) "NRC Editorial Style Guide." The goals of the "NRC Editorial Style Guide" are readability and consistency for all agency documents.

All format guidance, as specified in NUREG-0650, "Preparing NUREG-Series Publications," Rev. 2 (January 1999), will remain the same with one exception. You will no longer be required to include the NUREG-series designator on the bottom of each page of the manuscript. The NRC will assign this designator when we send the camera-ready copy to the printer and will place the designator on the cover, title page, and spine. The designator for each report will no longer be assigned when the decision to prepare a publication is made. The NRC's Publishing Services Branch will inform the NRC Project Manager for the publication of the assigned designator when the final manuscript is sent to the printer.

For the electronic manuscript, the Contractor shall prepare the text in Microsoft Word, and use any of the following file types for charts, spreadsheets, and the like.

File Types to be Used for NUREG-Series Publications	
File Type	File Extension
Microsoft®Word®	.doc
Microsoft® PowerPoint®	.ppt
Microsoft®Excel	.xls
Microsoft®Access	.mdb
Portable Document Format	.pdf

This list is subject to change if new software packages come into common use at NRC or by our licensees or other stakeholders that participate in the electronic submission process. If a portion of your manuscript is from another source and you cannot obtain an acceptable electronic file type for this portion (e.g., an appendix from an old publication), the NRC can, if necessary, create a tagged image file format (file extension.tif) for that portion of your report. Note that you should continue to submit original photographs, which will be scanned, since digitized photographs do not print well.

If you choose to publish a compact disk (CD) of your publication, place on the CD copies of the manuscript in both (1) a portable document format (PDF); (2) a Microsoft Word file format, and (3) an Adobe Acrobat Reader, or, alternatively, print instructions for obtaining a free copy of Adobe Acrobat Reader on the back cover insert of the jewel box.

15.0 OTHER CONSIDERATIONS (TYPE N/A IF NOT APPLICABLE)

References

1. Bond LJ, SR Doctor, and TT Taylor. 2008. *Proactive Management of Materials Degradation - A Review of Principles and Programs*. PNNL-17779, Pacific Northwest National Laboratory, Richland, WA.
2. Bond, LJ, TT Taylor, SR Doctor, AB Hull, and SH Malik, (2008) *Proactive Management of Materials Degradation for nuclear power plant systems*. Proc. Int. Conf. Prognostics and Health Management 2008, Denver, CO, October 6-9. IEEE Reliability Society, # OP-20-01 120
3. Chopra, OK, et al, *Managing Aging Effects on Dry Cask Storage Systems for Extended Long-Term Storage and Transportation of Used Fuel*, Rev. 0, FCRD-USED-2012-000119, 2012.
4. EPRI 3002000576, *Long-Term Operations: Assessment of R&D Supporting AMPs for LTO*, Aug. 2013 (80pp).
5. NEI, *Roadmap for Subsequent License Renewal*, Dec. 2013. (45pp)
6. NEI, *Second License Renewal Roadmap*, May 2015. (22pp).
7. NUREG/CR-6923, *Expert Panel Report on Proactive Materials Degradation Assessment*, 2007 (3895pp, ML063520517)
8. NUREG/CR-7153, *Expanded Materials Degradation Assessment*, 5 volumes, October 2014 (861pp)
9. SECY-14-0016, *Ongoing Staff Activities to Assess Regulatory Considerations for Power Reactor Subsequent License Renewal*, January 31, 2014 (25pp)
10. Taylor, WB, CE Carpenter, KJ Knobbs, S Malik, *Using Technology to Support Proactive Management of Materials Degradation for the U.S. Nuclear Regulatory Commission*, Proceedings of the ASME Pressure Vessels & Piping Division/K-PVP Conference, PVP 2010, July 18-22, 2010. Bellevue, WA, USA. Paper PVP2010-26063.
11. *The Scalable Reasoning System: Lightweight Visualization for Distributed Analytics*, IEEE Symposium on Visual Analytics Science & Technology, 978-1-4244-2935-6/08

Access to Non-NRC Facilities/Equipment (Type N/A if not applicable)

N/A

Applicable Publications (Type N/A if not applicable)

N/A

Controls over document handling and non-disclosure of materials (Type N/A if not applicable)

N/A

Supplemental Information for Modification

Project Title: Strategic Approach for Obtaining Material and Components Aging Information

Contract or Agreement #: NRC-HQ-25-14-D-0001 Task Order Number NRC-HQ-60-15-T-0023

1. Why is the extension necessary?

No change to ceiling or period of performance; need to update the SOW to reflect accepted proposal.

2. What is left to be delivered?

Note: contract began in Sept. 2015, so no deliverables are due yet.

Task Number	Deliverable/Milestone Description (include NRC acceptance criteria if applicable)	Due Date (if any)
All	Monthly Letter Status Report (MLSR)	20 th day of each month
1.1	PNNL to provide Report 1.1. Draft TLR to NRC on Subtask (1.1) reviewing anticipated NPP LTO materials degradation and prognostics	NLT 9 months after contract award
1.1	NRC to provide comments to contractor on Report 1.1 on NPP LTO materials degradation and prognostics	NLT 1 month after receiving draft Report 1.1 from PNNL
1.2	PNNL to provide Report 1.2. Draft TLR to NRC on Subtasks (1.2-1.4) concerning availability of ex-plant material and information, and a systematic approach to harvesting ex-plant materials.	NLT 12 months after contract award
1.2	NRC to provide comments to contractor on Report 1.2 concerning availability of ex-plant material and information, and a systematic approach to harvesting ex-plant materials.	NLT 1 month after receiving draft Report 1.2 from PNNL
1.3	Summary Report 1.3. Draft TLR to NRC including information from Subtasks (1.1-1.5). (Note: At the discretion of COR, a decision may also be made to publish Summary Report 1 as a NUREG/CR rather than as a TLR, depending on the significance of the literature review and research assessment results).	NLT 16 months after contract award
1.3	The Contractor will make a technical presentation to the NRC staff on Summary Report 1.3 at NRC Headquarters in Rockville, MD.	When the draft Summary Report 1.3 is delivered to NRC.
1.3	NRC to provide comments to contractor on Summary Report 1.3.	NLT 2 months after receiving draft Summary Report 1.3 from PNNL

1.3	DOE Contractor to publish Summary Report 1.3 as TLR. Deliver 12 hard copies to the NRC COR, in addition to an electronic file.	NLT 2 months after receiving NRC comments
Task 2 is optional pending outcome of Task 1.		
2	PNNL to provide Report 2 Draft TLR to NRC based on results from Subtask (2.1) concerning technical gap identification and subtask (2.2) determination of significance and disposition of gaps	NLT 24 months after original contract award
2	NRC to provide comments to contractor on Report 2 concerning technical gap identification, significance, and disposition	NLT 1 month after receiving draft Report 2 from PNNL
2	PNNL to publish TLR Report 2 technical gap identification, significance, and disposition. Deliver 12 hard copies to the NRC COR, in addition to an electronic file.	NLT 1 month after receiving NRC comments
Task 3 is optional pending outcome of Task 2		
3.1	PNNL to provide Report 3.1 Draft TLR to NRC based on results from Subtasks (3.1 and 3.2) concerning specific laboratory experimentation, analytical model development, and adequacy of existing codes and standards for SLR.	NLT 46 months after contract award
3.1	NRC to provide comments to contractor on Report 3.1 concerning specific laboratory experimentation and analytical model development	NLT 1 month after receiving draft Report 3.1 from PNNL
3.1	PNNL to publish TLR Report 3.1 concerning specific laboratory experimentation, analytical model development, and adequacy of existing codes and standards for SLR. Deliver 12 hard copies to the NRC COR, in addition to an electronic file.	NLT 1 month after receiving NRC comments
Task 4 is optional pending outcome of Task 1 and partially pending on Task 2 and 3.		
4	PNNL to provide Report 4 Draft TLR to NRC documenting development of prognostic tool to track and resolve critical SLR technical issues	NLT 46 months after contract award
4	NRC to provide comments to contractor on Report 4 reviewing development of prognostic tool to track and resolve critical SLR technical issues	NLT 1 month after receiving draft Report 3.2 from PNNL
4	PNNL to publish TLR Report 4 reviewing development of prognostic tool to track and resolve critical SLR technical issues R. Deliver 12 hard copies to the NRC COR, in addition to an electronic file.	NLT 1 month after receiving NRC comments

3. Who caused the delay? N/A

4. Will cost be impacted? No

Note to requester: Portions of this record are redacted under FOIA Exemption 3, Federal statute 41 U.S.C. §253b(m)(1) to protect contractor proposal information that has not been set forth or incorporated by reference into the final contract.



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Tel: (509) 375-2763
Fax: (509) 375-6497
MSIN: K5-26
pradeep.ramuhalli@pnnl.gov

September 4, 2015

Michael Turner
Contracting Officer
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Turner:

Subject: Revised Proposal for Agreement Number NRC-HQ-25-14-D-0001, “Technical Assistance in Support of Agency Environmental Reactor Programs”, Task Order No. NRC-HQ-60-15-T-0023 “Strategic Approach for Obtaining Material and Components Aging Information”, under EWA No. 65559

Per further discussions with NRC, PNNL is submitting a revised cost proposal for the work statement for Pacific Northwest National Laboratory (PNNL) Project No. 66419, Task Order No. NRC-HQ-60-15-T-0023, “Strategic Approach for Obtaining Material and Components Aging Information”, under EWA 65559, NRC Agreement Number NRC-HQ-25-14-D-0001 “Technical Assistance in Support of Agency Environmental Reactor Programs” is attached. This submittal supersedes the August 6 and September 3 proposal packages. The cost proposal covers the cost of the labor and expenses associated with the work statement included in your request for proposal (RFP) dated July 22, 2015. Critical to this effort is a scoping study (Task 1) that reviews relevant literature to identify and assess the needs with respect to SLR, based on which a gaps assessment and additional research to address key gaps (Optional Tasks 2-4) are defined. PNNL staff will use their technical knowledge and experience to propose additions, deletions, or deviations from the proposed research plan as research progresses, to address any emergent issues. The work plan for Tasks 2-4 is expected to evolve, depending on the findings from Task 1.

Ms. Eva Eckert Hickey is the PNNL Program Manager for the EWA and Dr. Pradeep Ramuhalli is the Task Project Manager.

This task proposal includes the cost proposal for Task No. NRC-HQ-60-15-T-0023 (attachment 1), the schedule of deliverables (attachment 2), a proposed staffing plan (attachment 3), and Conflict of Interest Information (attachment 4). Upon request from NRC, the professional qualifications for staff that have previously been submitted will be resubmitted.



