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Written submission from Ontario Power Generation Inc. – Pickering Nuclear Generating Station

Mémoire de Ontario Power Generation Inc. – Centrale nucléaire de Pickering

In the Matter of

À l'égard de

Request from Ontario Power Generation Inc. to remove a resolution action from the Pickering Nuclear Generating Station integrated implementation plan (Revision 1)

Demande de Ontario Power Generation Inc. concernant le retrait d'une mesure de résolution du plan intégré de mise en œuvre, révision 1, pour la centrale nucléaire Pickering

Public Hearing - Hearing in writing based on written submissions

Audience publique - Audience fondée sur des mémoires

January 2021

Janvier 2021

Canada

ONTARIO POWER GENERATION

1675 Montgomery Park Road, P.O. Box 160, Pickering, Ontario L1V 2R5

October 6, 2020

P-CORR-00531-06155

Mr. M. A. LEBLANC
Commission Secretary
Secretariat

Canadian Nuclear Safety Commission
280 Slater Street
Ottawa, Ontario
K1P 5S9

Dear Mr. Leblanc:

Pickering NGS: Request for Approval to Amend the Integrated Implementation Plan (IIP) to Remove Resolution Action G25-RS1-04-20

The purpose of this letter is to request Canadian Nuclear Safety Commission (CNSC) approval to remove resolution action G25-RS1-04-20 from the Pickering Periodic Safety Review 2 (PSR2) Integrated Implementation Plan (IIP) (Revision 1), which was accepted by the CNSC in Reference 1.

Resolution Action G25-RS1-04-20 was identified to track the update of Large Break Loss of Coolant Accident (LBLOCA) analysis for Pickering NGS to facilitate its re-categorization from a category 3 CANDU Safety Issue (CSI) to category 2. The LBLOCA analysis approach originally foreseen to resolve G25-RS1-04-20 was the more realistic implementation of the Limit of Envelope (LOE) method, as described in Reference 2.

OPG has continued to make progress in LBLOCA analysis and participates in an initiative that is pursuing the use of the Composite Analytical Approach (CAA) by industry. OPG supports the use of industry accepted tools and methodologies as part of its long term plans; however, the LBLOCA analysis at Pickering using the CAA cannot be completed within the IIP implementation period which ends on December 31, 2020. Therefore, OPG seeks to remove Resolution Action G25-RS1-04-20 from the IIP with supporting rationale.

Enclosure 1 is an assessment of the impact on the Pickering PSR2 Global Assessment Report (GAR) results with resolution statement for the Global Issue GI-25-RS1 removed. The assessment concluded that the impact on the GAR is minimal and its overall conclusions that support Pickering's safe and reliable operation beyond 2020, are not changed. The ranking of this resolution statement in the GAR is low and its associated resolution action enhancement value contribution in

the IIP is minimal. The assessment supports the rationale to change the resolution plan type for GI-25-RS1 to Acceptable Deviation (AD) in the GAR and the removal of its associated resolution action (G25-RS1-04-20) from the IIP.

Notwithstanding that this resolution action will be removed from the IIP, OPG maintains that small safety analysis margins for LBLOCA scenario are due to the excessive conservatisms associated with the traditional LOE analysis methodology regarding reactor operation in an incredible mode of operation (operating at all Safe Operating Envelope limits simultaneously, conservative treatment of break size and its opening characteristics, and multiple and simultaneous impairments of the mitigation systems). Further, removal of the resolution action from the IIP does not alter OPG's commitment to address the LBLOCA CSI re-categorization following a CNSC accepted methodology, and an effective tracking mechanism already exists for Category 3 CSI's with annual updates provided to the CNSC as in Reference 3.

In Reference 4, OPG requested CNSC staff concurrence with the removal of the IIP resolution statement G25-RS1-04-20 from the IIP in Reference 1 and CNSC provided a response in Reference 5.

Also, in Reference 1 OPG undertook a commitment to submit the LBLOCA CAA project update to the CNSC by October 30, 2020, which includes the plan for addressing the LBLOCA issues. We are pleased to have been able to provide this information expeditiously and it was submitted to the CNSC in Reference 6.

OPG is requesting CNSC approval to remove resolution action G25-RS1-04-20 from the Pickering Periodic Safety Review 2 (PSR2) Integrated Implementation by December 1, 2020 in keeping with OPG's commitment to close all IIP actions by the end of 2020.

If you have any questions, please contact Sara Irvine, Manager, Pickering Regulatory Affairs at 289-314-3367.

