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DARLINGTON NGS INTEGRATED IMPLEMENTATION PLAN

Darlington NGS Integrated Implementation Plan (IIP)

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Prepared by:
Garry Lam — Date: April 21, 2015
Section Manager
Nuclear Safety Integration
Nuclear Refurbishment

Prepared by:
Thomas Lau — Date: April 21, 2015
Manager
Nuclear Safety Integration
Nuclear Refurbishment

Reviewed by:
Imtiaz Malek — Date: April 21, 2015
Director
Nuclear Safety
Nuclear Refurbishment

Reviewed by:
Behzad Alavi — Date: April 21, 2015
Senior Manager
Plant Aging Management

Reviewed by:
Jeff Lehman — Date: 21-APR-2015
Director
Station Engineering
Darlington NGS

Approved by:
Dietmar Reiner — Date: Apr 24/15
Senior Vice President
Nuclear Projects

Approved by:
Brian Duncan — Date: April 24/2015
Senior Vice President
Darlington NGS

Table of Contents

Page

List of Tables and Figures

Page

Tables

Revision Summary

Revision Number	Date	Comments
R000	2013-11-14	Initial Issue
R001	2014-10-31	General - Revised IIP to reflect feedback received following CNSC staff initial review [R-6] Section 1.0 - Added Section 1.1 CNSC Review and Assessment of the GAR and IIP Section 2.0 - Added the IIP Criteria used for the CCA and Code Gap IIP Commitments. Section 3.0 - High-level expectation of schedule has been provided. - Life Extension Model has been removed. Major Activities - Major Activities have been removed as they are identified in the respective IIP Commitment tables located in the Appendices. IIP Change Control Process - The IIP Change Control Process has been limited to a high-level description. Specific details will be described in the IIP Change Control Process document. Tables - Removed Roadmap of Items Considered in the Development of the IIP. Appendices - Appendix A identifies the Open IIP Commitments for EA, CCAs and Code Gaps. - Appendix B identifies the IIP Commitments that have been completed for EA, CCAs and Code Gaps. - Appendix C identifies the IIP Item Number mapping between IIP R000 and IIP R001. - Appendix D describes the Integrated Aging Management Program.
R002	2015-04-30	General Revised IIP to reflect feedback received from CNSC staff of IIP R001 [R-7]. Section 3.0 Clarified TRF work to be managed by TRF lifecycle planning Section 5.0 Removed as managed systems instruction for Change Control and Close-out of actions has been issued Appendix A Removed items completed since R001 issuance Appendix B Inserted items completed since R001 issuance Appendix C Updated table for completed items

1.0 INTRODUCTION

The Darlington Nuclear Generating Station, also referred to here as Darlington, is a four-unit generating station that includes a separately housed Tritium Removal Facility (TRF). The site is located in the Municipality of Clarington, Regional Municipality of Durham, in the Province of Ontario. Darlington has operated successfully since the early 1990s and a program has been implemented to extend the life of the plant for 30 additional years.

The justification for the continued operation of Darlington following Life Extension is documented in a Global Assessment [R-1] carried out in accordance with the Canadian Nuclear Safety Commission (CNSC) Regulatory Document RD-360, "Life Extension of Nuclear Power Plants" [R-2]. The regulatory document, hereafter referred to as RD-360, requires the licensee to demonstrate that continued station operation poses no unreasonable risk to health, safety, security of the public or the environment, and will continue to conform to international obligations.

The results from the Global Assessment [R-1] demonstrated that Darlington is a safe and reliable nuclear power plant today. Implementation of the improvements, as documented here, will result in Darlington being an even safer and more reliable source of clean electrical power to the Province of Ontario for another 30 years.

Three principal activities were undertaken by OPG to systematically identify the environmental and safety enhancements that will assure ongoing safe operation for 30 additional years:

1. Environmental Assessment (EA)

   The EA is a comprehensive assessment of the potential impacts of refurbishment and continued operation on the natural environment including public safety and socio-economic considerations. The EA is focused on the impacts beyond the plant boundary. The EA determined that refurbishment and continued operation of Darlington, given the mitigations described, will not have significant adverse environmental impacts. The results of the EA are contained in the Environmental Impact Statement [R-3], the technical support documents, and the CNSC decision as documented in the CNSC's Record of Proceedings [R-4].

2. Integrated Safety Review (ISR)

   The ISR is a systematic and comprehensive assessment of the plant design and actual condition, and of the management system used to operate and maintain the nuclear plant. The ISR enabled determination of the reasonable and practical modifications that should be made to the plant design or the management system to further enhance future safe operation. The results of the ISR are documented in a series of reports based on established Safety Factor review topics listed in N-PROC-LE-0005 "Nuclear Refurbishment Integrated Safety Review – Darlington" [R-5].

3. Global Assessment (GA)

   The Global Assessment used the results of the EA and ISR and examined them in an integrated manner. It assessed the strengths, opportunities for improvement, and actions to address the opportunities for improvement, in order to provide an overall judgment on the acceptability of the risk arising from continued operation. The GA further assessed the adequacy, and implementation timing of the actions arising from the EA and ISR that are identified to extend the life of the plant.

The IIP presents the scope and schedule for the implementation of actions identified through the ISR and the EA.

1.1 CNSC Review and Assessment of the GAR and IIP

Canadian Nuclear Safety Commission (CNSC) staff completed their review and assessment OPG's submission of the Global Assessment Report (GAR) and Integrated Implementation Plan (IIP). As documented in the CNSC correspondence letter [R-6], OPG's GAR as submitted was acceptable to CNSC staff as it meets all applicable requirements of RD-360. CNSC staff accepted OPG's IIP Revision 001 with implementation of several required specific changes [R-7].

2.0 INTEGRATED IMPLEMENTATION PLAN (IIP) SCOPE

The scope of OPG's Integrated Implementation Plan (IIP) includes:

- Mitigating measures and follow-up program activities from the Environmental Assessment (EA)
- Actions from the Integrated Safety Review:
    - Recommendations from Component Condition Assessments (CCA);
    - Actions to close gaps identified through the balance of the Integrated Safety Review (ISR) and CNSC questions; and
    - Actions resulting from the review of updates to modern ISR Codes and Standards and significant operating experience since the submission of the ISR to the end of 2013.

1. The Environmental Assessment (EA)

The scope of the IIP resulting from the EA includes the mitigation measures, the Safety Improvement Opportunities (SIO's) committed in the EA and the follow-up program elements. The mitigation measures and SIOs address potential environmental effects. The follow-up program elements are actions to confirm that the predictions of environmental effects are accurate post refurbishment, and that the mitigation measures are effective.

2. Components Condition Assessments (CCAs)

CCAs were performed on critical components to determine condition, reliability of material and to ensure that required activities are in place to monitor the condition of the components going forward; or that components are repaired or replaced as necessary to ensure good system performance as the plant ages. The Aging and Actual Condition of SSCs Safety Factor Report presented a preliminary list of recommended actions required to allow each unit within the station to reach the end of its current life, as well as actions to be undertaken during and following the refurbishment.

Actions to address issues identified in the CCAs are included in the IIP based on the following criteria:

- Components that are part of the 58 Safety Related Systems identified in the ISR; and
- Components have high nuclear Safety Significance (Reactor Safety 1 or 2); and

- Components with a condition of less than “Good”, and the activities to bring them to “Good” condition are not already part of normal station maintenance; or

- Components rated with a condition of “Good” based solely on past performance history and no physical inspections have been done. Inspection activity is required to confirm actual physical condition of component;

Actions resulting from the CCA Recovery Project are included in the IIP if they met the criteria outlined above.