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The proposed period of performance for this task order is September 17, 2015 – September 30, 2019.

PNNL, to the best of its knowledge and belief, asserts that it has no current work, planned work, and where appropriate, past work for DOE and others (to mean - organizations in the same and/or similar technical area as the present and/or ongoing NRC project scope of work); and PNNL hereby asserts that it is not aware of any same/similar technical work that would give rise to any potential OCOI as defined in the Atomic Energy Act of 1954, as amended, and in the NRC/DOE MOU. See Attachment 4 for disclosed projects.

Consistent with DOE's full cost recovery policy, DOE collects, as part of its standard indirect cost rate, a Laboratory Directed Research and Development (LDRD) cost levied on all monies received at the laboratory. The estimated amount of LDRD costs is identified in the proposal cost estimate section. DOE believes that LDRD efforts provide opportunities in research that are instrumental in maintaining cutting edge science capabilities that benefit all of the customers at the laboratory.

DOE will conclude that by approving and providing funds to DOE to perform the work under this proposal, you acknowledge that such activities are beneficial to your organization and consistent with appropriations acts that provide funds to you. Please note that the LDRD costs do not represent a new charge. Rather, the new Congressional requirement is for DOE to separately identify this indirect cost element.

If you have any questions, feel free to contact me at 509-375-2763.

Sincerely,

A handwritten signature in black ink, appearing to read "R. Pradeep".

Dr. Pradeep Ramuhalli
Task Project Manager
Applied Physics Group
Pacific Northwest National Laboratory

cc w/attach: Lori Bisping, PNNL
Eva Hickey, PNNL
Matthew Hiser, NRC
Amy Hull, NRC
Tonya Keller, PNNL
Katie Knobbs, PNNL
Steve Schlahta, PNNL
Steve Unwin, PNNL

ATTACHMENT 1 - COST PROPOSAL

PART 1: DOE Laboratory Cost and Technical Proposal for NRC Work Cover Sheet			Date Proposal Sent: September 2015	
			X	New
			Revision No. _____	
Project Title: Strategic Approach for Obtaining Material and Components Aging Information			DOE Contractor Account Number	
NRC Requisitioning Office: Office of Nuclear Regulatory Research			NRC Agreement Number: NRC-HQ-25-14-D-0001	
DOE Laboratory: Pacific Northwest National Laboratory			NRC Agreement Modification Number:	
DOE Site Address: Richland, WA			NRC Task Order Number: NRC-HQ-60-15-T-0023	
COGNIZANT PERSONNEL	E-MAIL ADDRESS	TELEPHONE NUMBER	NRC Task Order Modification Number:	
NRC COR: Amy B. Hull	amy.hull@nrc.gov	301-251-7656	NRC Common Cost Center Code	
Other NRC Staff: Matthew Hiser	matthew.hiser@nrc.gov	301-251-7601	NRC B&R Number:	
DOE Project Manager: Jeffrey W. Day	jeffrey.day@science.doe.gov	509-372-4629	NRC BOC	
Laboratory Project Manager: Pradeep Ramuhalli	pradeep.ramuhalli@pnnl.gov	509-375-2763	PERIOD OF PERFORMANCE	
Principal Investigator(s): Pradeep Ramuhalli Katie Knobbs	pradeep.ramuhalli@pnnl.gov katie.knobbs@pnnl.gov	509-375-2763 509-372-4560	Estimated Start Date: September 17, 2015	
			Estimated End Date: September 30, 2019	
PROPOSED COST BY FISCAL YEAR				
(b)(3):41 U.S.C. § 253b(m)(1)				
Signature - Approval Authority			Date	
Approval Authority - Name, Email and Phone				

NOTE: OPTIONAL TASKS 2-4 ARE INCLUDED IN THIS COST PROPOSAL

PART 2. TOTAL PROPOSED COST BREAKDOWN - ALL			
NRC Requisition Number:	NRC Agreement Number: NRC-HQ-25-14-D-0001	NRC Agreement Modification Number:	NRC Task Order Number: NRC-HQ-00-15-T-0023
NRC Task Order Modification Number:			
Project Title: Strategic Approach for Obtaining Material and Components Aging Information			
(b)(3):41 U.S.C. § 253b(m)(1)			

PART 2: TOTAL PROPOSED COST BREAKDOWN - TASK 1				
NRC Regulation Number	NRC Agreement Number: NRC-HQ-25-14-D-0001	NRC Agreement Modification Number:	NRC Task Order Number: NRC-HQ-60-15-T-0023	NRC Task Order Modification Number:
Project Title: Strategic Approach for Obtaining Material and Components Aging Information				

(b)(3):41 U.S.C. § 253b(m)(1)

NRC Request Number		NRC Agreement Number: NRC-HQ-25-14-D-0001		PART 2: TOTAL PROPOSED COST BREAKDOWN - OPTION 2		NRC Agreement Modification Number:		NRC Task Order Number: NRC-HQ-60-15-T-0023		NRC Task Order Modification Number:	
Project Title: Strategic Approach for Obtaining Material and Components Aging Information											

(b)(3):41 U.S.C. § 253b(m)(1)

PART 2: TOTAL PROPOSED COST BREAKDOWN - OPTION 3				
NRC Requisition Number	NRC Agreement Number: NRC-HQ-25-14-D-0001	NRC Agreement Modification Number:	NRC Task Order Number: NRC-HQ-00-15-T-0023	NRC Task Order Modification Number:
Project Title: Strategic Approach for Obtaining Material and Components Aging Information				

(b)(3):41 U.S.C. § 253b(m)(1)

PART 2: TOTAL PROPOSED COST BREAKDOWN - OPTION 4				
NRC Request Number	NRC Agreement Number: NRC-HQ-25-14-D-0001	NRC Agreement Modification Number:	NRC Task Order Number: NRC-HQ-60-15-T-0023	NRC Task Order Modification Number:
Project Title: Strategic Approach for Obtaining Material and Components Aging Information				
(b)(3):41 U.S.C. § 253b(m)(1)				

PART 3: SPENDING PLAN				
	NRC Agreement Number: NRC-HQ-25-14-D-0001	NRC Agreement Modification Number	NRC Task Order Number: NRC-HQ-60-15-T-0023	NRC Task Order Modification Number
Project Title: Strategic Approach for Obtaining Material and Components Aging Information				
(b)(3):41 U.S.C. § 253b(m)(1)				

COST ELEMENT INFORMATION

(b)(3):41 U.S.C. § 253b(m)(1)

(b)(3):41 U.S.C. § 253b(m)(1)

ATTACHMENT 2

NRC Agreement Task Order No.: NRC-HQ-60-15-T-0023 - Proposal

Strategic Approach for Obtaining Material and Components Aging Information

As requested in the Statement of Work for Task Order No. NRC-HQ-60-15-T-0023, the scope is provided below.

STATEMENT OF WORK

NRC Agreement Number	NRC Agreement Modification Number	NRC Task Order Number (If Applicable)	NRC Task Order Modification Number (If Applicable)
NRC-HQ-25-14-D-0001	N/A	NRC-HQ-60-15-T-0023	N/A
Project Title Strategic Approach for Obtaining Material and Component Aging Information			
Job Code Number	B&R Number	DOE Laboratory Pacific Northwest National Laboratory (PNNL)	
NRC Requisitioning Office Nuclear Regulatory Research (RES)			
NRC Form 187, Contract Security and Classification Requirements <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> Not Applicable		<input type="checkbox"/> Involves Proprietary Information <input type="checkbox"/> Involves Sensitive Unclassified	
<input checked="" type="checkbox"/> Non Fee-Recoverable		<input type="checkbox"/> Fee-Recoverable (If checked, complete all applicable sections below)	
Docket Number (If Fee-Recoverable/Applicable)		Inspection Report Number (If Fee Recoverable/Applicable)	
Technical Assignment Control Number (If Fee-Recoverable/Applicable)		Technical Assignment Control Number Description (If Fee-Recoverable/Applicable)	

1.0 BACKGROUND

Regulatory Context:

The NRC has established a license renewal process that will allow nuclear power plants (NPP) to renew their licenses for an additional 20 years, via 10 CFR 54.31(d) stating that “a renewed license may be subsequently renewed.” The biggest challenges for the NRC and the industry will be addressing the major technical issues for this second “subsequent” license renewal (SLR)

beyond 60 years. As summarized in SECY-14-0016, the NRC staff believe that the most significant technical issues challenging power reactor operation beyond 60 years are related to:

- Reactor pressure vessel (RPV) neutron embrittlement at high fluence
- Irradiation assisted degradation (IAD) of reactor internals and primary system components
- Concrete and containment degradation
- Electrical cable qualification and condition assessment.

Understanding the causes and control of degradation mechanisms forms the basis for developing aging management programs (AMPs) to ensure the functionality and safety margins of NPP systems, structures, and components (SSC). The resolution to these issues should provide reasonable assurance of safe operation of the components in the scope of license renewal during the subsequent period of extended operation.

Because of the cost and inefficiency of piecemeal sampling, there is a need for a strategic and systematic approach to sampling materials from SSC in decommissioning plants. The envisioned work addresses both passive and active components. In that sense, it addresses aging management of passive components under the license renewal rule, 10 CFR 54, as well as the maintenance of active components covered by the maintenance rule, 10CFR50.65, as seen in Figure 1 below.