Jon Franke
Senior Vice President.
Pickering Nuclear

cc: A. Viktorov, Director, Pickering Regulatory Program Division, Ottawa
CNSC Pickering Regulatory Program Division
CNSC Records Office

References:

1. CNSC Letter, A. Viktorov to R. Lockwood, “Pickering NGS: CNSC Staff Acceptance of Pickering NGS Periodic Safety Review 2 (PSR2) Integrated Implementation Plan (IIP), Revision 1”, March 2, 2018, e-Doc 5470609, CD# P-CORR-00531-05333.

2. OPG Letter, R. Lockwood to A. Viktorov, “Pickering NGS Periodic Safety Review 2 – Submission of Integrated Implementation Plan Revision 1”, March 1, 2018, CD# P-CORR-00531-05311.

3. OPG Letter, D. Townsend to G. Frappier, “Progress Update on Category 3 CANDU Safety Issues – Implementation of Risk Control Measures”, June 18, 2020, CD# N-CORR-00531-20185.

4. OPG Letter, M. R. Knutson to A. Viktorov, “Pickering NGS: Request for Concurrence to Remove Resolution Action G25-RS1-04-20 from the Integrated Implementation Plan (IIP)”, July 14, 2020, e-Doc 6342501, CD# P-CORR-00531-06078.

5. CNSC Letter, A. Viktorov to M.R. Knutson, :Pickering NGS – CNSC staff review of Request for Concurrence to Remove Resolution Action G25-RS1-04-20 from the Integrated Implementation Plan (IIP)”, July 24, 2020, e-Doc 6341757, CD# P-CORR-00531-06108.

6. OPG Letter, M.R. Knutson to A. Viktorov and J. Burta, “Large Break Loss of Coolant Accident Safety Analysis Margins – OPG’s Adoption of Composite Analytical Approach”, September 23, 2020, CD# N-CORR-00531-22326.

Enclosure:

1. Kinectrics Report, “Pickering NGS: Basis for Removing Resolution Action G25-RS1-04-20 from the Integrated Implementation Plan”, July 7, 2020, P-REP-03680-00038-R000.

Enclosure 1 to P-CORR-00531-06115, J. Franke to M.A Leblanc, “Pickering NGS: Request for Approval to Amend the Integrated Implementation Plan (IIP) to Remove Resolution Action G25-RS1-04-20”.

Enclosure 1

Pickering NGS: Basis for Removing Resolution Action G25-RS1-04-20 from the Integrated Implementation Plan

P-REP-03680-00038-R000

Issued July 7, 2020

(19 pages including this cover)

KINECTRICS

ONTARIO POWER GENERATION	
ACCEPTED	✓
ACCEPTED AS NOTED	
REVISE AND RESUBMIT	
July 07, 2020	
Signature	Date
Name: Ahmed Hafez	
Dept: Strategic Planning & IIP Mgmt.	
OPG Proprietary	
Doc No.: P-REP-03680-00038 Rev: 00	
This acceptance does not relieve the contractor from responsibility for errors or omissions or from any obligations or liability under this contract.	

Pickering NGS: Basis for Removing Resolution Action G25-RS1-04-20 from the Integrated Implementation Plan

PV030/RP/001 R03

July 6, 2020

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Revision Summary

Rev	Date	Author	Comments
R00	June 5, 2020	P. Ho	Issued for client review and comment.
R01	June 18, 2020	P. Ho	Issued for client acceptance.
R02	June 19, 2020	P. Ho	Revised to address additional stakeholder review comments.
R03	July 6, 2020	P. Ho	Revised to address additional stakeholder review comments. Section 3.0 has been removed. The reference for Category 3 CSI tracking has been updated to reflect the latest June 2020 update.

EXECUTIVE SUMMARY

The Pickering Nuclear Generating Station (PNGS) Power Reactor Operating Licence (PROL) was renewed in September 2018 which allowed PNGS to continue commercial operations to the end of 2024. In support of the licence renewal of the PNGS PROL, OPG conducted a Periodic Safety Review (referred to as PSR2) in accordance with the requirements of REGDOC-2.3.3, “Periodic Safety Reviews”. The results of the PSR2 assessments were documented in the Global Assessment Report (GAR) and actioned in the Integrated Implementation Plan (IIP). Licence Condition (LC) 15.1 requires the licensee to implement the IIP, to ensure the continued safe and reliable commercial operation of PNGS to the end of 2024.