Any future CCA actions that meet the above criteria will be processed in accordance with the Aging Management Process [R-8].

3. Code Gaps

As part of the ISR, safety improvements were proposed to address gaps with respect to safety requirements identified during the review of modern codes and standards identified in N-PROC-LE-0005 [R-5]. Related gaps were consolidated into ISR Issues for prioritization and resolution. The safety significance of these ISR Issues was assessed in accordance with the Issue Prioritization Process N-INS-00770-10005 [R-9].

The code gaps have been consolidated into ISR Issues; ISR Issues with similar resolutions have been consolidated with a single action plan and completion date. TRF actions have been removed from the IIP as they will be managed by the TRF life cycle plan.

IIP scope will be monitored to completion and closed out through its own approved processes. Normal component ageing for the remaining station life will be managed in accordance with the Integrated Aging Management (IAM) Program N-PROG-MP-0008 [R-10] and executed as part of normal station practices. The IAM Program ensures that the condition of critical equipment is understood and that activities are in place to ensure the health of these components and systems while the plant ages. Elements of the IAM Program are detailed in Appendix D.

3.0 IIP SCHEDULE

The Darlington Life Extension Plan is to have:

- EA activities implemented in accordance with the EA Screening Report and EA Follow Up Program Report;
- The majority of unit specific physical work completed prior to restart of the first complete maintenance outage following the Refurbishment Outage for each respective unit;
- The majority of inspections required to confirm condition completed prior to unit restart from each respective Refurbishment Outage.
- The timing to execute contingency actions (repairs or replacements resulting from inspections) will be determined by using a graded approach:
    - Inspection results that are favourable will require no further action;
    - Inspections revealing minor degradation will require either enhanced monitoring or will be addressed by normal station practices;
    - Inspections revealing safety significant defects that would prevent unit start-up will be prioritized in alignment with the Technical Operability Evaluation Process N-PROC-MP-0045 [R-11] and corrected as required prior to unit restart of each respective Refurbishment Outage.
- The majority of safety improvements applicable to the entire station will be implemented prior to the restart from the Unit 2 Refurbishment Outage;

Specific year end completion dates have been identified for all actions in the IIP for unitized and non-unitized work, unless otherwise noted. There are cases where the activity will be completed by the restart of a unit outage rather than the year end date. These details have been provided in the ‘Date’ column of the subsequent tables.

4.0 DESCRIPTION OF APPENDICES

Appendix A - IIP Commitments

Activities identified in Appendix A are open actions which are required for Life Extension. These include:

- EA Mitigation Program Elements including SIO's (Table 1);
- EA Follow-Up Monitoring Program Elements (Table 2);
- Component Condition Assessments (Table 3);
- Code Gaps (Table 4).

Appendix B - Completed Activities

Activities identified in Appendix B have been completed since the submission of IIP R000 and R001. These include:

- EA Activities (Table 5);
- Component Condition Assessments (Table 6,7);
- Code Gaps (Table 8, 9).

Reference to the associated completion documentation has been provided.

Appendix C - IIP Mapping

In R001 of the IIP, new IIP Item Numbers were assigned to each activity as multiple line items were consolidated into a single line item. Appendix C identifies the mapping between the IIP Item Number in IIP R000 and IIP R001. The numbering established in R001 of the IIP remains the same in R002 of the IIP.

Appendix D – Integrated Aging Management Program

Appendix D describes the elements of the OPG equipment aging management process.

Appendix A: Open Activities

Table 1 is a summary of the activities to address the EA Mitigation Measures. Table 2 is a summary of the activities to address EA Follow-up Program Elements. The following is a brief description of the columns for both tables:

1. The 'IIP Item Number' column lists a unique identifier. This number remains the same as was produced in R001 of the IIP. Appendix C identifies the mapping between the IIP Item Number in IIP R000 and IIP R001.
2. The 'Environmental Component' column identifies the source reference(s) for the line item.
3. The 'Mitigation Objective' or 'Monitoring and Follow-up Objective' column lists the high level mitigation measure or follow-up program elements.
4. The 'Action Plan' column lists the proposed strategy to meet the objectives of the mitigation measures and follow-up program elements.
5. The 'Tracking Number' column lists the Action Request (AR) number or Darlington Scope Request (DSR) number that internally tracks each item to completion.
6. The 'Completion Date' column identifies the year end date in which the identified actions will be completed. 'Refurbishment Outage' completion dates are linked to the Refurbishment Outage restart dates and not the year end date.

Table 1: EA Mitigation Measures (Open Activities)

IIP Item Number	Environmental Component (Reference)	Mitigation Objective (In design and Additional Mitigation Measures)	Action Plan	Tracking Number	Completion Date
IIP-EA 001	Aquatic CNSC Screening Report - page 90 (also in EIS Table 5.15)	Mitigate fish impingement and entrainment losses by means of offsetting.	1) Evaluate the need for a *Fisheries Act* authorization and document rationale for decision. Reference: NK38-CORR-00539.4-10001 Authorization under the Fisheries Act for DNGS 2) Submit application to obtain authorization under section 32 of the *Fisheries Act* as appropriate. Application will assess the need for long term impingement and entrainment monitoring beyond those required as part of the Follow-up monitoring program. 3) Develop any compensation program and update environmental monitoring program/procedures to include requirements defined by the Fisheries Act authorization which may include impingement and entrainment monitoring, thresholds to trigger review of mitigation options and compensation/offset program.	Complete [R-13] Complete [R-14] AR# 28159540-17	2014 2014 2016
IIP- EA 003	Socio-Economics CNSC Screening Report – page 108, 109 and 111 (also in EIS Table 5.15) Traffic and Transportation CNSC Screening Report – page 107 (also in EIS Table 5.15)	Reduce traffic disruption during peak periods and maintain safe traffic conditions both on-site and off-site during the Refurbishment Phase.	1) Develop a Traffic Management Working Group (TMWG) Terms of Reference between the interested parties (OPG, Ministry of Transportation, Durham region and Clarington) to plan a coordinated program of road improvements to maintain safe and efficient transportation operations in the Local Study Area. Darlington Nuclear Traffic Management “Working Group” (TMWG), NK38-CORR-13110-0456325, provides the Terms of Reference (purpose, mandate, scope of activities, membership, schedule and agenda/minutes) 2) Develop and implement a Travel Demand Management (TDM) program to reduce and control DN site traffic during peak periods and to reduce disruption to the use or enjoyment of community and recreational facilities on or off the DN site. Issue a report documenting the TDM initiatives that were implemented. TDM initiatives will consider shift changes at times other than traditional peak travel periods; shuttle/transit service to DN site, and carpool incentives. 3) Perform an assessment to confirm effectiveness of traffic management and travel demand management initiatives by periodically assessing levels of service at key intersections and road links during Refurbishment phase (until Horizon 2021 which represents peak Project-related traffic conditions).	Complete [R-15] AR# 28159540-02 AR# 28159540-01	2014 2017 2022