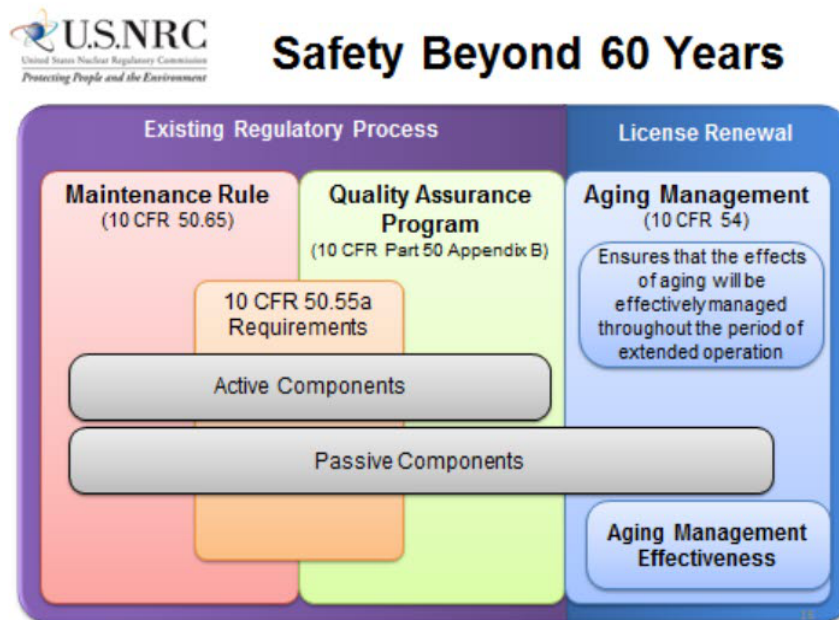


Figure 1: Relationship between aging management of active and passive components (from NRR/RES presentation to ACRS, 2014)

In the past few years, four plants have ceased operation or announced that they will cease operation: Crystal River Unit 3 (PWR), Kewaunee (PWR), San Onofre Units 2 & 3 (PWR), and Vermont Yankee (BWR). These plants comprise a range of reactor types, containments, and SSCs important to safety. The primary objective of this project is to develop a long-range strategy for obtaining information from these plants as they go through decommissioning. The focus will be on timely acquisition of experiential real-world aging-degradation information that can significantly improve the agency's risk-informed and performance-based regulatory approach, but has been very difficult or impossible to obtain from the operating reactor fleet.

Technical Context:

Creating a roadmap for obtaining information from designated NPPs as they go through decommissioning is complementary to ongoing NRC research in developing technical information to support evaluating SLR as well as data collection and testing of ex-plant materials.

Material degradation has traditionally been managed reactively in response to events and operating experience, rather than proactively to prevent failures. For the NPPs currently entering their first license renewal period from 40-60 years, and submitting SLR applications, it is necessary to evaluate potential degradation mechanisms out to 80 years of operation. Evaluation of material properties in SSCs from actual decommissioned NPPs will provide a basis for comparison with results of laboratory tests and calculations to resolve the four issues listed above.

The proactive management of materials degradation (PMMD) information tool was originally created at PNNL for RES (POC: Amy Hull) to give an expert opinion of the possible future degradation mechanisms on a subcomponent/material specific basis (PNNL-17779)ⁱ. Combined with the LER database, the PMMD information tool allows one to not only react to past events, but to anticipate future issues. The original PMMD information tool was based on NUREG/CR-6923, "Proactive Materials Degradation Assessment (PMDA)," for the first license renewal period, so it is now appropriate to integrate information from the excel databases from the recently-published five volumes of NUREG/CR-7153, "Expanded Materials Degradation Assessment (EMDA)" for SLR. At this juncture, there is demonstrated industry interest in NPP long-term operation (LTO) and regulatory interest in SLR.

2.0 OBJECTIVES

Understanding and managing material and component degradation is a key need for the continued safe and reliable operation of NPPs, but has significant uncertainties. In many cases, the scientific basis for understanding and predicting long-term environmental degradation behavior of materials in NPPs is incomplete. A strategic approach to examination and testing of materials and components from decommissioned reactors can dramatically increase our knowledge-acquisition rate in this very important area.

There are three inter-related objectives to this work:

- (1) Develop a long-range strategy for obtaining information from decommissioned NPPs as well as providing the flexibility to get ex-plant components from operating plants as well. The focus will be on timely acquisition of experiential real-world aging-degradation information that can significantly improve the agency's risk-informed and performance-based regulatory approach, but has been very difficult or impossible to obtain from the operating reactor fleet.
- (2) Construct a strategic plan and specifications for obtaining unique and significant materials aging degradation information from diverse sources (operating experience, other nuclear facilities, other long-lived industrial plants, other materials organizations such as ASM and NACE) that will inform the NRC's age-related regulatory oversight in the future. Implementation of this plan and specifications, in cooperation with industry and DOE partners can be accomplished over time, through individual research projects as the identified plants progress through their decommissioning process. This exploratory research is expected to provide fundamental insights on reactor materials degradation and information addressing potential technical issues or identified gaps to support anticipated future NRC needs.
- (3) Update the PMMD information tool to incorporate LTO/SLR-relevant information so that it can be better used to inform prioritization in the ex-plant material strategic plan.

3.0 SCOPE OF WORK

There are a number of technical gaps that this project seeks to address. Most importantly, the current piecemeal approach can be replaced with a strategic plan that is more comprehensive, broader in scope, and more risk-informed. The strategic plan for inspections and/or testing developed in this project will be useful guidance for obtaining key measurements of degradation in a variety of areas. These measurements will be valuable on their own and will also be useful in basic research on the underlying mechanisms and modes of degradation, and for validation of modeling and simulation tools. Data and information developed from implementation of the strategic plan will also be useful in evaluating aging management and mitigation strategies proposed by the industry.

Many sources of materials degradation information will be queried, including human repositories of knowledge both within NRC and within the industry. Both the PMDA and EMDA present information in terms of component or material degradation susceptibility and currently available knowledge for degradation mitigation or prevention. A component with high degradation susceptibility/low knowledge would be the strongest candidate for proactive actions. It is necessary to be able to understand this before prioritizing ex-plant materials sampling available from a given retired NPP. Previously, under the auspices of NRC contracts (i.e., JCN N6029, N6907), PNNL used the large amount of information presented in the PMDA report to develop a web-based platform to facilitate analysis through interactive visualizations that offer intuitive ways to explore the information. PNNL shall explore the viability of adding materials degradation susceptibility data presented in the EMDA Report.

Such an information tool (Figure 2 below) is expected to save considerable staff efforts to understand and apply the PMDA and EMDA insights to regulatory review of licensee

information. PNNL shall develop a web-based modified scalable reasoning system (SRS) for tracking, disposition, and resolution of critical issues, such as determining the appropriate SSC from which to acquire cast austenitic stainless steel (CASS) material of specific composition and radiation dose.

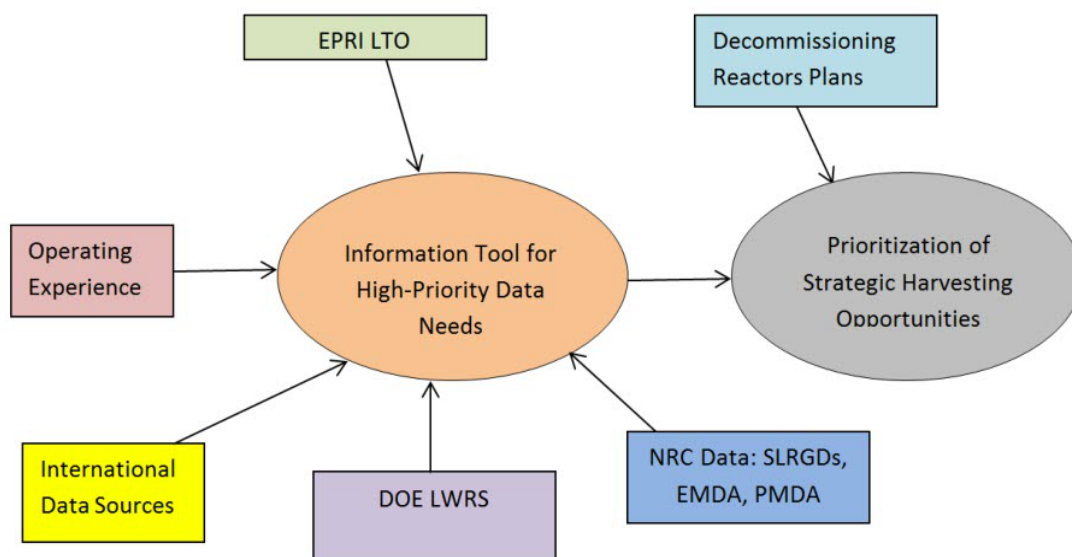


Figure 2: Pre-conceptual Architecture of prognostic tool to track and resolve critical technical issues for SLR

As shown in Figure 2 above, the information tool was originally envisioned as integrating domestic and international operating experience and experimental information as well as information from the EPRI LTO, DOE Light Water Reactor Sustainability (LWRS) program, and NRC sources such as EMDA, PMDA, and SLR guidance documents (SLRGDs) and precursors. The international data sources that might provide effective data feed include the cable aging data and knowledge (CADAK, <http://cadak.hrp.no/cadak>.) project and the Component Operational Experience, Degradation and Ageing Programme (CODAP, <http://www.oecd-neo.org/jointproj/codap.html>), both sponsored by OECD/NEA. The Atlas constructed by PNNL from the Program to Assess the Reliability of Emerging Non-destructive Technology (PARENT) and the Program to Inspect Nickel Alloy Components (PINC) Atlas is an international database containing a vast array of SCC crack morphology and NDE information. PNNL shall investigate whether this is an appropriate framework to track issue resolution associated with SLR. This is a much broader objective than just developing a strategic roadmap for harvesting SSCs.

The general tasks and their duration are described in Table 1.

Table 1: Task Description and Duration

Task	Task Title/Description	Duration (Months)
Task 1	Scoping Study and technical literature review	18
Task 2	Decision Making on Specific Confirmatory Research Needed to Address Gaps (optional)	6
Task 3	Confirmatory Research Addressing Technical Gaps (optional)	33
Task 4	Development of Independent Decision Making Tools (optional)	33

The conditional tasks shall be conducted, as detailed in Figure 3 below. A decision on further optional research outlined in Tasks 2, 3, and 4 will be made after completion of Task 1 depending on the outcome and recommendation from the conclusion of specific tasks. The overall nexus between the scoping study and other potential tasks is shown in Figure 3.

The PNNL staff shall not restrict their activities solely to these descriptions and shall be flexible in using their technical knowledge and experience in proposing additions, deletions, or deviations from the prescribed requirements as research progresses.