The IIP contains commitments with target completion dates for safety enhancement actions and the completion date for the last actions is December 31, 2020. IIP Resolution Action G25-RS1-04-20 and associated IIP Action G25-RS1-04-20.1 “Re-categorization of the Large Break Loss of Coolant Accident” were identified to track the update of Large Break Loss of Coolant Accident (LBLOCA) analysis for PNGS to facilitate re-categorization from a Category 3 CANDU Safety Issue (CSI) to Category 2. OPG has continued to make progress with respect to resolution of these issues. In parallel, OPG has participated in an industry initiative for LBLOCA analysis. The industry initiative to update LBLOCA analysis uses the Composite Analytical Approach (CAA). The CAA involves applying a Leak-Before-Break approach to reclassify certain LBLOCA break scenarios to the Beyond Design Basis Accident (BDBA) category. As the CNSC acceptance of the CAA for Bruce Power is further advanced, OPG will continue to support the industry efforts in the resolution of LBLOCA safety analysis margins using CAA as part of its long term plan. Additionally, OPG is in the process of developing detailed analysis plans for implementation of the CAA approach for its fleet of reactors. These plans will be submitted to the CNSC to obtain concurrence before execution of the analysis. Given the change in direction, OPG seeks to remove the Resolution Action from the IIP, with appropriate justification.

To justify the basis for removal of IIP Resolution Action G25-RS1-04-20, this assessment established that the Resolution Action and the associated IIP Action are not required to enable the continued safe operation of PNGS beyond the end of 2020. Through review of background CSI history and IIP Resolution Action development in the PSR2 process, the assessment confirmed that the overall conclusions of the GAR are not changed by the removal of the IIP Resolution Action. The conclusions of the Global Issue in the GAR are not affected, and there continues to be no impact on the deterministic prioritization criteria with respect to Defence-in-Depth measures. The issue does not result in a new initiating event and has no impact on the frequency of the LOCA initiating events. For the probabilistic prioritization criteria assessed by the GAR, recategorization of the Category 3 CSIs remain unaffected. Further, the ranking of the resolution in the GAR was low. Therefore, there is minimal enhancement value to the IIP for this Action to remain.

The removal of IIP Resolution Action G25-RS1-04-20 and associated IIP Action G25-RS1-04-20.1 is therefore justified since the overall GAR conclusions are not changed, and the IIP Action is adequately tracked through another fully effective regulatory mechanism. This assessment concludes that removing the Resolution Action from the

IIP does not impact the ability for the continued operations of PNGS beyond the end of 2020.

In practicality, although this Resolution Action is being removed from the IIP, the work itself will continue to be completed outside of the IIP process. An effective regulatory tracking mechanism for LBLOCA analysis already exists in Category 3 CSI tracking. As this work continues to progress, an update is provided annually to the CNSC through this regulatory tracking mechanism.

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1.0 BACKGROUND

The Pickering Nuclear Generating Station (PNGS) Power Reactor Operating Licence (PROL) was renewed in September 2018 to allow PNGS to continue commercial operations to the end of 2024. In support of the licence renewal of the PNGS PROL, OPG conducted a Periodic Safety Review (referred to as PSR2) in accordance with the requirements of REGDOC-2.3.3, "Periodic Safety Reviews" [1]. The results of the PSR2 assessments were documented in the Global Assessment Report (GAR) [2] and actioned in the Integrated Implementation Plan (IIP) [3]. Licence Condition (LC) 15.1 and the corresponding Compliance Verification Criteria of the Licence Conditions Handbook (LCH) [4] requires the licensee to implement the IIP, to ensure the continued safe and reliable commercial operation of PNGS to the end of 2024.

1.1 Problem Statement

The IIP contains commitments with target completion dates for safety enhancement actions and the completion date for the last actions is December 31, 2020. IIP Resolution Action G25-RS1-04-20 and associated IIP Action G25-RS1-04-20.1 "Re-categorization of the Large Break Loss of Coolant Accident" were identified to track the update of Large Break Loss of Coolant Accident (LBLOCA) analysis for PNGS to facilitate re-categorization from a Category 3 CANDU Safety Issue (CSI) to Category 2. OPG has continued to make progress with respect to resolution of these issues. In parallel, OPG has participated in an industry initiative for LBLOCA analysis. The industry initiative to update LBLOCA analysis uses the Composite Analytical Approach (CAA). The CAA involves applying a Leak-Before-Break approach to reclassify certain LBLOCA break scenarios to the Beyond Design Basis Accident (BDBA) category. As the CNSC acceptance of the CAA for Bruce Power is further advanced, OPG will continue to support the industry efforts in the resolution of LBLOCA safety analysis margins using CAA as part of its long term plan. Additionally, OPG is in the process of developing detailed analysis plans for implementation of the CAA approach for its fleet of reactors. These plans will be submitted to the CNSC to obtain concurrence before execution of the analysis. Given the change in direction, OPG seeks to remove the Resolution Action from the IIP, with appropriate justification.