IIP Item Number	Environmental Component (Reference)	Mitigation Objective (In design and Additional Mitigation Measures)	Action Plan	Tracking Number	Completion Date
IIP- EA 005	Socio-Economics CNSC Screening Report – page 110 and 111 (also in EIS Table 5.15)	Inform neighbours and the public of the refurbishment project and on-going activities of the DNGS operations.	1) Ensure activities to periodically inform the public about the progress of the Project; share information with key stakeholders regarding the timing and magnitude of the on-site labour force; and work in partnership with government and educational institutions through existing liaison mechanisms and programs, are identified in communication plans in accordance with NK38-PLAN-09701-10067 Refurbishment Program Communications Plan. Issue annual communication reports documenting the above. 2) Communicate information to the public based on level of public interest of station operations, activities, and anticipated effects on environment and the health and safety of persons. “Nuclear Public Information and Disclosure,” N-STD-AS-0013 defines the on-going public and stakeholder communication program.	AR# 28159540-38 to -46 2014 report completed [R-16] AR# 28159540-38 to -46 2014 report completed [R-16]	Annually from 2014 to 2025 Annually from 2014 to 2025
IIP-EA 006	Socio-Economics CNSC Screening Report – page 110 (also in EIS Table 5.15)	Minimize disruption of recreation facilities and amenities on the DN site which includes maintaining public access to the Waterfront Trail.	1) Establish and maintain agreements with the Municipality of Clarington to ensure safe public access of the Waterfront trail that traverses the DN site. Site Plan Agreement (G14375) item #8 specifies the OPG lands set aside for the Waterfront trail and the Licensing agreement (Licence P502128) for the Waterfront trail. 2) Undertake a Recreational User Survey of DN site recreation facilities for two seasons in one year after the restart of all reactors. 3) Results of the Recreation User Survey will be reviewed as part of the DN Public Affairs program and with the Community Advisory Committee.	Complete [R-17] [R-18] AR# 28159540-03 AR# 28159540-04	2012 2026 2026

IIP Item Number	Environmental Component (Reference)	Mitigation Objective (In design and Additional Mitigation Measures)	Action Plan	Tracking Number	Completion Date
IIP-EA 009	Accidents & Malfunctions CNSC Screening Report Section 7.5.2	Implement the following design modifications as identified in Section 7.5.2 in the CNSC Screening Report through the Safety Improvements for the DNGS Refurbishment Project. Credit for these improvements were taken in the EA resulting in RC7 as the representative accident scenario: 1. Containment Filtered Venting System (CFVS) 2. Powerhouse Steam Venting System (PSVS) 3. Third Emergency Power Generator (EPG) 4. Provision of Alternate and Independent Supply of Water to Heat Transport System (Emergency Heat Sink).	Implement the following modifications: 1) A Containment Filtered Venting System (CFVS). The purpose of the CFVS is to provide controlled and filtered emergency venting of containment to prevent over-pressurization and assure containment integrity in the unlikely event of a multi-unit Severe Accident. A Severe Accident is a Beyond Design Basis Accident [1](BDBA) that involves significant core degradation. To enhance the CFVS modification, a Shield Tank Overpressure Protection modification will be implemented. The purpose of this modification is to enhance the relief capacity of the shield tank surrounding each unit's calandria vessel to prevent shield tank catastrophic failure and to limit the containment over pressurization in the unlikely event of a multi unit Severe Accident. 2) Powerhouse Steam Venting System (PSVS) enhancements. These enhancements are related to duplication of the programmable controller logic of the current PSVS to improve the reliability of the PSVS which is an important system to protect plant systems following a steam line break. 3) A third Emergency Power Generator (EPG3). The third EPG is planned to be able to withstand a seismic event which is more demanding than the Design Basis Earthquake for which the existing two EPGs are designed, and to increase emergency power reliability when one EPG is not available. A Design Basis Earthquake is a representation of the combined effects, at the site, of a set of possible earthquakes having a very small probability of being exceeded during the life of the plant. 4) Provide an alternate and independent source of Emergency Water supply to the Heat Transport System by: a. Installing Emergency Mitigation Equipment. b. Installing permanent Fire Water pumps and a permanent line from the Emergency Service Water System to the Heat Transport System and using an existing Emergency Coolant Injection System line for injection to the Heat Transport System..	DSR# IP0030-1 DSR# IP0540-1 DSR# SI0040-1 DSR# SI0030-1 Complete [R-19] DSR# SI0050-1	U0: 2016[2] U3: 2015 U4: 2016[2] U1: 2017[3] U2: 2019 (Refurbishment Outage Restart) U1: 2016[2] U2: 2016[2] U3: 2016[2] U4: 2016[2] U0: 2016[2] 2012 U2: 2019 U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart)

[1] A BDBA is an event with a frequency of occurrence less than 1 in 100,000 reactor years.
[2] Activity will be completed prior to U2 Refurbishment breaker-open.
[3] Activity will be completed prior to U2 Refurbishment Outage Restart (breaker-closed) and prior to bulkhead installation.

Table 2: Follow-up Program Elements (Open Activities)

IIP R001 Item Number	Environmental Component (Reference)	Monitoring and Follow-up Objective	Action Plan	Tracking Number	Completion Date
IIP EA-010	Surface Water CNSC Screening Report – page 167	Characterize the conventional chemical (i.e., non-radiological) parameters present in DNGS effluent streams.	1) Develop a sampling plan. Measured parameters will be based on sources of chemicals, metals of construction (e.g. corrosion product transport), and review of Constituents of Potential Concern (COPCs) considered in the EA studies (see Non-Human Health – Ecological Risk Assessment TSD (OPG 2011d) and Human Health TSD (OPG 2011e)). The monitoring frequency will be determined considering the range of conditions encountered under normal operations. Proposed sample locations are at the point of discharge (i.e., MISA or ECA control point). Condenser cooling water (CCW) sampling is also proposed as confirmation of the parameters measured in the systems and to compare with ECA limits.	Complete [R-20]	2014
			2) Conduct effluent characterization according to sampling plan.	AR# 28159540-19	2016[2]
			3) Document and report findings. Update the Liquid Effluent Assessment performed during the EA studies considering the results of the effluent characterization. The measured concentrations will be used to identify Constituents of Potential Concern (COPC). Assess the exposure to the COPCs and provide an assessment of environmental risk to receptors. The ERA will be revised according to these new insights. If the ERA identifies new environmental issues or the need to study an environmental issue further, additional site data may be needed to refine exposure calculations, reduce uncertainty and identify risk management or remediation measures if required. These recommendations identified as part of this follow-up program element will be addressed as part of compliance with CSA N288 series standards and incorporated in the site Emergency Management Plan accordingly, and this follow-up monitoring will be complete.	AR# 28159540-20	2016

[2] Activity will be completed prior to U2 Refurbishment breaker-open.