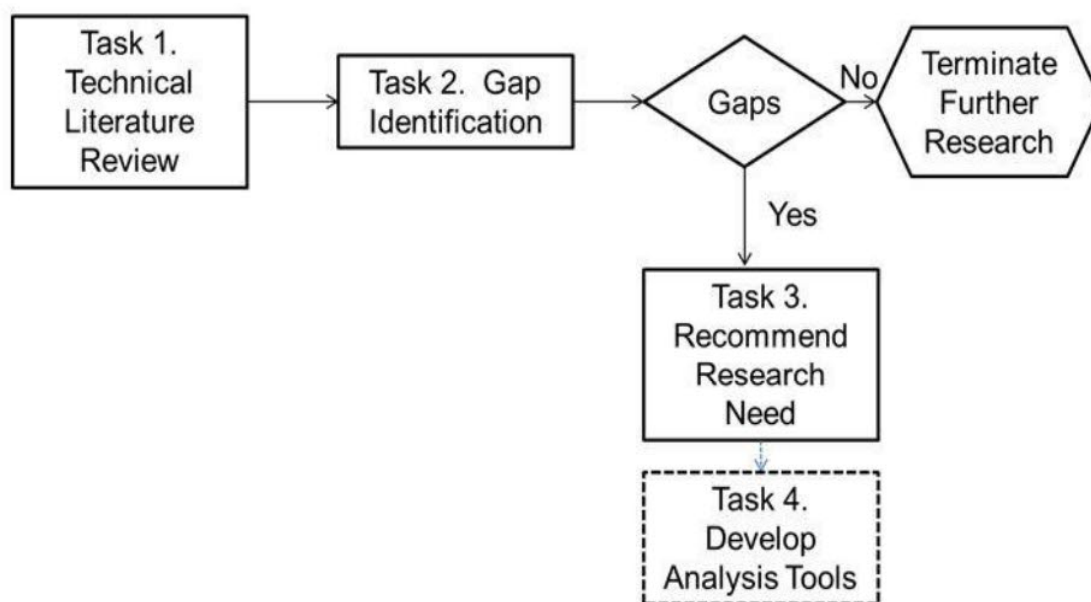


Figure 3: Schematic of the Overall Research

4.0 SPECIFIC TASKS

Task 1 is the scoping study. Tasks 2-4 are optional. NRC plans to revise the SOW for these tasks based on the outcome of Task 1. The time at which the tasks begin and end will be dependent on available information and NRC's ongoing evaluation of testing priorities. NRC staff does not require that PNNL necessarily perform the tasks be performed sequentially following the order in which they are listed. For the test matrix described in this section, nearly all subtasks will have to be tested in tandem with another subtask in order to complete the program within the requested period of performance. PNNL and the NRC CORs will continually review the testing plan during monthly status update teleconferences.

PNNL shall, in the first stage of Task 1, develop a questionnaire and help the NRC staff conduct interviews with focus groups from various technical disciplines within NRC. PNNL shall, in the second stage of Task 1, assist the NRC staff conduct one or two public workshops. PNNL shall analyze and combine the results of the first two phases into a final strategic plan in the third stage. This strategic plan will provide a prioritization of strategic harvesting opportunities. PNNL shall help the NRC staff develop the ex-plant harvesting strategic plan in cooperation with industry and other federal agencies such as DOE as well as any international counterparts that may be interested in participation.

In Tasks 2-4, PNNL may be assigned optional tasks to identify requirements to further elucidate the risk assessment of component degradation. Such research should also provide technical data and information, as necessary, to request the national codes and standards bodies (such as ASME, ASTM, or NACE) to re-examine requirements for structural materials for passive components in light water reactors (LWRs) and in assessing material degradation during service and its effect on design safety margin of components. The PNNL principal investigator (PI) for this project shall attend ASME, ASTM, or NACE Code Committee meetings, as appropriate and as approved by the COR during the course of this research. The PI shall provide adequate information to support an IAEA international cooperative research program (ICRP) on this subject to bring worldwide resources to address this research need.

The specific tasks are as follows:

(b)(3):41 U.S.C. § 253b(m)(1)

Task 1 – Literature Review and Assessment of Greatest Needs in Sampling of Ex-plant Materials

NRC recently completed a research program to investigate material degradation after extended operation. To investigate aging degradation mechanisms, aging degradation effects, and the relative susceptibility to degradation, PNNL shall perform a comparison of available information.


PNNL shall conduct the Task 1 scoping study and provide all resources necessary to accomplish the subtasks and deliverables. Task 1 shall be performed in stages as shown in the Task-specific subsections below.

The activities required for this task are:

Task 1.1 – Conduct Materials Aging Degradation Literature Review

PNNL shall selectively review both domestic and international sources of technical information of generic nature with respect to anticipated material degradation in NPPs during LTO, extrapolating to 80 years of operation. The objective is to identify other issues not in PMDA/EMDA, such as related to active components or spent fuel storage systems, and to determine what is being done to address LTO issues. NRC will provide guidance on appropriate information to review.

(b)(3):41 U.S.C. § 253b(m)(1)



Task 1.2 – Evaluate Availability of Ex-Plant Material and Information

PNNL shall evaluate what relevant ex-plant material is projected to be available for potential harvesting. PNNL shall work with the NRC COR to develop a questionnaire and interview the cognizant individuals at the plants who possess critical knowledge.

(b)(3):41 U.S.C. § 253b(m)(1)

Task 1.3 – Develop Questionnaire and Conduct Interviews with Prospective NRC Stakeholders

PNNL shall develop a questionnaire and work with NRC staff to conduct interviews with focus groups from various technical disciplines within NRC. This would include the SLR Expert Panels for a sample of different aging management programs (AMPs) as well as other NRC technical advisory groups. PNNL shall have a comprehensive approach to all the possible stakeholders interested in harvesting materials from decommissioned plants. The objective of this initial scoping study is to assess interest in issues concerning both passive and active component degradation. The questionnaire will address, as a minimum, (1) the perceived needs for ex-plant materials, (2) the perceived utility of the existing information tool and how and where this prognostic tool should be maintained (NRC, contractor, cloud). During the early brainstorming and scoping study, PNNL shall also consider degradation of SSC materials associated with extended long-term storage of used fuel.

(b)(3):41 U.S.C. § 253b(m)(1)

Task 1.4 – Develop Questionnaire and Conduct Interviews with Prospective External Stakeholders

Based on interactions with NRC staff in Task 1.3 above, PNNL shall propose a preliminary strategic approach to sampling representative ex-plant materials during one or two presentations at public workshops to further refine the concept of what would be needed in a useful interrogatory tool linking aging-degradation research objectives with available resources

for ex-plant materials. The searchable information tool shall be available via an interactive web page.

(b)(3):41 U.S.C. § 253b(m)(1)

Task 1.5 –Conduct Scoping Analysis on Viability of Searchable Information Tool

Task 1.5.1 PNNL shall briefly consider available approaches to creating a preliminary database that will link the highest susceptibility/lowest knowledge anticipated degradation scenarios with potential availability of ex-plant materials. As part of this subtask, PNNL shall review the status and viability of the PMMD information tool created as part of the PMMD project (conducted at PNNL under previous NRC contracts (i.e., JCN N6029, N6907). The goals of the PMMD project were to identify reactor components that could reasonably be expected to experience future degradation, estimate the susceptibility of components to various degradation mechanisms, and assess the degree of knowledge available to develop mitigative strategies. It was anticipated that this information could be used to guide regulatory actions related to license renewal and subsequent license renewal. The PMMD panel evaluated 3863 components (2203 for PWRs, 1603 for BWRs) for their susceptibility to 16 degradation mechanisms (Figure 4 below). Because of the unwieldiness of the source material, a searchable information tool (pmmd.pnl.gov) was developed to make this information usable to NRC staff and others.

Task 1.5.2 PNNL shall work with the NRC to create a proposal to develop a platform for the searchable database methodology (selected in Task 1.5.1) that can be supported within NRC.

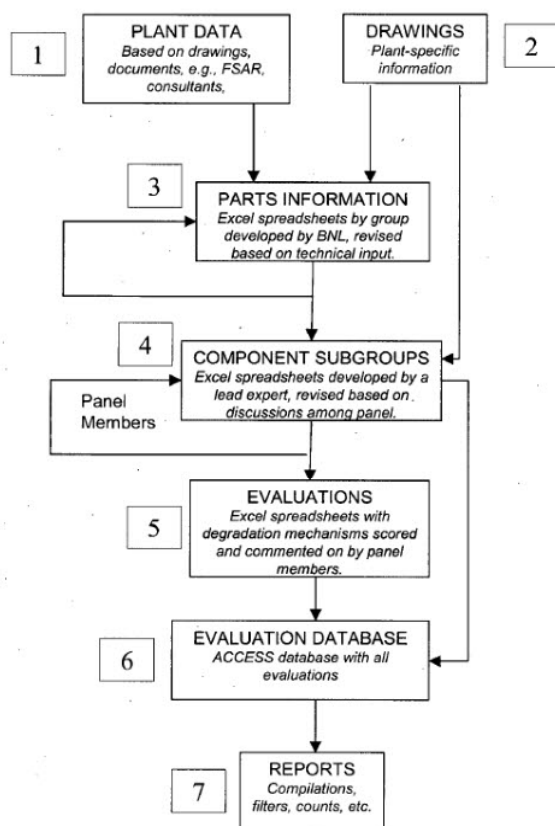


Figure 4. Flowchart for files created and used in PMMD infotool

(b)(3):41 U.S.C. § 253b(m)(1)

Task 1.6 – Provide Archival Summary Document of Findings from Task 1

PNNL shall analyze and review the reports generated from the work conducted under Tasks 1.1 through 1.5 and provide a stand-alone NUREG/CR documenting the major findings.

Optional Task 2 – Decision Making on Specific Research Need to Address Gaps

If the Task 1 scoping study succeeds in determining previously unidentified significant knowledge gaps that need further attention, more work will be done in the context of Task 2, pending the approval from the NRC Contract Officer (CO). Thus, Task 2 is optional pending the outcome of Task 1 and requires NRC activation. The activities required for this task are:

Task 2.1 – Gap Identification

PNNL shall identify specific information and technical data gaps from the execution of Task 1 and document these gaps. In identifying the gaps, PNNL shall include an examination of the current ASME B&PV Code or other industry practices that the NRC has endorsed with respect to addressing the specific degradation mechanism in the design and the assurance of the retention of the design margin during the period of licensed reactor operation time.

Task 2.2 – Determine Significance and Disposition of Technical Gaps

PNNL shall determine whether or not there are any technical gaps from the execution of Task 2.1. If there are no gaps and if it is determined that the current ASME Code or other industry practices ensure that the design margin for components are adequate, recommend termination of further research in this topic by NRC. If specific information and technical gaps are identified then proceed to Task 3 after getting approval from the NRC Contract Officer (CO).

As noted, Task 2 is optional, the need to perform this task will be determined by the NRC. In the PNNL response to this SOW, the optional task should be costed separately. The NRC will provide written notice to PNNL via modification to this agreement if the optional task will need to be performed.

