

SUBJECT: SUPPLEMENT TO EVALUATION AND ANALYSIS OF A FEW
INTERNATIONAL PERIODIC SAFETY REVIEW SUMMARY REPORTS

SUMMARY:

This report supplements the Technical Letter Report (TLR) titled *Evaluation and Analysis of A Few International Periodic Safety Review Summary Reports* and describes the Nuclear Regulatory Commission's (NRC's) efforts in performing a limited scope pilot review of Periodic Safety Review (PSR) summary reports from other countries for potential insights to inform the NRC's regulatory process. The staff identified comments within the reports that could provide an input to current regulatory review efforts. However, the value of these comments was in the operational experience that could possibly inform the NRC's guidance or regulations. The staff did not find insights within these reports that would indicate a need for a change in the NRC's regulatory process itself.

BACKGROUND:

Following a 2010 International Atomic Energy Agency (IAEA) Integrated Regulatory Review Service (IRRS) mission and subsequent report, the U.S. Nuclear Regulatory Commission staff provided a Policy Issue paper SECY-11-0084, "Staff Action Plan to Address the Integrated Regulatory Review Service Mission," to the Commission to address the recommendations and suggestions contained within the report. Suggestion S9 of the IRRS report stated that the "NRC should incorporate lessons learned from PSRs performed in other countries as an input to the NRC's assessment process." The SECY paper established a commitment for the staff to conduct a "limited scope pilot effort to review a sample of PSRs performed in other countries for potential insights to be assessed by the NRC's regulatory processes." As part of this pilot effort, the staff contracted Argonne National Laboratory (ANL) to review a selection of PSR summary reports and provide potential insights. The staff then performed a supplemental evaluation of the PSRs, to assess the topics and issues on an individual basis. As a result of this review, the staff identified several potential insights that should be further considered in the existing regulatory processes or for incorporation into future regulatory guidance. These insights primarily relate to external hazards and long-term aging degradation management.

DISCUSSION:

To initiate the review described in SECY-11-0084, the staff contracted ANL to perform "a review of some translated Periodic Safety Review reports and related documentation from foreign nuclear regulatory authorities to identify any potential new regulatory insights regarding license renewal related topics and nuclear power plant operating experience." The NRC staff provided partial translations of PSR summary reports¹ to ANL for this evaluation.

¹ The "PSR summary reports" mentioned throughout this document refer to reports that were generated by the regulatory bodies associated with each facility, not the original PSR reports that were prepared by individual licensees for the regulators to review. PSR summary reports generally contain less context and background information than the original PSRs, limiting the information available for this task.

In December 2013, ANL submitted a TLR titled “Evaluation and Analysis of A Few International Periodic Safety Review Summary Reports.” This TLR includes summaries of 14 PSR summary reports from 9 countries and proposes “technical issues that merit further consideration” identified within each PSR summary report. These “technical issues” primarily regarded aging degradation and aging management.

While the ANL TLR provides a selection of issues from the selected PSR summary reports, the evaluation of these issues primarily focused on aging degradation and aging management. To ensure that all possible areas within the regulatory framework were being considered, the staff performed a complete secondary review of all issues within the PSR summary reports. This document provides the methodology and results of this supplemental evaluation of the PSR summary reports, as well as challenges encountered during this process. A list of the PSR summary reports reviewed by both the staff and ANL, as well as one report that was only reviewed by the staff (Santa María de Garoña) is provided in Appendix A.

Review Methodology and Results

Initial screening of issues:

For its supplemental evaluation of the PSR summary reports, the staff used a systematic approach to categorize issues as they relate to the U.S. regulatory process, and then identify those issues requiring further consideration. This approach began with the review of all comments/recommendations (“issues”) within the international regulators’ PSR summary reports listed in Appendix A. Of the (371) comments captured in the PSR summary reports, the staff identified (124) issues early in its review and determined that such issues either:

- were within the scope of aging degradation and aging management, and were therefore already considered in the NRC’s existing license renewal process; or
- directly referenced U.S. NRC regulatory methods (e.g., regulatory guides, Generic Communications, Generic Safety Issues, U.S. industry specifications and codes), and therefore were assumed to already be addressed within the NRC’s regulatory framework²; or
- did not contain enough information to further assess due to lack of context and limited access to additional information used in the PSR.