IIP R001 Item Number	Environmental Component (Reference)	Monitoring and Follow-up Objective	Action Plan	Tracking Number	Completion Date
IIP EA-011	Surface Water CNSC Screening Report – page 167	Confirm the effectiveness of mitigation measures to protect stormwater quality in the area subject to refurbishment activities (i.e., Protected Area).	1) Develop a sampling plan. Measured parameters will include MISA parameters as well as other historic relevant parameters based on water quality monitoring. The sample design should be based on the methodologies employed in the DNGS EA to allow comparison with historical studies. Sampling locations will be established during development of the study plan and focus on areas within the Protected Area (e.g., 2010/2011 stormwater control study catchment areas K1, K2, K3, J, L and M). 2) Conduct a stormwater control study according to the sampling plan. 3) Document and report findings. Include a comparison to previous stormwater sampling results and recommendation for additional monitoring if required.	AR# 28159540-06 AR# 28159540-07 AR# 28159540-08	2018 2019 2020
IIP EA-012	Aquatic CNSC Draft Report – page 97, 160 and 168 (Also in EIS Table 11.6.2)	Confirm the accuracy of the predictions made in the EA concerning changes in lakewater temperatures in the vicinity of the CCW discharge, and their associated possible effects on survival rates for round whitefish embryos.	1) Obtain and review the results of an in-progress CANDU Owners Group (COG) study examining thermal effects to round whitefish eggs over the two winter seasons (2011/2012 and 2012/2013). 2) Develop a sampling plan. A Thermal Monitoring Protocol Agreement established through consultations with regulatory agencies and other stakeholders will be included in the sampling plan. The Protocol should consider the results of the COG study in establishing: • Thermal benchmark(s) for comparison of measured values. • Determination of location(s) for ambient water temperature monitoring; and • Temperature thresholds that would trigger adaptive management response (e.g., increased thermal monitoring). 3) Implement annual ambient water temperature monitoring. 4) Conduct thermal monitoring during Refurbishment outage. 5) Report monitoring data collected during Refurbishment outage and assess likely effects on the survival of round white fish embryos. If the performance threshold is exceeded, review available mitigation options to determine if additional technically and economically feasible opportunities are available to further reduce the potential for effects. 6) Conduct thermal monitoring after restart of all reactors (i.e. Continued Operation phase). 7) Report monitoring data collected during Continued Operation phase and assess likely effects on the survival of round white fish embryos. If the performance threshold is exceeded, review available mitigation options to determine if additional technically and economically feasible opportunities are available to further reduce the potential for effects.	Complete [R-21] AR# 28159540-22 AR# 28159540-23 AR# 28159540-24 AR# 28159540-25 AR# 28159540-26 AR# 28159540-27	2015 2015 2016 2020 2021 2026 2027

IIP R001 Item Number	Environmental Component (Reference)	Monitoring and Follow-up Objective	Action Plan	Tracking Number	Completion Date
IIP EA-013	Aquatic CNSC Screening Report – pages 168 to 171 (Also in EIS Table 11.6.2 and "Adaptive Management for Impingement and Entrainment Effects During Continued Operations of DNGS" (Discussion Draft))	<u>Benthic Invertebrate Community Study</u> Determine baseline abundance and species diversity of benthic invertebrates in the vicinity of the DNGS intake. Species presence will be classified to order (or genus if possible) and will be compared to future entrainment study results. These benthic results will also be compared to near shore benthic studies conducted in 2008 in the vicinity of the proposed New Nuclear at Darlington (NND) infill area. <u>Entrainment Monitoring</u> • Characterize early life stages of fish and macro invertebrates being entrained by station operation. The sampling should be conducted in a manner sufficient to reflect the diel and seasonal cycles in organism abundance within the capture zone of the intake; • Monitor at a level capable of detecting fish Species at Risk and aquatic species of conservation concern that have been identified by provincial or federal agencies. Sampling should target species based on life history characteristics and potential for interaction with station operation; and, • Determine the total fish and macro invertebrate losses and associated impact. <u>Impingement and Entrainment</u> • Characterize early life stages of fish and macro invertebrates being entrained and fish impinged by station operation. The sampling should be conducted in a manner sufficient to reflect the deil and seasonal cycles in organism abundance within the capture zone of the intake; • Monitor at a level capable of detecting fish Species at Risk and aquatic species of conservation concern that have been identified by provincial or federal agencies. Sampling should target species based on life history characteristics and potential for interaction with station operation; and, • Determine the total fish and macro invertebrate losses and associated impact.	<u>Benthic Invertebrate Community Study</u> 1) Develop a sampling plan for Benthic Invertebrate Community Study in the vicinity of DNGS intake. 2) Conduct Benthic Invertebrates Community study. 3) Document and report findings including a comparison to the 2008 study in the vicinity of NND. <u>Entrainment Monitoring</u> 1) Develop a sampling plan which includes entrainment sampling methodology. The selected methodology will consider methodologies from other jurisdictions. Sampling plan should include development of performance threshold(s) for impingement and entrainment (i.e. unacceptable levels of impingement and entrainment losses especially in reference to Species at Risk and aquatic species of conservation concern) through consultations with regulatory agencies and other stakeholders. 2) Using the methodology developed from activity 1), conduct entrainment study prior to start of the refurbishment outage. 3) Document and report findings. <u>Impingement and Entrainment</u> 1) Prepare sampling plan for impingement and entrainment. 2) Conduct impingement and entrainment monitoring according to the sampling plan.	AR# 28159540-28 AR# 28159540-29 AR# 28159540-30 AR# 28159540-31 AR# 28159540-32 AR# 28159540-33 AR# 28159540-34 AR# 28159540-35	2015 2016[2] 2016 2015 2016[2] 2016 2025 2027

[2] Activity will be completed prior to U2 Refurbishment breaker-open.

IIP R001 Item Number	Environmental Component (Reference)	Monitoring and Follow-up Objective	Action Plan	Tracking Number	Completion Date
			3) Document and report findings. If the performance threshold(s) are exceeded, review available mitigation options to determine if additional technically and economically feasible opportunities are available to further reduce the potential for effects (see Section 3.3).	AR# 28159540-36	2027
IIP EA-014	Malfunction and Accidents CNSC Screening Report – page 169	Update the station PRA to confirm that the assignment of probabilities appropriately represent the SIO changes. This will take place after the station design has been finalized, all the design changes with supporting Safety Analysis and procedural documents (e.g., Emergency Operating Procedures, Abnormal Incident Manual) and the plant modifications are declared Available for Service (AFS) are complete prior to bringing the refurbished units back on-line. The PRA will be updated and reported to the CNSC as per S-294 requirements.	1) Provide the SIO implementation status update prior to the restart of each the refurbished units. 2) Once all of the refurbished units are back on-line, update the PRA to reflect the plant changes in all units. A review of the PRA results will be completed to confirm that the event frequencies predicted in the EA based on conceptual design features are consistent with the installed equipment.	AR# 28159540-09,-10,-11,-12 AR# 28159540-13	U2: 2019 U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart) 2026

IIP R001 Item Number	Environmental Component (Reference)	Monitoring and Follow-up Objective	Action Plan	Tracking Number	Completion Date
IIP EA-015	Effects of the Environment on the Project CNSC Screening Report – page 169	Confirm the liquefaction potential of foundation materials in the Protected Area is acceptably low.	1) Carry out a review including the following general steps: • Compile and review all available data regarding the fill material in the Protected Area where there are relevant safety-related systems, structures and components on their liquefaction potential. This material is readily available from sources accessed for the EA studies and the ISR. • For contextual purposes, review the geotechnical conditions relevant to the construction history for DNGS. • Based on relevant collected data, undertake an evaluation of the stability of the fill materials with regard for liquefaction potential under seismic and static load conditions. The evaluation criteria will be established based on the objectives, scope and methods adopted for the evaluation program. They will incorporate geotechnical guidance and standards as they are appropriate and applicable. • Should sufficient verification not be realized for the prediction of low liquefaction potential, recommendations for further investigation will be provided as appropriate. 2) If required, conduct a liquefaction assessment study based on recommendations of the review in activity 1).	AR# 28159540-14 AR# 28159540-14	2019 (U2 Refurbishment Outage Restart) 2019 (U2 Refurbishment Outage Restart)

Table 3 provides a summary of the activities to address CCAs in support of the ISR. The activities are categorized based on whether they were identified based on input from the Major Components Program [R-22] or from the ISR System Reviews which is documented in the Aging and Actual Condition of SSCs Safety Factor Report [R-23]. The following is a brief description of the columns in the table:

1. The 'IIP Item Number' column lists a unique identifier. This number remains the same as was produced in R001 of the IIP. Appendix C identifies the mapping between the IIP Item Number in IIP R000 and IIP R001.
2. The "CCA" column lists a sequential CCA number, if applicable, for the Commodity Group included in a particular system.
3. The "System" column lists the applicable system.
4. The "Description" column lists the name of the Commodity Group (e.g. Vault Coolers). This is the generic name for components in a Commodity Group.
5. The "Condition" column lists the overall condition of components in each Commodity Group, if applicable. The condition is ranked "Very Good", "Good", "Satisfactory", "Poor" or "Very Poor" in accordance with Section 1.10.6.2 of N-PROC-MP-0060 [R-8].