Optional Task 3 – Research Addressing Technical Gaps Related to Material Degradation

If critically important information and technical gaps are identified in Task 2, Task 3 is activated after getting approval from the NRC CO. Thus, Task 3 is optional pending the outcome of Task 2. The activities required for this task are:

Task 3.1 – Recommend Specific Laboratory Experimentation and Analytical Model Development

PNNL shall work with NRC subject matter experts (SMEs) to recommend specific laboratory experimentation and analytical model development, which may address the information gap identified in Task 2.1. If novel nondestructive evaluation methods (such as the next-generation acoustic emission technology which reportedly can 'hear' crack initiation) become available to identify progressing reactor material degradation by the time Task 3 is initiated, PNNL shall recommend inservice inspection (ISI) technology enablers which will be suitable for detecting the material changes resulting from different stressors. PNNL shall work with NRC SMEs to recommend the need for developing tools for detection and assessment of potential degradation of the design safety margin to independently confirm the licensee's technical basis for LTO.

Task 3.2 – Review Adequacy of Existing Codes and Standards

PNNL shall conduct a review of existing applicable ASME B&PV Codes that may need to be revised as a result of Task 2.1 and PNNL shall work with NRC SMEs to engage relevant ASME Code Committees for assessing future path. PNNL shall propose other Codes and Standards that should be reviewed (such as but not limited to, ANS, ASTM, and NACE codes and standards).

As noted, Task 3 is optional, the need to perform this task will be determined by the NRC. In the PNNL response to this SOW, the optional task should be costed separately. The NRC will provide written notice to PNNL if the optional task will need to be performed.

(b)(3):41 U.S.C. § 253b(m)(1)

Optional Task 4 – Investigate Development of Independent Decision Making Tools

Task 4 is optional pending the outcome of Tasks 1 – 3. If gaps are identified under Task 2 and appropriate research needed to inform the gaps are also identified under Task 3, NRC expects that the industry will perform the needed research and provide NRC the data for regulatory decisions.

Depending on the outcome of Tasks 2 and 3 and ensuing industry research, the decision-making tool development may be complex and truly involve multi-year, multi-disciplinary long term research. It is expected, however, that the decision making tool may include: (a) Material and component condition after different stressors; (b) Better knowledge of specific degradation and its potential for reducing the design safety margin for the components; (c) Incorporation of plant data into the various material, inspection, and structural integrity evaluation models; and (f) An integration of all these aspects into the regulatory decision making process to consider the risk contribution due to material degradation.

Specific subtasks for this task will be established later in this research. PNNL shall investigate the feasibility of developing a modern visualization confirmatory analysis research tool for aging management of safety-significant SSC degradation in NPPs. As currently envisioned, this could provide a knowledge management and strategic planning tool for conducting gap assessments and prioritizing R&D resources related to NPP LTO. This research will leverage the work previously performed by PNNL on the PMMD Information Tool, sponsored by RES.

RES/DE would benefit from a R&D gap assessment, strategic planning and knowledge management tool to enhance the tracking, disposition, resolution of technical issues that surface as industry moves towards SLR. Such a database would save staff time in addressing the degradation challenges for NPP passive components, spent fuel pools, and independent spent fuel storage installations (ISFIs). The proposed LTO issues visualization tool can incorporate, up-to-date information on critical issues associated with cable, concrete and RPV aging. Work is actively progressing on developing SLR guidance documents with unresolved technical issues arising almost on a daily basis. These could be captured by the proposed service-oriented analytic framework. The existing PMMD database containing detailed information about susceptibility, knowledge, and confidence associated with hundreds of degradation scenarios can be augmented with aging risk indices, when developed by the DOE LWRS research. This will enable a better understanding of service life projections of NPP SSC.

As noted, Task 4 is optional, the need to perform this task will be determined by the NRC. In the PNNL response to this SOW, the optional task should be costed separately. The NRC will provide written notice to PNNL if the optional task will need to be performed.

(b)(3):41 U.S.C. § 253b(m)(1)

5.0 DELIVERABLES AND/OR MILESTONES SCHEDULE

Except for Task 1.6 where a draft summary NUREG/CR is stipulated, all deliverables shall be in the form of technical letter reports or alternatives previously discussed and determined acceptable by the COR. Based on the detailed tasks provided in Section 4.0 of this Statement of Work, PNNL shall estimate the number of Figures/Tables or other copyrighted information from technical journals, etc. and shall incorporate this estimation in the cost proposal in addressing the SOW. PNNL shall also estimate reasonable effort by their technical editing staff in order to provide the NRC tech-edited draft final and final reports.

(b)(3):41 U.S.C. § 253b(m)(1)

Task Number	Deliverable/Milestone Description <i>(include NRC acceptance criteria if applicable)</i>	Due Date <i>(if any)</i>
All	Monthly Letter Status Report (MLSR)	20 th day of each month
1.1	PNNL to provide Report 1.1. Draft Progress Report/TLR to NRC on Subtask (1.1) reviewing anticipated NPP LTO materials degradation and prognostics	NLT <input type="text"/> months after contract award
1.1	NRC to provide comments to contractor on Report 1.1 on NPP LTO materials degradation and prognostics	NLT 1 month after receiving draft Report 1.1 from PNNL
1.1	PNNL to publish Report 1.1. Deliver 12 hard copies to the NRC COR, in addition to an electronic file.	NLT 1 month after receiving NRC comments

(b)(3):41 U.S.C. § 253b(m)(1)

(b)(3):41 U.S.C. § 253b(m)(1)

(b)(3):41 U.S.C. § 253b(m)(1)

(b)(3):41 U.S.C. § 253b(m)(1)

(b)(3):41
U.S.C. §
253b(m)(1)

1.2	PNNL to provide Report 1.2. Draft [redacted] TLR to NRC on Subtask [redacted] (1.2 [redacted]) concerning availability of ex-plant material and information (b)(3):41 U.S.C. § 253b(m)(1) (b)(3):41 U.S.C. § 253b(m)(1)	NLT [redacted] months after contract award
1.2	NRC to provide comments to contractor on Report 1.2 concerning availability of ex-plant material and information	NLT 1 month after receiving draft Report 1.2 from PNNL
1.2	PNNL to publish Report 1.2 concerning availability of ex-plant material and information. Deliver 12 hard copies to the NRC COR, in addition to an electronic file.	NLT 1 month after receiving NRC comments
1.3	PNNL to provide Report 1.3 (consisting of questionnaire and interview results) to NRC on Subtask (1.3) concerning interest of prospective NRC stakeholders in a systematic approach to harvesting ex-plant materials	NLT 10 months after contract award
1.3	NRC to provide comments to contractor on Report 1.3 concerning interest of prospective NRC stakeholders in a systematic approach to harvesting ex-plant materials	NLT 1 month after receiving Report 1.3 from PNNL
1.4	PNNL to provide Report 1.4 (consisting of questionnaire and interview results) to NRC on Subtask (1.4) concerning interest of prospective external stakeholders in a systematic approach to harvesting ex-plant materials	NLT 14 months after contract award
1.4	NRC to provide comments to contractor on Report 1.4 concerning interest of prospective external stakeholders in a systematic approach to harvesting ex-plant materials	NLT 1 month after receiving Report 1.4 from PNNL
	PNNL to provide Report [redacted] to NRC on Subtask (1.5.1) with suggested alternatives for creating a prognostic tool to track and resolve critical technical issues for SLR	NLT 16 months after contract award
	NRC to provide comments to contractor on Report [redacted] concerning alternatives for creating a prognostic tool to track and resolve critical technical issues for SLR	NLT 1 month after receiving Report 1.5.1 from PNNL
	Summary Report 1.6. Draft [redacted] to NRC including information from Reports 1.1 through 1.5.2. (b)(3):41 U.S.C. § 253b(m)(1) (Note: At the discretion of COR, a decision may also be made to publish Summary Report 1 as a TLR rather than as an NUREG/CR, depending on the significance of the literature review and research assessment results).	NLT [redacted] months after contract award
	The Contractor will make a technical presentation to the NRC staff on Summary Report [redacted] at NRC Headquarters in Rockville, MD. (b)(3):41 U.S.C. § 253b(m)(1)	When the draft Summary Report [redacted] is delivered to NRC.
	NRC to provide comments to contractor on Summary Report [redacted] (b)(3):41 U.S.C. § 253b(m)(1) (b)(3):41 U.S.C. § 253b(m)(1)	NLT 2 months after receiving draft Summary Report [redacted] from PNNL
	DOE Contractor to publish Summary Report [redacted] as [redacted] Deliver 12 hard copies to the NRC COR, in addition to an electronic file. (b)(3):41 U.S.C. § 253b(m)(1)	NLT 2 months after receiving NRC comments
Task 2 is optional pending outcome of Task 1.		

(b)(3):41
U.S.C. §
253b(m)(1)(b)(3):41
U.S.C. §
253b(m)(1)(b)(3):41
U.S.C. §
253b(m)(1)(b)(3):41
U.S.C. §
253b(m)(1)(b)(3):41
U.S.C. §
253b(m)(1)(b)(3):41
U.S.C. §
253b(m)(1)

2	PNNL to provide Report 2 Draft TLR to NRC based on results from Subtask (2.1) concerning technical gap identification and subtask (2.2) determination of significance and disposition of gaps	NLT 24 months after original contract award
2	NRC to provide comments to contractor on Report 2 concerning technical gap identification, significance, and disposition	NLT 1 month after receiving draft Report 2 from PNNL
2	PNNL to publish TLR Report 2 technical gap identification, significance, and disposition. Deliver 12 hard copies to the NRC COR, in addition to an electronic file.	NLT 1 month after receiving NRC comments
Task 3 is optional pending outcome of Task 2		
3.1	PNNL to provide Report 3.1 Draft TLR to NRC based on results from Subtask (3.1) concerning specific laboratory experimentation, and analytical model development, (b)(3):41 U.S.C. § 253b(m)(1)	NLT 46 months after contract award
3.1	NRC to provide comments to contractor on Report 3.1 concerning specific laboratory experimentation and analytical model development	NLT 1 month after receiving draft Report 3.1 from PNNL
3.1	PNNL to publish TLR Report 3.1 concerning specific laboratory experimentation, and analytical model development (b)(3):41 U.S.C. § 253b(m)(1) Deliver 12 hard copies to the NRC COR, in addition to an electronic file.	NLT 1 month after receiving NRC comments
3.2	PNNL to provide Report 3.2 Draft TLR to NRC reviewing adequacy of existing codes and standards for SLR	NLT 46 months after contract award
3.2	NRC to provide comments to contractor on Report 3.2 reviewing adequacy of existing codes and standards for SLR	NLT 1 month after receiving draft Report 3.2 from PNNL
3.2	PNNL to publish TLR Report 3.2 reviewing adequacy of existing codes and standards for SLR. Deliver 12 hard copies to the NRC COR, in addition to an electronic file.	NLT 1 month after receiving NRC comments
Task 4 is optional pending outcome of Task 1 and partially pending on Task 2 and 3.		
4	PNNL to provide Report 4 Draft TLR to NRC documenting development of prognostic tool to track and resolve critical SLR technical issues	NLT 46 months after contract award
4	NRC to provide comments to contractor on Report 4 reviewing development of prognostic tool to track and resolve critical SLR technical issues	NLT 1 month after receiving draft Report 3.2 from PNNL
4	PNNL to publish TLR Report 4 reviewing development of prognostic tool to track and resolve critical SLR technical issues R. Deliver 12 hard copies to the NRC COR, in addition to an electronic file.	NLT 1 month after receiving NRC comments