The objective of this assessment is to establish the basis for removal of Resolution Action G25-RS1-04-20 and associated IIP Action G25-RS1-04-20.1 from the IIP and demonstrate that the Resolution Action is not required to be in the IIP to support the continued operations of PNGS beyond the end of 2020. To support this basis, this assessment reviews the history of CSI development, and provides background information on the development of the IIP Resolution Action in the PSR2 process.

2.0 CANDU SAFETY ISSUE DEVELOPMENT

The staff of the Canadian Nuclear Safety Commission (CNSC) assess the resolution status of ongoing design and analysis Safety Issues for Canadian CANDU reactors and identified Risk Control Measures (RCMs) to address these issues. These Safety Issues are classified into three broad categories according to the adequacy and effectiveness of the control measures implemented by the licensees to maintain safety

margins. The issues that are considered relevant to CANDU reactors in operation in Canada were assessed in 2009, using a Risk Informed Decision Making (RIDM) process [5].

The safety issues are classified into the following three categories:

- *Category 1: The issue has been satisfactorily addressed in Canada.*
- *Category 2: The issue is a concern in Canada - appropriate measures are in place to maintain safety margins.*
- *Category 3: The issue is a concern in Canada - measures are in place to maintain safety margins, but the adequacy of these measures needs to be confirmed.*

For LBLOCAs, the CNSC identified the following Category 3 Safety Issues, along with each of their Risk Significance Level (RSL) [5]:

a. AA9 Analysis for Void Reactivity Coefficient (RSL3)

b. PF9 Fuel Behaviour in High Temperature Transients (RSL3)

c. PF10 Fuel Behaviour in Power Pulse Transients (RSL3)

d. PF12 Channel Voiding During Large LOCA (RSL2)

The RSL of a CSI is a measure of the impact on the risks related to various safety areas of a given issue. For the Category 3 CSIs, there were four Risk Significance Levels used to assess them [5]:

- *RSL1: There is no additional risk due to the matter of concern (MC) or the additional risk is negligible.*
- *RSL2: The MC causes a moderate increase of the risk, but it is still well within the tolerable region.*
- *RSL3: The increase of the risk from the state when the MC is absent is significant. RSL3 lies at or near the upper limit of the tolerable range and, as such, it represents significant concerns.*
- *RSL4: Highest risk increase. The accepted limits are exceeded. The risk is intolerable.*

The implementation of an RCM to a Category 3 CSI would reduce the Risk Significance of the CSI. For the four identified Category 3 CSIs related to LBLOCA, none were identified as RSL4, which would require immediate mitigating action. To address the four Category 3 CSIs, the CNSC concluded that two RCMs could be considered to address the issues related to LBLOCA, namely [5]:

- the Composite Analytical Approach (CAA), and
- the Low Void Reactivity Fuel (LVRF).

The industry has decided to develop the CAA to address the issues related to LBLOCA. The CAA involves a Leak-Before-Break approach to reclassify certain LBLOCA break scenarios to the Beyond Design Basis Accident (BDBA) category. This approach is expected to confirm the level of confidence in the adequacy of existing design provisions and the supporting safety case.

Based on completion and acceptance of analysis to address Channel Voiding, the CNSC approved the re-categorization of PF12 from Category 3 to Category 2 [6] in 2013. The CNSC accepted that the scope of PF12 was similar to a Generic Action Item (GAI) 00G01 – Channel Voiding during a Large Loss of Coolant Accident, which had been closed in the previous year [7].

Over the next several years, cooperation within the industry continued to develop the CAA for use. Considering the time frame expected for completion of the CAA initiative, in parallel, OPG initiated the modified Limit of Operating Envelope (LOE) methodology for DNGS to update LBLOCA analysis. Annually, OPG continues to provide progress updates to the CNSC on the Category 3 CSIs, the most recent in June 2020 [8]. The annual update is tracked as a Regulatory Management Action (REGM) under Action Request (AR) number 28234443.

As the industry has now progressed further in adoption of the CAA, OPG will continue to support the industry efforts in the resolution of LBLOCA safety margins using CAA as part of its long term plan. OPG is planning to implement CAA for its fleet of reactors to resolve the LBLOCA safety analysis margin issues and to enable re-categorization of the remaining three Category 3 CSIs related to LBLOCA.

3.0 IIP RESOLUTION ACTION GENERATION IN PSR2

This section provides an overview of how the CSI development led to the generation of the IIP Resolution Action in the PSR2 process.