Condition Classification	Criteria
Very Good	a) The component meets all functional design requirements, with no reduction in operating margin and exhibits no apparent degradation, i.e., is in "like new" condition, **and** b) The ageing management practices have been optimized to ensure the component remains in a "like new" condition.
Good	a) The component meets all its functional design requirements, with only a slight reduction in operating margins. Some slight ageing degradation is evident, **or** b) The ageing management practices are adequate but have not been optimized to ensure that the component remains in "like new" condition.
Satisfactory	a) The component still meets all its functional design requirements, but operating margins are significantly eroded. This can be attributed to evidence of significant ageing degradation, **or** b) The ageing management practices are ineffective in only one area and should be reviewed and/or changed.
Poor	a) The component can only marginally meet its functional design requirements and has lost all its operating margin. Severe aging degradation is evident, **or** b) The ageing management practices are ineffective in a number of areas and need to be revised.
Very Poor	a) The component cannot meet one or more of its functional design requirements The component needs immediate or near term maintenance, repair and/or replacement to restore its condition, **or** b) The current ageing management practices are completely ineffective and need revision.

6. The "Activity Description" column identifies the required activities to resolve the issues or recommendations. A detailed assessment of adequacy of these activities to address the identified degradation by the CCAs was performed as part of the Global Assessment.
7. The "DSR#" column identifies the tracking number originating from the Darlington Scope Request (DSR) Database in accordance with NK38-INS-09701-10001 [R-24].
8. The "Date" column either identifies the end year or the unit restart date in which the IIP item will be completed. A date for each affected unit is provided, if applicable.

Table 3: CCAs (Open Activities)

IIP R001 Item Number	CCA	System	Description	Condition	Activity Description	DSR#	Date
IIP-CC 001	N/A	N/A	Shutdown Cooling Pumps	N/A	Install two Shutdown Cooling (SDC) "Auxiliary" pumps which are physically separate and of diverse design than the existing SDC pumps.	TS0500-1	U2: 2019 U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart)
IIP-CC 002	N/A	Major Components Program	Feeders	N/A	Replace Feeders	TS0010-4	U2: 2019 U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart)
IIP-CC 003	N/A	Major Components Program	Fuel Channels	N/A	Replace Fuel Channels	TS0010-4	U2: 2019 U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart)
IIP-CC 004	N/A	Major Components Program	Calandria Tubes	N/A	Replace Calandria Tubes	TS0010-4	U2: 2019 U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart)
IIP-CC 005	N/A	Major Components Program	End Fittings	N/A	Replace End Fittings	TS0010-4	U2: 2019 U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart)
IIP-CC 006	N/A	Major Components Program	Calandria	N/A	Conduct an internal inspection of the calandria	TS0010-4	U2: 2019 U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart)
IIP-CC 007	N/A	Major Components Program	Lattice Tubes	N/A	Perform visual inspection of all Lattice Tubes for leaks	TS0010-4	U2: 2019 U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart)

IIP R001 Item Number	CCA	System	Description	Condition	Activity Description	DSR#	Date
IIP-CC 008	936	G.05 Boiler Feedwater System, USI# 43000, System #: 0005	Auxiliary Boiler Feed Pumps	Good	Perform an internal inspection of a selected Auxiliary Boiler Feed Pump. Repair/replace based on inspection results.	IP1400-1	U2: 2019[4] U3: 2022[4] U1: 2024[4] U4: 2025[4] (Each Unit Refurbishment Outage Restart)
IIP-CC 009	49	Class II Power System, USI# 50320, System #: 0011	Distribution Bus	Satisfactory	Clean and test MCC (three 120/208Vac buses per unit) per NK38-CMP-53307-03.	TS0540-1	U2: 2019 U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart)
IIP-CC 010	3244	Class IV Power System, USI# 50340, System #: 0013	Transformers, 4 kV (10MVA) (silicone)	Poor	Complete the tapchanger bypass modification on 0-53240-T59 and 0-53240-T60.	TS0560-6	U0: 2019
IIP-CC 011	710	Digital Control Computers System, USI# 69000, System #: 0016	Computer - DCC	Satisfactory	Replace the DCC, CP and SEM CPUs.	TS0360-3	U0-U4: 2024
IIP-CC 014	1456	Emergency Coolant Injection System, USI# 34320, System #: 0018	Check Valves > 3"	Good	Inspect representative sample of check valves (3 of 10 large NVs) and repair as required[5].	TS0150-1	U0: 2019[4] (U2 Refurbishment Outage Restart)
IIP-CC 015	3491	Emergency Coolant Injection System, USI# 34320, System #: 0018	Check Valves < 3"	Good	Inspect representative sample of NVs and repair as required[5].	TS0150-5	U3: 2018 U4: 2019 U1: 2020 U2: 2022 (Each Unit Planned Outage Restart)
IIP-CC 016	1535	Emergency Coolant Injection System, USI# 34320, System #: 0018	Heat Exchanger (HX) – R/S	Satisfactory	Inspect the inlet and outlet nozzles of 0-34330-HX1 and HX2 for pitting corrosion.	TS2260-1	U0: 2019[4] (U2 Refurbishment Outage Restart)
IIP-CC 017	2094	Emergency Coolant Injection System, USI# 34320, System #: 0018	Hydraulic Power Unit	Satisfactory	Conduct a detailed study to evaluate options for potential ECI Hydraulic Control Circuit replacement.	TS2520-1	2017
IIP-CC 018	339	Emergency Filtered Air Discharge System , USI# 73750, System #: 0019	Moisture element	Satisfactory	Replace 4 moisture probes and transmitters for EFADS.	TS0160-6	U0: 2023
IIP-CC 019	2071	Emergency Filtered Air Discharge System , USI# 73750, System #: 0019	Rad Monitor computer and peripherals.	Satisfactory	Replace EFADS computer and associated components.	TS0160-8	U0: 2023
IIP-CC 020	3524	Emergency Power Generators System, USI# 49200, System #: 0020	Gas Producer / Power Turbine Unit	Poor	Replace EPG 1 and EPG2 degraded Gas Generator.	TS0480-1	U0: 2019

[4] If safety significant defects are found as a result of inspections, they will be corrected by the date specified.
[5] Sample sizes for inspections are based on similarity of materials of construction, fabrication, procurement, design, installation, operating conditions/environment, system function, location, existing technical information, system and structure design, OPEX and previous failure history