(b)(3):41
U.S.C. §
253b(m)(1)

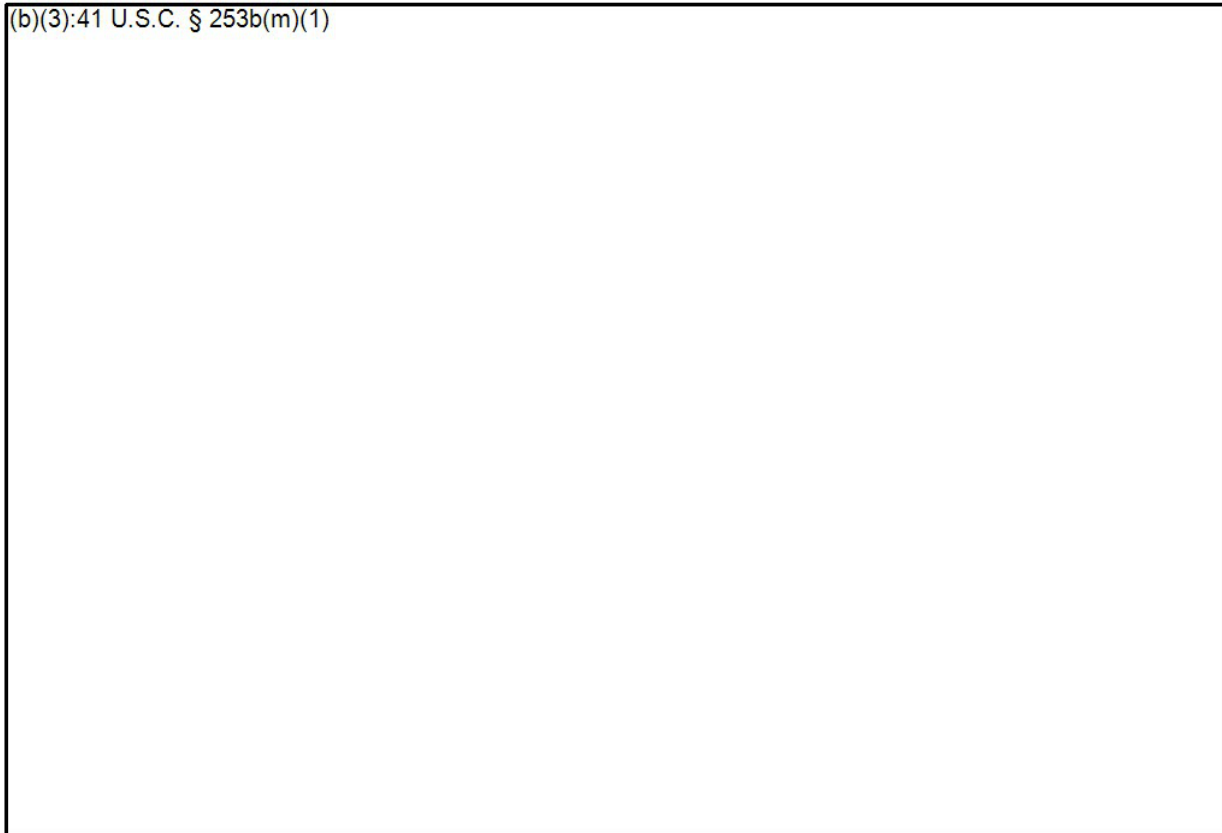
(b)(3):41
U.S.C. §
253b(m)(1)

6.0 TECHNICAL AND OTHER SPECIAL QUALIFICATIONS REQUIRED

Specific qualifications for this effort include senior materials engineers and metallurgists who have in-depth knowledge of reactor pressure vessel and core internal materials subjected to irradiation and stress at elevated temperature, and effects of water chemistry on structural reactor materials. The personnel involved should have in-depth experience, knowledge, and demonstrated contributions in the areas of mechanical deformation, material degradation phenomena, such as corrosion, stress corrosion cracking and irradiation effects. The contract personnel should be well-versed in the use of nuclear power plant ASME B&PV Codes and Standards, Industry Guidance Documents, such as those of NEI, EPRI, NRC's Regulatory Guides and NRC's License Renewal Guidance Documents (such as NUREGs 1800, 1801, and 1950) Information Notice (IN), Regulatory Issue Summary (RIS), Generic Letter (GL), Generic Issue (GI) for licensing review by the NRC staff.

The contract personnel should also be aware of the safety evaluation reports (SER) written by the NRC staff on industry guidance documents, as applicable. The contract personnel should have previous experience developing appropriate software architecture for proposed R&D planning tool.

(b)(3):41 U.S.C. § 253b(m)(1)



MEETINGS AND TRAVEL

The PNNL Principal Investigator and one other engineer shall visit the NRC Headquarters in Rockville, MD and present the overall research outcome to the staff and share in technical

(b)(3):41
U.S.C. §
253b(m)(1)

discussions. Any suggestions from the staff, as appropriate, may be considered for the final report by the PI. No other domestic or foreign travel is permitted under the initial scoping study.

(b)(3):41 U.S.C. § 253b(m)(1)

(b)(3):41
U.S.C. §
253b(m)(1)



REPORTING REQUIREMENTS

PNNL is responsible for structuring the deliverable to follow agency standards. The current agency standard is Microsoft Office Suite 2010. The current agency Portable Document Format (PDF) standard is Adobe Acrobat 9 Professional. Deliverables shall be submitted free of spelling and grammatical errors and conform to requirements stated in this section.

Monthly Letter Status Reports

In accordance with Management Directive 11.7, NRC Procedures for Placement and Monitoring of Work with the U.S. Department of Energy, PNNL shall electronically submit a Monthly Letter Status Report (MLSR) by the 20th day of each month to Amy Hull, the Contracting Officer Representative (COR), to Matthew Hiser and Joseph Kanney, the technical monitors, with copies to the Contracting Officer (CO) and the Office Administration/Division of Contracts to ContractsPOT.Resource@nrc.gov. If a project is a task ordering agreement, a separate MLSR shall be submitted for each task order with a summary project MLSR, even if no work has been performed during a reporting period. Once NRC has determined that all work on a task order is completed and that final costs are acceptable, a task order may be omitted from the MLSR.

MLSR should be distributed additionally to the Chief, Corrosion and Metallurgy Branch, RES, the Director, Division of Engineering, RES. Other required distribution will be communicated at the start of this research program.

The MLSR shall include the following: agreement number; task order number, if applicable; job code number; title of the project; project period of performance; task order period of performance, if applicable; COR's name, telephone number, and e-mail address; full name and address of the performing organization; principal investigator's name, telephone number, and e-mail address; and reporting period. At a minimum, the MLSR shall include the information discussed in Attachment 1. The preferred MLSR format can also be found in Attachment 1.

(b)(3):41 U.S.C. § 253b(m)(1)

(b)(3):41
U.S.C. §
253b(m)(1)

PERIOD OF PERFORMANCE

The estimated period of performance for this work is 48 months from date of agreement award.

(b)(3):41 U.S.C. § 253b(m)(1)

(b)(3):41
U.S.C. §
253b(m)(1)

CONTRACTING OFFICER'S REPRESENTATIVE

The COR monitors all technical aspects of the agreement/task order and assists in its administration. The COR is authorized to perform the following functions: assure that the DOE Laboratory performs the technical requirements of the agreement/task order; perform inspections necessary in connection with agreement/task order performance; maintain written and oral communications with the DOE Laboratory concerning technical aspects of the agreement/task order; issue written interpretations of technical requirements, including Government drawings, designs, specifications; monitor the DOE Laboratory's performance and notify the DOE Laboratory of any deficiencies; coordinate availability of NRC-furnished material and/or GFP; and provide site entry of DOE Laboratory personnel.

Contracting Officer's Representative

Name: Dr. Amy B. Hull

Agency: U.S. Nuclear Regulatory Commission

Office: Office of Nuclear Regulatory Research

Mail Stop: CS-05-C07M

Washington, DC 20555-0001

E-Mail: amy.hull@nrc.gov

Phone: 301-251-7656

Alternate Contracting Officer's Representative

Name: Matthew Hiser

Agency: U.S. Nuclear Regulatory Commission

Office: Office of Nuclear Regulatory Research

Mail Stop: CS-05-C07M

Washington, DC 20555-0001

E-Mail: Matthew.Hiser@nrc.gov

Phone: 301-251-7601

(b)(3):41
U.S.C. §
253b(m)(1)



MATERIALS REQUIRED

N/A

(b)(3):41 U.S.C. § 253b(m)(1)



(b)(3):41
U.S.C. §
253b(m)(1)



NRC-FURNISHED PROPERTY/MATERIALS

PNNL will transfer NRC furnished property and materials acquired under previous contracts (i.e., JCN N6029, N6907) to this task order. NRC will provide additional information from EMDA and SLR databases.

(b)(3):41
U.S.C. §
253b(m)(1)



RESEARCH QUALITY

The quality of NRC research programs are assessed each year by the Advisory Committee on Reactor Safeguards. Within the context of their reviews of RES programs, the definition of quality research is based upon several major characteristics:

Results meet the objectives (75% of overall score)

Justification of major assumptions (12%)

Soundness of technical approach and results (52%)

Uncertainties and sensitivities addressed (11%)

Documentation of research results and methods is adequate (25% of overall score)

Clarity of presentation (16%)

Identification of major assumptions (9%)

It is the responsibility of the DOE Laboratory to ensure that these quality criteria are adequately addressed throughout the course of the research that is performed. The NRC COR shall review all research products with these criteria in mind.

(b)(3):41
U.S.C. §
253b(m)(1)



STANDARDS FOR CONTRACTORS WHO PREPARE NUREG-SERIES MANUSCRIPTS

The U.S. Nuclear Regulatory Commission (NRC) began to capture most of its official records electronically on January 1, 2000. The NRC will capture each final NUREG-series publication in its native application. Therefore, please submit your final manuscript that has been approved by your NRC Project Manager in both electronic and camera-ready copy.