As stated in Section 1.0, PSR2 was used to support and complement the licence renewal application for PNGS to support commercial operation beyond 2020. In accordance with CNSC REGDOC-2.3.3 [1], the elements of PSR2 consist of the following four phases:

1) *Preparation of a PSR2 Basis Document [9]*
   The PSR2 Basis Document describes the scope and methodology for PSR2.
2) *Conduct of the Safety Factor reviews and identification of Compliances and Gaps*
   Safety Factors cover all aspects important to the safety of an operating Nuclear Power Plant. The results of the Safety Factor reviews are documented in Safety Factor Reports. The Safety Factor Reports address the Review Tasks derived from IAEA SSG-25 [10] for Safety Factors 1 to 14 and from CNSC REGDOC-2.3.3 [1] for Safety Factor 15.
3) *Analysis of the Gaps and identification of potential safety enhancements for PNGS in the Global Assessment process*
   The Global Assessment takes into account the Gaps identified during the Safety Factor reviews, the findings from Complementary Reviews, and any findings from CNSC staff reviews of the Safety Factor Reports and Complementary Reviews. The Global Assessment includes consideration of the five levels of defence-in-depth in order to make a conclusion on the overall acceptability of operation of the plant over the period considered in PSR2.
4) *Preparation of a plan for the implementation of safety enhancements (Integrated Implementation Plan)*

Preparation of the Integrated Implementation Plan [3] involves transforming the proposed Resolution Plans resulting from the Global Assessment into actions with corresponding schedules for implementation during the next licensing period.

3.1 Safety Factor 5 – Deterministic Safety Analysis

For the Category 3 CSIs, as they were related to Deterministic Safety Analysis, the CSIs were captured under Safety Factor 5 (SF5) [11], which assessed the applicable documentation for Deterministic Safety Analysis. Seven Review Tasks were identified for SF5, with Review Task #7 being applicable to CSIs. Review Task #7 had the following description:

> ***Review Task #7****: Capabilities of the Plant in its Current State*
>
> *Confirm that the capabilities of the plant in its current state, and where relevant with account taken of planned safety improvements, have been demonstrated to be within regulatory requirements and expectations for both normal operation and accident conditions.*
>
> *In addition, confirm that plans are in place to ensure that forecast operational conditions of the plant will meet acceptance criteria for the design basis, including adequacy of safety margins, throughout the period of PSR2.*

The following gap was identified under this Review Task for LBLOCA CSIs:

> ***Gap SF5-2:*** *Per Review Task #7, for the Large Break Loss of Coolant Accident (LBLOCA) CANDU Safety Issues (CSIs), while the development of the industry's proposed Composite Analytical Approach (CAA) is on-going, the licensing basis of existing CANDU reactors for the LBLOCA scenario will continue to be based on conservative safety analysis for which acceptance criteria are established. For the Category 3 non-LBLOCA CSI, the industry has applied to re-categorize the issue into a lower category based on analytical evidence and actions taken. Since four CSIs applicable to Pickering NGS (3 LBLOCA / 1 non-LBLOCA) are currently in Category 3 and are undergoing further assessment in order to re-classify into a lower category and address operation past 2020, a gap exists for Pickering PSR2. Note, the 3 LBLOCAs CSIs are also captured as a gap in the PSR2 Continued Operations Plan (COP) Report (PSR2 Gap COP-20) as they relate to Pickering B Integrated Implementation Plan (IIP) Item I09. The 1 non-LBLOCA CSI is also identified as a gap in the Hazards Analysis Safety Factor Report (PSR2 Gap SF7-1) as it relates to pipe whip*[1]*.*

[1] Since the completion of SF5, COP-20 has been closed to the IIP Action in November 2019, as documented in Reference [12]. Therefore, this assessment only considers the IIP Action for removal. The one non-LBLOCA CSI is captured under a separate IIP Action, G25-RS2-04-21.1, and is not considered for removal in this assessment.

SF5 concluded that the deterministic safety analysis programs and procedures at OPG are comprehensive, resulting in a systematic and disciplined approach to identifying, prioritizing and addressing any safety analysis related issues[2].

3.2 Global Assessment Report

The objective of the Global Assessment is to provide an overall assessment of the safety of the plant, and to assess the acceptability of Pickering NGS for continued operation over the PSR2 period, including an assessment of the defence-in-depth capability of PNGS. The Global Assessment process is documented in the GAR [2].

The GAR grouped Gap SF5-2 under Global Issue-25 (GI-25), Category 3 CANDU Safety Issues. Global Issues were prioritized with respect to their overall impact on enhancing Nuclear Safety. The prioritization allowed Resolution Plans to be developed with more importance for the GIs with high impact on Nuclear Safety, in descending order. For GI-25, the GAR utilized the matrix in Table 1 to determine the Safety Significance Level of the GI.