IIP R001 Item Number	CCA	System	Description	Condition	Activity Description	DSR#	Date
IIP-CC 021	2090	Emergency Service Water System, USI# 72800, System #: 0022	Butterfly and Ball MOV (EQ)	Satisfactory	Replace valve body on 0-72800-MV29, MV30, MV34, & MV35. Overhaul actuator on 0-72800-MV29, MV30, MV34, & MV35 and overhaul PAWCS HX1 ESW Supply Valve 0-72800-MV168, based on inspection results.	TS0180-7	Replace U0: 2015 Overhaul U0: 2022 (U2 Planned Outage Restart)
IIP-CC 022	2667	Emergency Service Water System, USI# 72800, System #: 0022	Globe and Gate Valve Motor Operated (MV)	Satisfactory	Inspect/overhaul and/or replace ECIS IWST ESW Supply valve. Replace bellows assembly IWST ESW supply valve (plug, bonnet included in the assembly). Overhaul or replace ESW steam generator injection valves.	TS0180-8	U0: 2015 U3: 2018 U4: 2019 U1: 2020 U2: 2022 (Each Unit Planned Outage Restart)
IIP-CC 023	1842	HVAC System for Main Control Room & Secondary Control Area, USI# 73910, System # 0032	Fire Damper	Satisfactory	Test required fire dampers and replace as necessary.	TS0190-3 TS0190-14	U0: 2019[4] (U2 Refurbishment Outage Restart) U2: 2019[4] U3: 2022[4] U1: 2024[4] U4: 2025[4] (Each Unit Refurbishment Outage Restart)
IIP-CC 024	1514	Main Condensate System, USI# 44000, System #: 0036	Drains Cooler/LP Heater Motor Operated Valves (RS)	Satisfactory	Inspect a representative sample of MVs to determine condition of stem, gate, seat and body. Overhaul/replace based on inspection[5].	TS1790-1 TS1790-2	U3: 2018 U4: 2019 U1: 2020 U2: 2022 (Each Unit Planned Outage Restart)
IIP-CC 025	2253	Miscellaneous Air Conditioning System, USI# 73940, System #: 0040	Air Conditioning Unit (RS)	Satisfactory	Replace the entire ACU.	TS0710-7	U012/U034/U1-U4: 2022 (U2 Planned Outage Restart)
IIP-CC 026	2274	Miscellaneous Air Conditioning System, USI# 73940, System #: 0040	Fire Damper (FDP)-R/S	Satisfactory	Test required fire dampers and replace as necessary.	TS0710-13 TS0710-18	U0: 2019[4] (U2 Refurbishment Outage Restart)

[4] If safety significant defects are found as a result of inspections, they will be corrected by the date specified.
[5] Sample sizes for inspections are based on similarity of materials of construction, fabrication, procurement, design, installation, operating conditions/environment, system function, location, existing technical information, system and structure design, OPEX and previous failure history

IIP R001 Item Number	CCA	System	Description	Condition	Activity Description	DSR#	Date
IIP-CC 027	2275	Miscellaneous Air Conditioning System, USI# 73940, System #: 0040	Damper (DP)-R/S	Satisfactory	Do a sample inspection of the dampers and determine the scope of replacement. Replace dampers as required[5].	TS0710-12 TS0710-17	U2: 2019[4] U3: 2022[4] U1: 2024[4] U4: 2025[4] (Each Unit Refurbishment Outage Restart)
IIP-CC 028	13	Moderator and Auxiliary Systems, USI# 32000, System #: 0042	Velan Swing Check Valves	Satisfactory	Overhaul X-32110-NV3/4/9/10/23/24/28 with new seat and disk material. Replace X-32210-NV112 in all units.	TS1450-1 TS1450-2	U2: 2019 U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart)
IIP-CC 029	23	Moderator and Auxiliary Systems, USI# 32000, System #: 0042	Manual Valves	Satisfactory	Replace the following isolating valves: 1/2/3/4-63253-V52 V53 and 1/2/3/4-32110-V5, V6, V21, V22, V25, V26, and 1/2/3/4-32110-MV1, MV2, MV7, MV8, MV11, MV12, MV31, MV32	TS1070-3	U2: 2019 U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart)
IIP-CC 031	449	Negative Pressure Containment System, USI# 34200, System #: 0044	Radiation Detector and Monitor	Satisfactory	Replace activity monitors.	TS0210-9	U012/U034/U1-U4: 2022 (U2 Planned Outage Restart)
IIP-CC 032	1008	Negative Pressure Containment System, USI# 34200, System #: 0044	Piping (line) PRV VAC DWS	Good	Develop program to address the aging related degradation mechanisms identified and perform condition assessment of the exposed piping to water and stagnant conditions.	TS1860-1	2016
IIP-CC 033	2526	Powerhouse Ventilation System, USI# 73220, System #: 0050	Air Cooling Units - R/S	Satisfactory	Replace 0-73260-ACU5 to 16, 1,2,3,4-73220-ACU2 to 10, ACU17 to 22.	TS0700-2	U0: 2022 (U2 Planned Outage Restart) U3: 2018 U4: 2019 U1: 2020 U2: 2022 (Each Unit Planned Outage Restart)
IIP-CC 034	2527	Powerhouse Ventilation System, USI# 73220, System #: 0050	Fire Damper (FDP)-R/S	Satisfactory	Test required fire dampers and replace as necessary.	TS0700-3 TS0700-10	U012/U034: 2019[4] (U2 Refurbishment Outage Restart)
IIP-CC 035	2459	Powerhouse Ventilation System, USI# 73220, System #: 0051	Pneumatic Operator (PO)-R/S	Poor	Refurbish Power Operators[6]	TS1240-1	U2: 2022 U3: 2025 U1: 2026 U4: 2028 (Each Unit Planned Outage Restart)

[5] Sample sizes for inspections are based on similarity of materials of construction, fabrication, procurement, design, installation, operating conditions/environment, system function, location, existing technical information, system and structure design, OPEX and previous failure history

[6] The majority (more than 70%) of the Power Operators (POs) will be refurbished prior to 2022 as online work. However, some areas may require an outage so a full unit outage cycle is required to ensure 100% completion of the work. The IIP committed completion date should be viewed as the latest possible completion date. Continuous monitoring of PO failures is done through safety related system tests (functional and stroke tests twice per year), as well as walk downs by the system responsible engineer. It should be noted that there have not been a significant number of PO failures so far that have caused system unavailability.