The final manuscript shall be of archival quality and comply with the requirements of NRC Management Directive 3.7 "NUREG-Series Publications." The document shall be technically edited consistent with NUREG-1379, Rev. 2 (May 2009) "NRC Editorial Style Guide." The goals of the "NRC Editorial Style Guide" are readability and consistency for all agency documents.

All format guidance, as specified in NUREG-0650, "Preparing NUREG-Series Publications," Rev. 2 (January 1999), will remain the same with one exception. You will no longer be required to include the NUREG-series designator on the bottom of each page of the manuscript. The NRC will assign this designator when we send the camera-ready copy to the printer and will place the designator on the cover, title page, and spine. The designator for each report will no longer be assigned when the decision to prepare a publication is made. The NRC's Publishing Services Branch will inform the NRC Project Manager for the publication of the assigned designator when the final manuscript is sent to the printer.

For the electronic manuscript, the Contractor shall prepare the text in Microsoft Word, and use any of the following file types for charts, spreadsheets, and the like.

File Types to be Used for NUREG-Series Publications	
File Type	File Extension
Microsoft®Word®	.doc
Microsoft® PowerPoint®	.ppt
Microsoft®Excel	.xls
Microsoft®Access	.mdb
Portable Document Format	.pdf

This list is subject to change if new software packages come into common use at NRC or by our licensees or other stakeholders that participate in the electronic submission process. If a portion of your manuscript is from another source and you cannot obtain an acceptable electronic file type for this portion (e.g., an appendix from an old publication), the NRC can, if necessary, create a tagged image file format (file extension.tif) for that portion of your report. Note that you should continue to submit original photographs, which will be scanned, since digitized photographs do not print well.

If you choose to publish a compact disk (CD) of your publication, place on the CD copies of the manuscript in both (1) a portable document format (PDF); (2) a Microsoft Word file format, and (3) an Adobe Acrobat Reader, or, alternatively, print instructions for obtaining a free copy of Adobe Acrobat Reader on the back cover insert of the jewel box.

(b)(3):41
U.S.C. §
253b(m)(1)



OTHER CONSIDERATIONS

References

1. Bond LJ, SR Doctor, and TT Taylor. 2008. *Proactive Management of Materials Degradation - A Review of Principles and Programs*. PNNL-17779, Pacific Northwest National Laboratory, Richland, WA.

2. Bond, LJ, TT Taylor, SR Doctor, AB Hull, and SH Malik, (2008) *Proactive Management of Materials Degradation for nuclear power plant systems*. Proc. Int. Conf. Prognostics and Health Management 2008, Denver, CO, October 6-9. IEEE Reliability Society, # OP-20-01 120
3. Chopra, OK, et al, *Managing Aging Effects on Dry Cask Storage Systems for Extended Long-Term Storage and Transportation of Used Fuel*, Rev. 0, FCRD-USED-2012-000119, 2012.
4. EPRI 3002000576, *Long-Term Operations: Assessment of R&D Supporting AMPs for LTO*, Aug. 2013 (80pp).
5. NEI, *Roadmap for Subsequent License Renewal*, Dec. 2013. (45pp)
6. NEI, *Second License Renewal Roadmap*, May 2015. (22pp).
7. NUREG/CR-6923, *Expert Panel Report on Proactive Materials Degradation Assessment*, 2007 (3895pp, ML063520517)
8. NUREG/CR-7153, *Expanded Materials Degradation Assessment*, 5 volumes, October 2014 (861pp)
9. SECY-14-0016, *Ongoing Staff Activities to Assess Regulatory Considerations for Power Reactor Subsequent License Renewal*, January 31, 2014 (25pp)
10. Taylor, WB, CE Carpenter, KJ Knobbs, S Malik, *Using Technology to Support Proactive Management of Materials Degradation for the U.S. Nuclear Regulatory Commission*, Proceedings of the ASME Pressure Vessels & Piping Division/K-PVP Conference, PVP 2010, July 18-22, 2010. Bellevue, WA, USA. Paper PVP2010-26063.
11. *The Scalable Reasoning System: Lightweight Visualization for Distributed Analytics*, IEEE Symposium on Visual Analytics Science & Technology, 978-1-4244-2935-6/08

Access to Non-NRC Facilities/Equipment

N/A

Applicable Publications

N/A

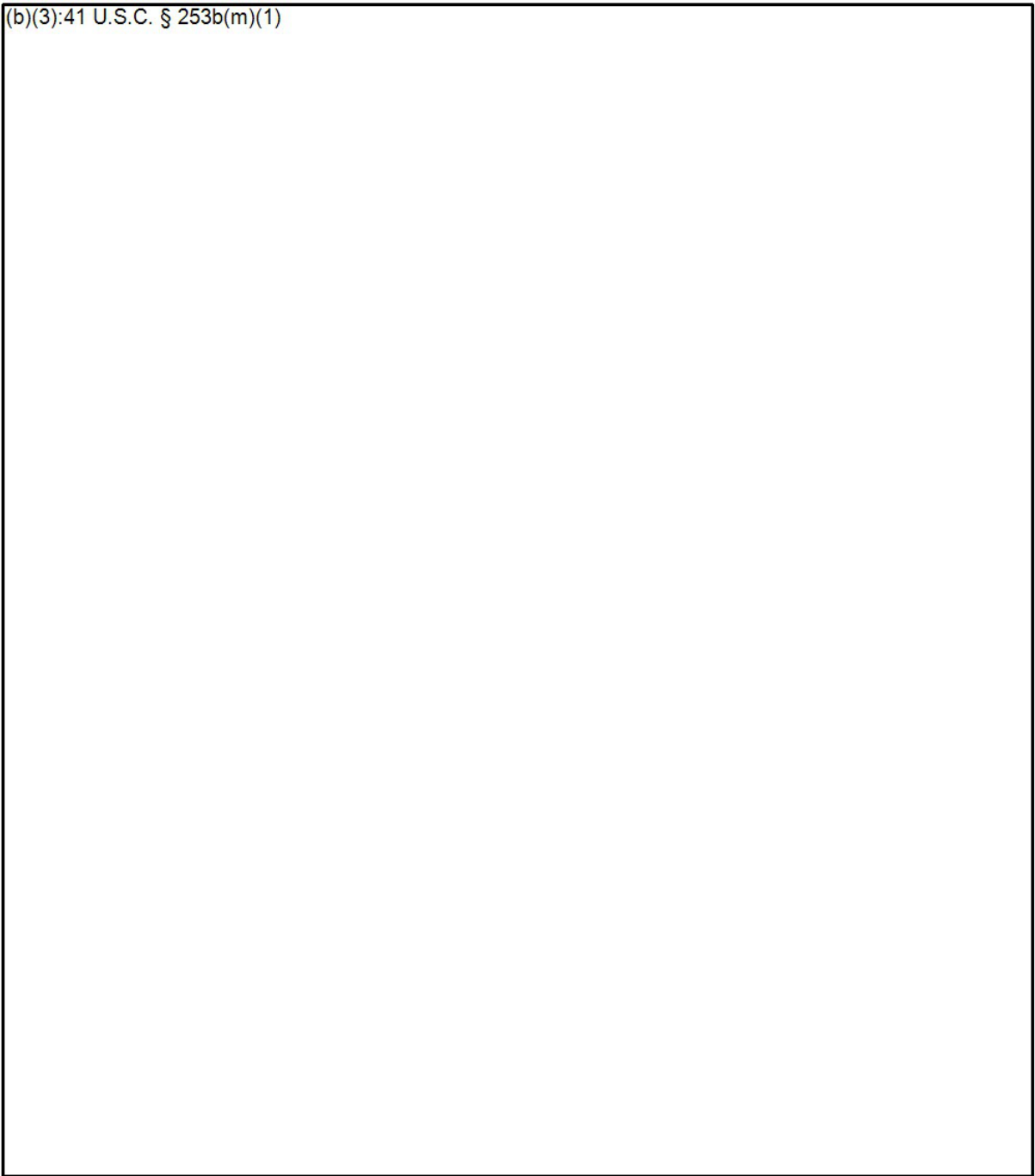
Controls over document handling and non-disclosure of materials

N/A


ATTACHMENT 3 – STAFFING PLAN
NRC Agreement Task Order No.: NRC-HQ-60-15-T-0023

Strategic Approach for Obtaining Material and Components Aging Information Alloys and Welds

(b)(3):41 U.S.C. § 253b(m)(1)




(b)(3):41 U.S.C. § 253b(m)(1)



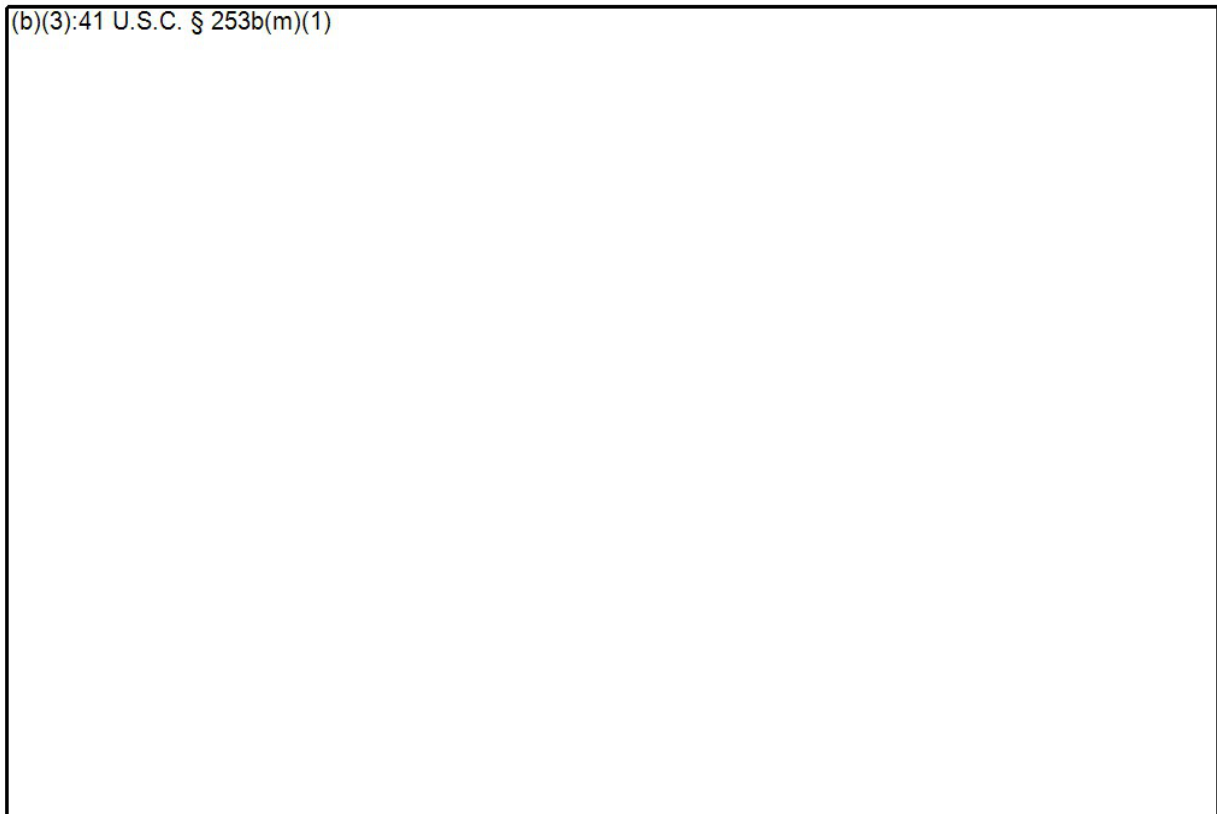
(b)(3):41 U.S.C. § 253b(m)(1)