[2] This is evidenced by discovery issues such as one related to delayed neutron fraction, which determines the response of CANDU reactors to reactivity additions. Through OPG's own internal systematic process, a preliminary impact assessment was completed, and concluded that no operability issues or concerns exist for PNGS and DNGS related to the delayed neutron fraction finding [13].

Table 1 - GI-25 Priority Determination

SECTION 4 - GI-25 PRIORITY DETERMINATION												
Safety Significance of Global Issue	**Deterministic Considerations**			**Probabilistic Considerations**								**Overall Safety Significance Level**
	E1 – Defence in Depth	E2 – Safety Significance Level	**Overall Deterministic Considerations**	F1 – Reactor Safety – Core Damage Frequency	F2 – Reactor Safety – Defence In Depth	F3 – Public Radiation Safety	F4 – Plant Operability	F5 – Occupational Radiation Safety	F6 – Emergency Preparedness	F7 – Environment	**Overall Probabilistic Considerations**	
	4	3	**3**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**N/A**	**3**

Rationale:

Resolution of this Global Issue will facilitate the reclassification of Category 3 CANDU Safety Issues, namely the CANDU Safety Issues related to Large Break Loss of Coolant Accidents and the CANDU Safety Issue related to high energy piping (IH6). Given the recent progress in addressing the findings of CNSC staff reviews, it is expected that the remaining Category 3 CSIs will be re-categorized to Category 2 (lower significance).

Regarding deterministic considerations, this Global Issue is not directly related to Defence in Depth (E1). However, although no safety barrier is directly impacted, completing the closure criteria for these CANDU Safety Issues will facilitate re-categorization of these CANDU Safety Issues to Category 2. Therefore, Safety Significance Level 4 is assigned to Defence in Depth (E1). Safety Significance Levels (E2) is assigned Safety Significance Level 3 since this issue is considered not significant by itself and has been supported by analytical evidence as discussed in Section 5 of this Global Issue. Accordingly, the overall Safety Significance Level for deterministic considerations is 3.

This Global Issue has no direct impact on the probabilistic considerations, i.e., Core Damage Frequency (F1), Defence in Depth (F2), Public Radiation Safety (F3), Plant Operability (F4), Occupational Radiation Safety (F5), Emergency Preparedness (F6) and Environment (F7). Therefore, these probabilistic considerations are not applicable.

In summary, the overall Safety Significance Level is 3. OPG is progressing the required work to complete the re-categorization of IH6[3] and is working with the industry on completing the re- categorization of the CANDU Safety Issue related to Large Break Loss of Coolant Accidents.

The overall Safety Significance level for GI-25 was concluded to be 3 – Low.

[3] As stated in Section 3.1, the recategorization of IH6 is tracked under a separate IIP Action and is not considered for removal in this assessment.

After the prioritization, a Resolution Plan for GI-25 was developed. The Resolution Plan provided the Resolution Statement GI-25-RS1:

> *Complete the re-categorization of the Large Break LOCA (LBLOCA) CANDU Safety Issues to Category 2.*

Subsequently, each Resolution Statement was ranked. Ranking of the Resolution Statements provides an order of priority to resolve them based on the magnitude and timeliness of the benefit to be achieved. For GI-25-RS1, the GAR gave a normalized ranking value of 19/100, with 100 being the highest ranking. GI-25-RS1 had the second lowest ranking value out of 35 Resolution Statements.

The GAR recognized that industry was progressing with updates to LBLOCA analysis, and therefore assigned a low ranking. With this final ranking for GI-25-RS1, the Resolution Statement was then transferred to the IIP to be actioned.

3.3 Integrated Implementation Plan for GI-25-RS1

In the final step of the PSR2 process, the IIP [3] was completed incorporating each Resolution Action from the GAR with baseline Target Completion Dates (TCDs). Each Resolution Action was captured in the form of an IIP Action. For GI-25-RS1, this was captured as the Resolution Action G25-RS1-04-20 and associated IIP Action G25-RS1-04-20.1, as seen in Table 2 below.