IIP R001 Item Number	CCA	System	Description	Condition	Activity Description	DSR#	Date
IIP-CC 036	1156	PHT and Auxiliaries System, USI# 33100, System #: 0053	Main HT Interconnect Motor Operated Valves	Good	Inspect two representative PHT loop isolation / interconnect MOVs to determine condition and provide an inspection and rehab strategy.	TS0090-2	U2: 2019 U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart)
IIP-CC 037	1198	PHT and Auxiliaries System, USI# 33100, System #: 0053	Main HT Pump Trip Pressure Switches	Satisfactory	Replace the cable associated with PHT trip pressure switches and perform any corrective maintenance for switch modules and pressure switches in all units.	TS0090-7	U2: 2019 U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart)
IIP-CC 039	1148	PHT and Auxiliaries System, USI# 33100, System #: 0053	Main HT Pumps	Good	Inspect 2-33120-P3 and fix the gasket leaks. Repair gasket leaks on 1-33210-P2. Inspect one Unit 3 pump and repair/replace if required.	TS0090-1 TS0090-12	U2: 2019 U3: 2022 U1: 2024 (Each Unit Refurbishment Outage Restart)
IIP-CC 040	1149	PHT and Auxiliaries System, USI# 33100, System #: 0053	Main HT Pump Motors & Heaters	Satisfactory	Replace all PHT pump motors.	TS0320-1	U2: 2022 U3: 2025 U1: 2026 U4: 2028 (Each Unit Planned Outage Restart)
IIP-CC 041	161	PHT Pressure and Inventory Control System, USI# 33300, System #: 0054	Dresser Control Valves	Satisfactory	Inspect a representative sample of system AOVs to determine condition of valve internals (e.g. CV 3, 4, 11, 13, and 14). Replace or repair based on inspection[5].	TS0100-4	U3: 2018 U4: 2019 U1: 2020 U2: 2022 (Each Unit Planned Outage Restart)
IIP-CC 042	170	PHT Pressure and Inventory Control System, USI# 33300, System #: 0054	Bleed Cooler Temperature Control Valves	Satisfactory	Inspect a representative sample(s) of 1/2/3/4-67220-TCV36/37 and determine the scope of replacement/repair[5].	IP1380-1	U3: 2018 U4: 2019 U1: 2020 U2: 2022 (Each Unit Planned Outage Restart)
IIP-CC 043	490	Radiation Monitors and Samplers System, USI# 67989, System #: 0057	Noble Gas Monitor, Iodine Monitor, Particulate Monitor	Satisfactory	Replace computers and modicons for the stack monitor system.	TS0740-4	U012/U034/U0-U4: 2023
IIP-CC 044	3490	Radiation Monitors and Samplers System, USI# 67989, System #: 0057	Tritium Oxide Collectors	Satisfactory	Replace Labserco Tritium collectors on all affected stacks.	TS0740-1	U012/U034/U0-U4: 2023
IIP-CC 045	3493	Radiation Monitors and Samplers System, USI# 67978, System #: 0057	Rate meter	Poor	Replace Liquid Effluent Monitoring System[7].	TS0740-2	U0: 2023

[5] Sample sizes for inspections are based on similarity of materials of construction, fabrication, procurement, design, installation, operating conditions/environment, system function, location, existing technical information, system and structure design, OPEX and previous failure history

[7] Poor condition is based on past frequent battery failures along with other maintenance issues including decay of source, electronic component degradation and obsolescence issues. Risk Mitigation Strategy: A bridging strategy to find a suitable replacement for the computer backup battery has been completed. The batteries have been sourced and installed. Maintenance practices to ensure condition of the rate meter does not degrade prior to monitoring system replacement include periodic calibration and prompt repair/replacement if required.

IIP R001 Item Number	CCA	System	Description	Condition	Activity Description	DSR#	Date
IIP-CC 046	2192	Reactor Vault and Fuelling Duct Atmosphere Cooling System, USI# 73720, System #: 0060	Vault Coolers (RS)	Satisfactory	Replace coils (like-for-like).	TS0280-1	U2: 2019 U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart)
IIP-CC 047	2193	Reactor Vault and Fuelling Duct Atmosphere Cooling System, USI# 73720, System #: 0060	Temperature Controllers, Vault Coolers (RS)	Satisfactory	Replace all 16 Temperature Controllers. (4 per unit).	TS0880-21	U1-U4: 2023
IIP-CC 048	3071	Reactor Vault and Fuelling Duct Atmosphere Cooling System, USI# 73720, System #: 0060	Backpressure Damper, Vault Cooler (RS)	Satisfactory	Perform an investigation to determine which components are failing and their associated failure modes.	TS0280-8 TS0280-9	U3: 2018 U4: 2019 U1: 2020 U2: 2022 (Each Unit Planned Outage Restart)
IIP-CC 049	1465	Shutdown Cooling System, USI# 33410, System #: 0067	Heat Exchangers	Poor	Replace heat exchangers[8].	TS0110-16	U2: 2019 U3: 2022 U1: 2024 U4: 2025
IIP-CC 050	1467	Shutdown Cooling System, USI# 33410, System #: 0067	Motor Operated Valves	Satisfactory	-Inspect 5 representative MOVs on U2. Inspect 4 representative valves each in U1, U3 and U4. -Inspect MOV intergate drain lines. -Replace bellows sealed valves, 33410-MV28 MV97 in U2. -Disassemble and inspect removed valves to determine path forward for remaining Units. -Provide an inspection and rehab strategy prior to and after inspections are complete in Unit 2.	TS0110-2 TS0110-13	U2: 2019 U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart)
IIP-CC 051	1471	Shutdown Cooling System, USI# 33410, System #: 0067	Manual Valves	Poor	Complete an engineering assessment of manual valves to determine if repacking is required. Repack the SDC manual valves as required[9].	TS0110-8	U2: 2019 U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart)

[8] Per the current schedule, the HX replacement will start in 2016 and be complete by 2019, based on the assumption that all the work will be executed Online. However, a contingency is in place in case of potential passing isolation of PULSW and PHT isolation valves. Based on the contingency plan, the OPG commitment dates for SDC HX replacement are for U2 2019, U3:2022, U1: 2024, U4: 2025. Risk Mitigation Strategy: Response to an SDC HX tube leak is addressed under NK38-OM-09013B-03.01.04, Abnormal Incidents Manual, SDC HX Tube Failure, wherein the leaking HX. is isolated, drained, disassembled, and the leaking and degraded tubes would be plugged or repaired.

[9] The valves are scheduled for replacement during the refurbishment outage because that is the only time that the shutdown cooling system can be taken out of service safely. Risk Mitigation Strategy: Because the valves are only required for maintenance they are operated infrequently and as a result the risk of failure is minimized. There are also alternatives available for isolating portions of the SDC system if one of the manual valves fails.

IIP R001 Item Number	CCA	System	Description	Condition	Activity Description	DSR#	Date
IIP-CC 052	3439 3440 3441 3442 3444	Shutdown System Computer Hardware System, USI# 68240, System #: 0068	SDS1 GA Computers	Satisfactory	Design and Replace SDS1 Trip Computer and the Display / Test Computer.	TS0350-5 TS0350-7	U2: 2022 (Planned Outage Restart) U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart)
IIP-CC 053	779	Shutdown System Process System, USI# 68200, System #: 0069	Element, Flow	Satisfactory	Conduct design review to select/modify the flow element prior to refurbishment. Replace SDS1 Flow Elements.	TS0010-4	U2: 2019 U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart)
IIP-CC 054	2789	Shutdown System Process System, USI# 68200, System #: 0069	S/A Clutch Power Supply	Satisfactory	Replace Shutoff Rod Clutch Power Supplies on all Units	TS0240-2	U2: 2022 U3: 2025 U1: 2026 U4: 2028 (Each Unit Planned Outage Restart)
IIP-CC 055	3446 3447 3449 3450 3451 3455 3456	Shutdown System Computer Hardware System, USI# 68340, System #: 0070	SDS2 GA Computers	Satisfactory	Design and replace the SDS2 Trip Computer and the Display / Test Computer.	TS0350-6 TS0350-8	U2: 2022 (Planned Outage Restart) U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart)
IIP-CC 056	853	Shutdown System Process System, USI# 68300, System #: 0071	Poison Tank Ball Position Level Alarm	Satisfactory	Replace LISS poison tank ball position level alarm system.	TS0260-3	U4: 2019 U1: 2020 U2: 2022 U3: 2025 (Each Unit Planned Outage Restart)
IIP-CC 057	861	Shutdown System Process System, USI# 68300, System #: 0071	Element, Flow	Satisfactory	Conduct design review to select/modify the flow element prior to refurbishment. Replace SDS2 Flow Elements.	TS0010-4	U2: 2019 U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart)
IIP-CC 059	3525	Standby Generators System, USI# 49100, System #: 0073	Standby Generator Building	Satisfactory	Perform an inspection for Standby Generator complex. Perform required repairs.	TS1590-1 TS1590-2	U0: 2018 U0: 2022 (U2 Planned Outage Restart)
IIP-CC 060	76	Structures - Reactor Building and Fueling Facilities, USI# 21000, System #: 0080	Reactor Building Structure	Satisfactory	Perform required inspections for Reactor Building Structure. Perform required repairs.	TS0510-1 TS0510-16	U014: 2018 U014: 2022 (U2 Planned Outage Restart)