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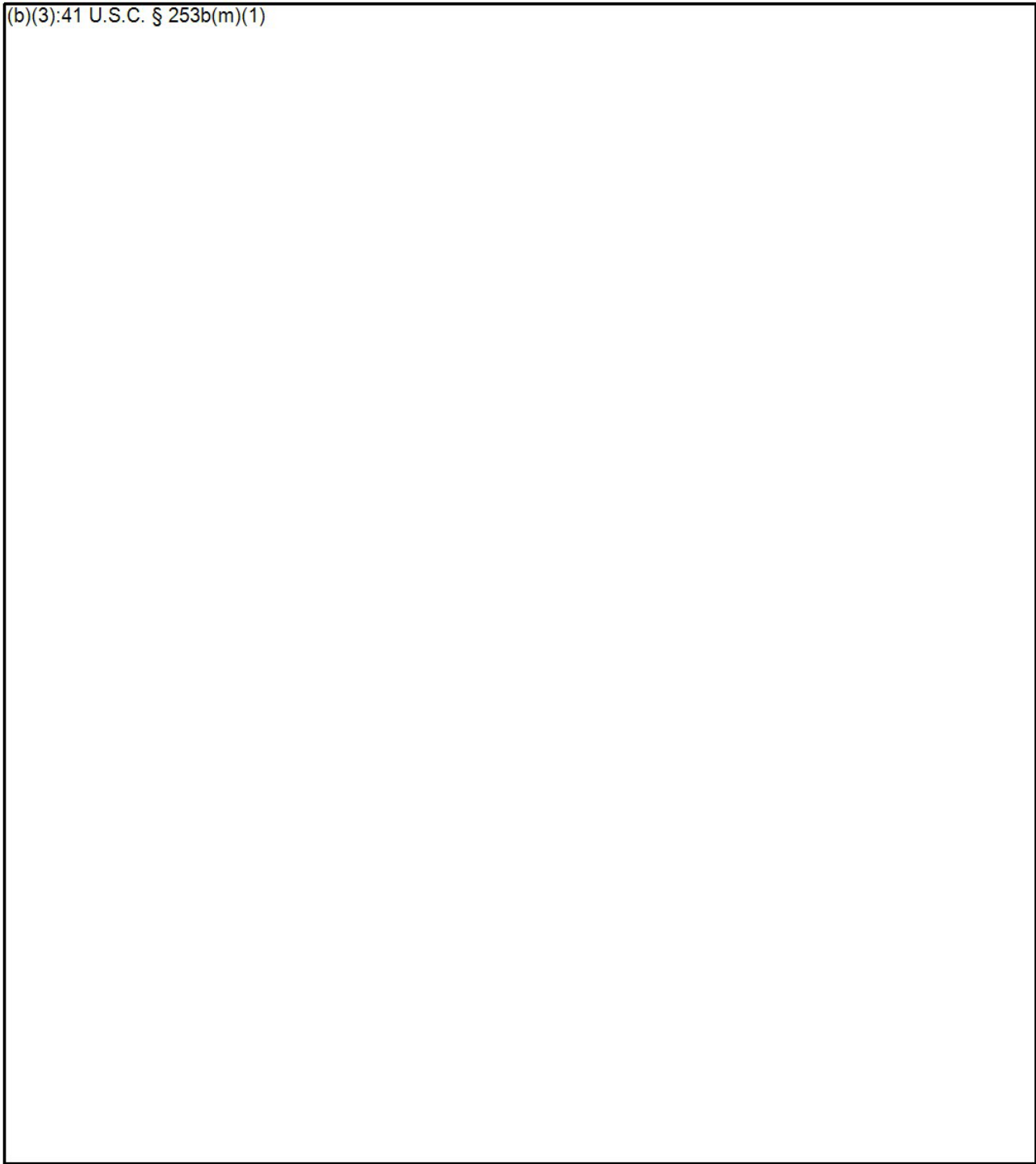
ATTACHMENT 4
NRC Agreement Task Order No.: NRC-HQ-60-15-T-0023

Strategic Approach for Obtaining Material and Components Aging Information

ORGANIZATIONAL CONFLICT OF INTEREST INFORMATION

(b)(3):41 U.S.C. § 253b(m)(1)

(b)(3):41 U.S.C. § 253b(m)(1)



From: Purtscher, Patrick
Sent: Mon, 30 Jul 2018 10:16:21 +0000
To: 'Ramuhalli, Pradeep'
Subject: FW: revised report

Pradeep,

What is the status of the revised harvesting report?

Pat

From: Purtscher, Patrick
Sent: Monday, July 09, 2018 11:40 AM
To: Ramuhalli, Pradeep <Pradeep.Ramuhalli@pnnl.gov>
Subject: RE: RE: Cost estimate

1:30 PM Eastern

From: Ramuhalli, Pradeep [<mailto:Pradeep.Ramuhalli@pnnl.gov>]
Sent: Monday, July 09, 2018 11:39 AM
To: Purtscher, Patrick <Patrick.Purtscher@nrc.gov>
Subject: [External_Sender] RE: Cost estimate

Yes – will call you later today (this afternoon EDT). When would be a good time?

With best regards,

Pradeep Ramuhalli, PhD
Tel: 509-375-2763
Email: pradeep.ramuhalli@pnnl.gov

From: Purtscher, Patrick [<mailto:Patrick.Purtscher@nrc.gov>]
Sent: Monday, July 09, 2018 5:54 AM
To: Ramuhalli, Pradeep <Pradeep.Ramuhalli@pnnl.gov>
Subject: RE: Cost estimate

I do have some questions, can we talk today.

Pat
301-415-3942

(b)(6)

From: Ramuhalli, Pradeep [<mailto:Pradeep.Ramuhalli@pnnl.gov>]
Sent: Tuesday, July 03, 2018 3:38 PM

To: Purtscher, Patrick <Patrick.Purtscher@nrc.gov>

Subject: [External_Sender] Cost estimate

Pat,

As we discussed last week, the new tasking for assembling the database of available harvested materials at PNNL could use additional funds. A ballpark cost estimate for this effort is about [REDACTED] though the (b)(4) exact value will depend on the specifics of the scope. Let me know if you have any questions on this.

Please note that the material contained herein, including the cost estimate, is submitted for informational purposes and is not binding on Pacific Northwest National Laboratory or the U.S. Department of Energy. Binding commitments can only be made by the submission of a formal proposal that sets forth a specific statement of work, estimated cost, and that is signed by a Pacific Northwest National Laboratory Contracts Representative and approved by the U.S. Department of Energy.

With best regards,

Pradeep

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

From: Frankl, Istvan
Sent: Tue, 23 Aug 2016 17:52:08 -0400
To: Hull, Amy;Purtscher, Patrick;Hiser, Matthew;Rao, Appajosula
Subject: FY17 Budget Reductions for Specific CMB Projects

All,

(b)(5) [REDACTED] I had to reduce the FY17 budget for the following projects:

Project	Requested for FY17	Approved for FY17	Notes
Strategic Approach for Obtaining Material and Component Aging Information	(b)(5)		Contract Mod. Or APP17
Technical reports on disposition of the EMDA issues related to Long Term Operation Materials Degradation Issues			APP17
Testing of Irradiated Ex-Plant Materials in LWR Environment (including Void Swelling Investigations of Austenitic SS)			APP17

More details are provided in the link below:

(b)(5) [REDACTED]

Thanks,

Steve

From: Christensen, Jason
Sent: Tue, 15 May 2018 15:23:32 +0000
To: Hiser, Matthew
Subject: Harvesting Database

Amy wanted me to check with you on the harvesting database. Was the money allocated for that spent this year? [REDACTED]

(b)(5)

(b)(5)

Thanks,

Jason A. Christensen



Materials Engineer, Corrosion and Metallurgy Branch
Office of Research, Division of Engineering
U.S. Nuclear Regulatory Commission

Mail Stop T10-D66
Washington, DC 20555-0001
Jason.Christensen@nrc.gov
Phone: (301) 415-0723

From: Hiser, Matthew
Sent: Thu, 6 Oct 2016 13:31:15 -0400
To: Frankl, Istvan
Cc: Purtscher, Patrick
Subject: Harvesting FY17 Funds

Note to requester: Portions of this record are redacted under FOIA Exemption B5, Deliberative Process Privilege.

Hi Steve,

(b)(5) Pat and I discussed the FY17 budget for the harvesting contract at PNNL and agree that we could get by with [REDACTED] in FY17 to do what we need to do with PNNL.

Thanks and let us know if you need any more information!
Matt

From: Hull, Amy
Sent: Tue, 21 Jun 2016 08:09:54 -0400
To: Frankl, Istvan
Cc: Purtscher, Patrick;Hiser, Matthew
Subject: harvesting project? ACTION [REDACTED]

(b)(5)

I think the harvesting project could use more funds.

From: Frankl, Istvan
Sent: Monday, June 20, 2016 2:55 PM
To: RES_DE_CMB <RESDECMB@nrc.gov>
Subject: ACTION: [REDACTED] (b)(5)
Importance: High

CORs,

[REDACTED]

(b)(5)

Thanks,

Steve