Because the staff performing this initial review were from the Division of License Renewal, several of the issues were readily identifiable as those that are covered as part of the NRC’s review of aging management for license renewal. Additionally, many of the issues cited in the PSR reports directly referenced U.S. NRC regulatory methods or standards (e.g., Regulatory Guides, Generic Communications, Generic Safety Issues, U.S. industry specifications and codes, etc.), and therefore were presumed to already be captured within the NRC’s regulatory

² An example of such an issue is: “*The Operator needs to perform the necessary improvement actions including Uljin Units 3 & 4 unique performance evaluations according to Reg. Guide 1.82 (R3), USNRC’s Generic Letter 2004 – 02, NEI 04 – 07 relating to performance evaluation and improvement of containment building recirculation collection system in the event of loss of coolant accident (LOCA).*” (Uljin 3&4 2010 PSR summary report, pg. 51)

framework. To minimize redundant reviews and focus on areas for potential improvement, the staff performed this initial screen and eliminated the 124 issues from further consideration in this review.

Further screening of issues:

Following this initial screen, the remaining 247 comments were evaluated for instances where the PSR process might bring resolution to issues not covered by the NRC's regulatory process. During this evaluation, the staff found that some issues were very clearly and directly addressed through existing NRC regulatory requirements or guidance; some were not directly addressed but can be shown to be captured through the normal U.S. regulatory process and addressed on an individual basis; and the remaining issues were either complex enough to require further investigation or indicated a potential area for consideration in the NRC's regulatory process. Accordingly, the staff evaluated each comment and assigned it to one of three "bins" for easier and more efficient consideration:

- a.) The issue of concern is explicitly addressed through NRC requirements or guidance.
- b.) The issue of concern would reasonably be expected to be discovered and addressed through existing NRC regulatory processes.
- c.) Further evaluation is needed to determine whether the issue would be discovered and addressed through existing NRC regulatory processes, or if a change is warranted.

Bin "A" contains issues that can easily be shown to be addressed through NRC requirements or guidance, but do not directly reference NRC regulatory methods or approved standards. This bin is different from the early screening of the (124) issues that were eliminated, in that bin "A" does not have direct references to specific NRC regulatory methods or standards. Rather, they are general issues of concern (e.g., security, radiation protection) that are readily addressed by the NRC.

An example of an issue that clearly falls under existing regulations can be seen in the Olkiluoto PSR summary report regarding security requirements:

The security standing order submitted by TVO to STUK in August 2009 must be supplemented.... Issues to be included in the security standing order include, for example, management of the physical protection organisation and the arrangement of its operations.... (Olkiluoto 1 and 2 PSR summary report, pg. 89)

With respect to this example, U.S. nuclear power plants must create and maintain a security plan under 10 CFR 50.34 to meet the requirements set forth in 10 CFR 73.55, "Requirements for physical protection of licensed activities in nuclear power reactors against radiological sabotage." In this example, the issue doesn't directly reference U.S. regulations, but U.S. regulations clearly and completely address the issue as described.

Bin “B” contains issues that, while not readily identifiable as directly addressed by specific regulations or standards, were of the nature that the NRC staff would expect to be covered by established programs or processes. An example of a bin “B” issue is provided here from the Santa María de Garoña (Spain) PSR summary report:

In-house operating experience: As a general standard the corrective actions should be resolved within a period of time equivalent to one operating cycle. (Santa María de Garoña PSR summary report, page 11)

Like this example, many of the comments/issues in this bin address programmatic activities that can be shown to have similar programs in U.S. plants. For example, U.S. nuclear power plants are required to have Corrective Action Programs (CAP) in place, with standards regarding the time-to-resolution of deficiencies. These programs are regularly inspected by on-site Resident Inspectors to verify the proper capture, tracking, and implementation of corrective actions relating to plant specific operating experience. This issue is of a general nature and doesn’t provide lessons learned beyond ensuring that the CAP is effective, and therefore this comment does not provide information to improve existing U.S. regulations governing the CAP. It is reasonable to assume that a properly functioning CAP would address the issue from which this comment arose.

Since, as discussed above, the issues in bins “A” and “B” are those for which the NRC regulatory process is determined to be adequate, the focus of the review was on those issues in bin “C.”

Comments in bin “C” included those that the staff could not readily disposition as issues already addressed as part of the NRC’s existing regulatory process. Because of the potential unique nature of these issues, the staff examined them more closely and attempted to get additional context on the issues where available. To the extent that each issue could be tied to a similar program/process within the NRC, the staff aligned those programs/processes with the issues as discussed below.

After the final review of issues in bin “C,” the staff determined that 25 comments concerned issues that are being considered under separate regulatory review efforts such as the Japan Lessons Learned Directorate (JLD). For example, issues that dealt directly with updating of seismic analyses or flooding analyses would fall into this category since JLD is currently considering these issues.