Table 2 – IIP Resolution Action G25-RS1-04-20 and Associated IIP Action G25-RS1-04-20.1

Appendix B: Integrated Implementation Plan Resolution Action (RA) Overview		
GI #	**GI Title**	**CNSC S&C Area**
GI-25	**Category 3 CANDU Safety Issues**	04 – Safety Analysis
	Resolution Action	**Gap ID**
G25-RS1-04-20	Complete the re-categorization of the Large Break LOCA (LBLOCA) CANDU Safety Issues to Category 2. OPG submitted an update to CNSC staff on the resolution of the LBLOCA issue [N-CORR-00531-18022, OPG Correspondence, Resolution of Large Break LOCA (LBLOCA) Safety Analysis Margin Issue, April 25, 2016]. An OPG update on the status of CSIs and their resolution is submitted to the CNSC annually, the latest being [N-CORR-00531-18052, Progress Update On Category 3 CANDU Safety Issues - Implementation of Risk Control Measures, June 15, 2016]. Given the recent progress by industry in addressing the findings of CNSC staff reviews, it is expected that the remaining Category 3 CSIs will be re-categorized to Category 2 in 2017.	SF5-2, COP-20
AR #		**Related GI**
28206295		N/A
Completion Criteria:	Updated LBLOCA analysis is completed per N-CORR-00531-18618 (which contains the most current status update of Category 3 CANDU Safety Issues). Analysis results submitted to CNSC as part of request to re-categorize LBLOCA issues to Category 2.	**RS Ranking**
		34
Success Criteria:	Updated LBLOCA analysis submitted as part of request to re-categorize to Category 2 to CNSC for review.	**TCD**
		2020

IIP Action #	IIP Action Information	Unit	AR #	IIP Action	TCD
G25-RS1-04-20.1	**Re-categorization of the Large Break Loss of Coolant Accident**	018	28206295-01	N-SAIP	2020-06-30
Action:	Per N-CORR-00531-18618 (which contains the most current status update of Category 3 CANDU Safety Issues) use a modified limit of operating envelope (LOE) safety analysis methodology to update the LBLOCA analysis and re-categorize LBLOCA CSI to Category 2.				
Completion Criteria:	Updated LBLOCA analysis has been completed and submitted to CNSC as part of request to re-categorize LBLOCA CSI to Category 2.				

4.0 BASIS FOR REMOVAL OF IIP RESOLUTION ACTION G25-RS1-04-20

The basis for removal of IIP Resolution Action G25-RS1-04-20 and the associated IIP Action G25-RS1-04-20.1 must establish that the Resolution Action is not required to be in the IIP to support continued safe operation of PNGS beyond the end of 2020.

The LBLOCA scenario does not pose a large real safety risk due to the extreme conservatisms associated with the traditional LOE analysis methodology. This approach assumes a conservative treatment of break size and its opening characteristics. It then establishes a scenario where it is assumed that the reactor is operating at all Safe Operating Envelope (SOE) limits simultaneously with multiple simultaneous impairments of the mitigation systems. Hence, applying the LOE methodology establishes an incredibly low probability scenario with minimal contribution to plant safety risk from a LBLOCA.

As stated in Section 3.1, the gap SF5-2 determined that, “while the development of the industry’s proposed Composite Analytical Approach (CAA) is on-going, the licensing basis of existing CANDU reactors for the LBLOCA scenario will continue to be based on conservative safety analysis for which acceptance criteria are established.” Therefore, resolution of this gap by the end of 2020 is not required to support continued safe operation of PNGS past 2020.

To demonstrate that the overall conclusions of the GAR are not changed with the removal of the IIP Resolution Action, the prioritization and ranking results of the GAR are re-examined. The SF5-2 gap prioritization is provided in Table 1. To complete the prioritization, the GAR considered two aspects of GI-25, deterministic and probabilistic considerations. For deterministic considerations, there were two attributes considered, Defence-in-Depth, and Safety Significance Level. The Defence-in-Depth assessment consists of a hierarchical deployment of different levels of equipment and procedures in order to maintain the effectiveness of physical barriers placed between radioactive material and workers, the public or the environment, during normal operation and postulated events at the plant. As stated in Table 1, GI-25 is not directly related to Defence-in-Depth, hence a value of 4 was assigned. The issue does not result in a new initiating event and has no impact on the frequency of the LOCA initiating events. Therefore, the removal of the IIP Resolution Action does not change the conclusions on the deterministic aspects of Defence-in-Depth assessed in the GAR.

The GAR assigned a ranking of 3 to the Safety Significance Level, in accordance with Table E2 of the PSR2 Basis document [9]. Table E2 assigns Safety Significance Levels for GIs without a direct nuclear safety impact. In other words, GIs without an impact to Defence-in-Depth measures. A rank of 3 is assigned to an issue or condition which is not significant by itself, but has potential to be more significant or may be precursor to a more significant issue or condition. As stated in Table 1, GI-25 is not considered significant by itself, and has been supported by analytical evidence, as demonstrated in Section 2.0 of this assessment. Therefore, removal of the IIP Resolution Action does not change this conclusion. Hence, the GI-25 conclusions remain unaffected with regard to the deterministic aspects assessed in the GAR.