Another nine comments concerned issues that warranted consideration in the current process of revising the NRC’s guidance on license renewal and long term operations. These nine comments are being tracked in a comment resolution database and are being considered for incorporation into the Generic Aging Lessons Learned document (NUREG-1801 for Subsequent License Renewal) or separate guidance if warranted. These comments are listed in the table below (in no specific order):

	Source PSR	Comment
1	France 900 MWe PWR (ASN letter)	“ASN requests EDF to develop a specific programme to provide data relating to the [neutron irradiation induced] creep of 900-MWe reactor vessels in order for the envelope character of the creep to be taken into account from the design stage until the fourth decennial visit.”
2	Kori, Units 3 and 4	<ol style="list-style-type: none"> 1. “Need to establish performance long-term monitoring plan for internal radiation protective coating appropriate for newly enacted regulation and guideline and develop detailed application of the new technical standard.” 2. “Based on the assessment results of the protective coatings (steel liner plate, internal concrete and steel structures in containment building), need to establish a plan to analyze degradation phenomena, evaluate durability and mitigate degradation.”
3	Uljin, Units 3 and 4	“The Operator needs to supplement with additional data and develop estimation plan to increase reliability of compression strength estimation method using [Schmidt] Hammer.”
4	Yonggwang, Units 3 and 4	“Establishing a plan to examine the corrosion status of reinforcing rod considering the result of measuring the natural potential of the water intake structures for sea water for cooling the 1st equipment.”
5	Leibstadt	The Leibstadt PSR reported that limited tests on reactor vessel surveillance specimens have indicated that the ductility appeared to increase with radiation. The Swiss regulatory agency has determined that additional tests on unirradiated material are needed to clarify this unlikely finding.
6	Olkiluoto, Units 1 and 2	“The areas monitored for ageing in the containment include the deformations and long-term durability of concrete structures, the ambient conditions for steel structures and expansion joints... The cracks in concrete are monitored by taking measurements.”
7	Olkiluoto, Units 1 and 2	<p>Significant modifications carried out due to aging of structures at Olkiluoto Units 1 and 2 include the following:</p> <ol style="list-style-type: none"> 1. Reopening the expansion joint between the containment and reactor buildings of Unit 2 after it had closed because of concrete creep and relaxation of prestressed reinforcements.
8	Olkiluoto, Units 1 and 2	<p>Significant modifications carried out due to aging of structures at Olkiluoto Units 1 and 2 include the following:</p> <ol style="list-style-type: none"> 1. Cathode protection of seawater structures against chloride-induced corrosion.
9	Oskarshamn 3	OKG developed methods for containment inspection and testing based on its experience in the European containment research project “CONMOD.” The concrete containment management program uses the finite element (FE) method to evaluate the behavior of concrete containment under various loading conditions, and thus to identify critical regions.

Challenges and Alternative Processes

This review of the PSR summary reports provided a good opportunity for the staff to understand the issues and methods of resolution documented for each PSR. However, there were some limitations and drawbacks to performing this type of review. The selection of PSR summary reports was based entirely on availability, rather than from a deliberately selected sample set. The cost of translating reports was such that at times only partial translations could be included for this study, which limited the data and context that could be considered for those reports.

Alternatively, information gained from this exercise regarding nuclear power plant safety issues could have been captured in an already established, formal reporting system such as the International Reporting System (IRS) for Operating Experience. The U.S. NRC is a very active participant in this database and has a robust process in place for identifying and incorporating international lessons learned into its regulatory processes. Other information sharing sources such as bilateral and multilateral meetings and continued close relationships between regulatory body staffs can be leveraged for greater sharing of lessons learned.

Conclusion

This review has met the intent of the staff's commitment in SECY-11-0084 to conduct a limited scope pilot review of other countries' PSRs for potential insights to inform the NRC's regulatory process. Using a detailed, methodical approach the staff identified certain issues that warrant further consideration in the NRC's current processes, and those issues are being addressed through ongoing efforts such as JLD and subsequent license renewal guidance updates. Overall, this effort confirmed that the NRC's regulatory framework remains an adequate set of processes for establishing reasonable assurance that public health and safety are maintained at all times.

Appendix A

	Country	Nuclear Power Plant(s)	Report	Sections translated
1	Finland	Olkiluoto, Units 1 and 2	STUK (Säteilyturvakeskus Strålsäkerhetscentralen), 2010, <i>Safety Assessment of Olkiluoto NPP Units 1 and 2</i> , STUK-B 111, Helsinki, February.	Entire document (91 pages)
2a	France	900-MWe PWRs (Types CP0, CP1, and CP2)	<u>Lacoste, A.C., 2009, communication from André-Claude Lacoste (Autorité de Sûreté Nucléaire) to the President of Électricité de France, EDF's Pressurised-water Nuclear Reactors (PWR): ASN's Position on the Generic Aspects for the Extension of the Operating Lifetime of 900-MWe Reactors after the Third Decennial Visit (DEP-PRES-0077-2009), July 1.</u>	Entire document (15 pages)
2b	France	900-MWe PWRs (Types CP0, CP1, and CP2)	Autorité de Sûreté Nucléaire, 2011, Opinion No. 2011-AV-0120 of ASN (Nuclear Safety Authority) Dated 4 July 2011 Concerning the Continued Operation of Reactor No. 1 of the Fessenheim Nuclear Power Plant after 30 Years of Operation, Paris, July 4.	Entire document (7 pages)
2c	France	900-MWe PWRs (Types CP0, CP1, and CP2)	IRSN (Institut de Radioprotection et de Sûreté Nucléaire), 2009, <i>The Safety Review of 900 MWe Pressurized Water Reactors Associated with their Third Ten-Yearly Outage</i> , DSR REPORT No. 285, Paris.	Entire document (31 pages)
3	Slovenia	Krško	NEK (Nuklearna Elektrarna Krško), 2004, <i>Nuclear Power Plant Krško Periodic Safety Review Project Summary Report</i> , PSR-NEK-8.0, Rev. 0, Krško, Slovenia.	Entire document (112 pages)
4	South Korea	Kori, Units 3 and 4	Ministry of Science and Technology, 2006, <i>Kori 3 and 4 Periodic Safety Evaluation Assessment Results</i> , Korea Institute of Nuclear Safety (KINS), S. Korea, Daejeon, March.	Entire document (61 pages)
5	South Korea	Uljin, Units 3 and 4	Ministry of Science and Technology, 2010, <i>Uljin Units 3 & 4 Periodic Safety Evaluation Assessment Results</i> , Korea Institute of Nuclear Safety (KINS), S. Korea, Daejeon, April.	Entire document (75 pages)

	Country	Nuclear Power Plant(s)	Report	Sections translated
6	South Korea	Yonggwang, Units 3 and 4	Ministry of Science and Technology, 2007, <i>Yonggwang Units 3 & 4 Periodic Safety Evaluation Assessment Results</i> , Korea Institute of Nuclear Safety (KINS), S. Korea, Daejeon, June.	Entire document (84 pages)
7	Spain	Almaraz, Units 1 and 2	CSN (Consejo de Seguridad Nuclear), undated, <i>Periodic Safety Review Report</i> , Spanish Nuclear Safety Council.	Sections 4.2 and 5 (4 pages)
8	Spain	Santa María de Garoña	CSN (Consejo de Seguridad Nuclear), undated, <i>Summary Of The Report Relating To The Request For Renewal Of The Operating Permit For Santa María de Garoña Nuclear Power Plant For The Period 2009 – 2019</i> , Spanish Nuclear Safety Council.	Entire document (18 pages)
9	Sweden	Oskarshamn 3	SKI (Statens Kärnkraftinspektion), 2008, <i>Study of OKG PLC's Periodic Overall Assessment of Security in Oskarshamn 3</i> , SKI 2005/40, May 5.	Entire document (83 pages)
10	Switzerland	Leibstadt	ENSI (Eidgenössisches Nuklearsicherheits-inspektorat), 2009, <i>Report Concerning the Periodic Safety Review of the Leibstadt Nuclear Power Plant</i> , ENSI 12/1300, Würenlingen, Switzerland, August 10.	Chapters 1-3, Chapter 10, and Sections 5.3, 5.5 and 6.3 (total 117 pages)
11	Switzerland	Mühleberg	HSK (Hauptabteilung für die Sicherheit der Kernanlagen), 2007, <i>Safety Statement on the Periodical Safety Inspection of the Mühleberg Nuclear Power Station (KKM)</i> , HSK 11/1100, Würenlingen, Switzerland, November 12, Section 6.4, Chapter 11.	Chapters 1-3, Chapters 10-11 and Section 6.4 (total 134 pages)
12	Taiwan	Chinshan, Unit 1	Taiwan Atomic Energy Council, 2009, <i>The Third Ten-Year Overall Safety Assessment Review Report of Nuclear Power Plant 1, Unit 1</i> , NRD-SER-98-03, New Taipei City, Taiwan, June.	Entire document (67 pages)
13	United Kingdom	Sizewell B	Stationery Office, 2006, <i>Sizewell B Nuclear Power Station: The Findings of NII's Assessment of British Energy's Periodic Safety Review</i> , Health and Safety Executive, Norwich, U.K., June.	Entire document (22 pages)