Similarly, the GI was determined to have no direct impact on the GAR probabilistic ranking criteria, where the criteria are Core Damage Frequency, Defence-in-Depth,

Public Radiation Safety, Plant Operability, Occupational Radiation Safety, Emergency Preparedness and Environment. Because of the low frequency of the LBLOCA initiating event and its limited consequences, it does not contribute to Severe Core Damage Frequency. Only when postulating additional heat sink related failures, unrelated to the CSIs, could the LBLOCA result in a very small contribution to severe core damage. Therefore, the LBLOCA has no impact on the criteria ranking and removal of the IIP Resolution Action does not impact the conclusions reached in the GAR for the probabilistic consideration aspect.

When the PSR2 process was conducted in 2017, resolution of gap SF5-2 was considered to be practicable within the GAR prioritization time frame. However, given current knowledge, it could have been classified as an Acceptable Deviation within the context of PSR2. The following is stated in the PSR2 Basis document [9]:

> *Items of Very Low Impact on Nuclear Safety (Safety Significance level 4) will generally be deemed as Acceptable Deviations within the context of PSR2 (with the rationale provided), and while these items will not be tracked beyond the Global Assessment, they will be shared with the accountable organizations for consideration as potential enhancement initiatives for their future work program planning purposes. This will allow the organizations to prioritize the initiatives as part of their integrated programs to ensure the focus is on the right overall priorities. A similar treatment will be applied for items of Low Impact on Nuclear Safety (Safety Significance level 3) for which a practicable solution is not readily evident.*

Gap SF5-2 is considered in GI-25, which is prioritized as Safety Significance level 3, as established in Table 1. A resolution of the issue is no longer practicable within the original time frame to support re-categorization of the Category 3 CSIs. The planning for completion of the LBLOCA analysis using the CAA methodology is currently being developed. Therefore, gap SF5-2 can be considered to be an Acceptable Deviation, which does not require separate tracking beyond the Global Assessment.

For the ranking of G25-RS1, the GAR ranked the IIP Resolution Action to have the second lowest impact out of 35 IIP Resolution Actions. Furthermore, the enhancement value brought to the IIP by resolving this action by the end of 2020 is deemed to be minimal, as evidenced by the GAR ranking of the Resolution Statement. On this basis, the removal of the IIP Resolution Action will not change the overall conclusions of the GAR. The overall conclusion of the PSR2 continues to remain the same, as the resolution of the IIP Action does not impact the ability of PNGS to safely operate beyond the end of 2020, as evidenced by the discussion above.

OPG is continuing to advance LBLOCA analysis and has been continuing to update the CNSC staff with progress and status. However, it is evident that completion of the IIP Action is not practicable within the framework of PSR2, given the development period of the CAA, as discussed in Section 2.0. It is given that actual resolution to re-categorize the Category 3 CSIs will be beyond the IIP TCD of December 31, 2020. Therefore, to ensure the IIP Action can be completed outside the framework of PSR2, there is already a mechanism which is fully effective in monitoring the LBLOCA analysis to completion.

OPG provides annual progress updates to the CNSC on the Category 3 CSIs, the most recent in June 2020 [8]. This includes progress updates on the status of LBLOCA analysis. On this basis, it is unnecessary for the PNGS IIP to continue tracking of LBLOCA analysis to completion.

5.0 CONCLUSIONS

As established in Section 4.0, IIP Resolution Action G25-RS1-04-20 and the associated IIP Action G25-RS1-04-20.1 are justified to be removed from the IIP without affecting the ability for PNGS to continue to safely operate beyond the end of 2020. The overall conclusions of the GAR are not changed by the removal of the IIP Resolution Action, as the conclusions of the GI remain unchanged in the deterministic aspect with no impact to Defence-in-Depth measures assessed in the GAR. For the probabilistic aspects assessed by the GAR, recategorization of the Category 3 CSIs remain not applicable. Further, the ranking of the Resolution Statement G25-RS1 was low. Therefore, there is minimal enhancement value to the IIP for this Resolution Action to remain.

In practicality, to complete the IIP Action, an effective tracking mechanism for LBLOCA analysis already exists in Category 3 CSI tracking. An update is provided annually to the CNSC through this tracking mechanism.

Therefore, removal of IIP Resolution Action G25-RS1-04-20 and the associated IIP Action G25-RS1-04-20.1 is justified since GAR conclusions are minimally affected, and the IIP Action is adequately tracked through another fully effective mechanism. This assessment concludes that removing the Resolution Action from the IIP does not impact the ability for the continued operations of PNGS beyond the end of 2020.

6.0 REFERENCES

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