IIP R001 Item Number	CCA	System	Description	Condition	Activity Description	DSR#	Date
IIP-CC 061	77	Structures - Reactor Building and Fueling Facilities, USI# 21000, System #: 0080	Reactor Building Internal Structure	Satisfactory	Perform inspections for the Reactor Building Internal Structures. Perform required repairs.	TS0510-2 TS0510-17	U014: 2018 U014: 2022 (U2 Planned Outage Restart)
IIP-CC 062	78	Structures - Reactor Building and Fueling Facilities, USI# 21000, System #: 0080	Reactor Auxiliary Bay including structural and architectural elements	Good	Perform inspections for the civil structures located in the Reactor Auxiliary Bay (RAB). Perform required repairs.	TS0510-11 TS0510-18	U014: 2018 U014: 2022 (U2 Planned Outage Restart)
IIP-CC 063	79	Structures - Reactor Building and Fueling Facilities, USI# 21000, System #: 0080	FFAA - West & East	Good	Perform required inspections for the civil structures located in Fuelling Facilities Auxiliary Areas (FFAA). Perform required repairs.	TS0510-12 TS0510-25	U012/U034: 2018 U012/U034: 2022 (U2 Planned Outage Restart)
IIP-CC 064	80	Structures - Reactor Building and Fueling Facilities, USI# 21000, System #: 0080	Irradiated Fuel Area	Satisfactory	Perform required inspections for irradiated fuel area. Perform required repairs.	TS0510-14 TS0510-28	U014: 2018 U014: 2022 (U2 Planned Outage Restart)
IIP-CC 065	81	Structures - Reactor Building and Fueling Facilities, USI# 21000, System #: 0080	Fuel Handling & Service Area	Good	Perform required inspections for fuel handling and service area. Perform required repairs.	TS0510-15 TS0510-29	U012/U034: 2018 U012/U034: 2022 (U2 Planned Outage Restart)
IIP-CC 067	84	Structures - Powerhouse System, USI# 22000, System #: 0081	Turbine Hall & Turbine Auxiliary Bay civil/ structural elements	Good	Perform required inspections for turbine hall and turbine auxiliary bay. Perform required repairs.	TS0510-9 TS0510-26	U014: 2018 U014: 2022 (U2 Planned Outage Restart)
IIP-CC 069	86	Structures - Powerhouse System, USI# 22000, System #: 0081	Central Control Area	Good	Perform inspection of civil structures located in the central control area. Perform required repairs.	TS0510-4 TS0510-30	U0: 2018 U0: 2022 (U2 Planned Outage Restart)
IIP-CC 071	90	Circulating Water Systems System, USI# 27100, System #: 0083	Pumphouse	Good	Perform required inspections on Pumphouse Structures. Perform required repairs.	TS0510-6 TS0510-22	U0: 2018 U0: 2022 (U2 Planned Outage Restart)
IIP-CC 072	94	Emergency Power System & Emergency Service Water Complex System, USI# 28300, System #: 0084	EPS Buildings Including EPS, EPG, ESW and EPS Fuel Management	Good	Perform required inspections on EPS Buildings, including EPS, EPG, ESW and EPS Fuel Management Structures. Perform required repairs.	TS0510-8 TS0510-24	U0: 2018 U0: 2022 (U2 Planned Outage Restart)

IIP R001 Item Number	CCA	System	Description	Condition	Activity Description	DSR#	Date
IIP-CC 073	2712	Fuel Handling Trolley System, USI# 35700, System #: 0206	Cable-Power-Harsh-Trolley-I&C	Satisfactory	Perform a visual inspection and megger testing on cables and connections and send power cable sample for analysis. Change the power cables as required based on results of inspection. Replace all catenary power cables.	TS0430-1 TS0430-6 TS0430-18	U0: 2019[4] (U2 Refurbishment Outage Restart) U0: 2025 U0: 2025
IIP-CC 074	2713	Fuel Handling Trolley System, USI# 35700, System #: 0206	Cable-Signal-Harsh-Trolley-I&C	Satisfactory	Perform a visual inspection and megger testing on the signal cables and connections and send sample for analysis. Change the signal cables as required based on results of inspection. Replace all catenary signal cables.	TS0430- 2 TS0430-7 TS0430-19	U0: 2019[4] (U2 Refurbishment Outage Restart) U0: 2025 U0: 2025
IIP-CC 075	2930	Fuel Handling Trolley System, USI# 35700, System #: 0206	Catenary – Mechanical	Satisfactory	Perform verification of the chain for length Perform any necessary contingency work.	TS0430-4 TS0430-15	U0: 2019[4] (U2 Refurbishment Outage Restart) U0: 2025
IIP-CC 076	2931	Fuel Handling Trolley System, USI# 35700, System #: 0206	Fuelling Machine Support Frame Catenary Support – Mechanical	Good	Visually inspect welds for cracks and visually inspect frame and attachment hardware for corrosion. Repair as required.	TS0430-5 TS0430-16	U0: 2019[4] (U2 Refurbishment Outage Restart) U0: 2025
IIP-CC 077	2685	Fuel Machine Head System, USI# 35210, System #: 0208	Homing & Locking (Snout) Assembly	Satisfactory	Replace manifolds for fine homing and gap sensing on all fuel machine heads.	TS0450-9	U0/U012/U034: 2025
IIP-CC 078	2741	Irradiated Fuel Bay System, USI# 34410, System #: 0209	Heat Exchanger	Poor	Change gasket and plate material on the heat exchangers.	TS0460-13	U012/U034: 2015

[4] If safety significant defects are found as a result of inspections, they will be corrected by the date specified.

Table 4 provides a summary of the activities to address the Code Gaps resulting from the ISR and CNSC comments. The following is a brief description of the columns in the table:

1. The 'IIP Item Number' column lists a unique identifier. This number remains the same as was produced in R001 of the IIP. Appendix C identifies the mapping between the IIP Item Number in IIP R000 and IIP R001.
2. The "Issue Number and Title" column lists the following:
    a. Issue Number assigned by the ISR Gap Resolution Process N-INS-00770-10004 [R-25].
    b. Title of the ISR Issue including the PROL (Power Regulator Operating License) and non-PROL Code(s) and Standard (s) in which the ISR Issue was discovered.
3. The "Issue Description" column lists a high level description of the ISR Issue.
4. The "Action Plan" column includes a description of the required activities to address the ISR Issue. A detailed assessment of adequacy of these activities to address the identified issues at a gap level was performed as part of the Global Assessment.
5. The "Tracking #" column identifies the DSR tracking number originating from the Darlington Scope Request (DSR) Database in accordance with NK38-INS-09701-10001 [R-24] or the OPG internal Action Request (AR) number, or CNSC Action Item (AI) Number.
6. The "Date" column either identifies the end year or the unit restart date in which the IIP item will be completed. A date for each affected unit is provided, if applicable.

Table 4: Code Gaps (Open Activities)

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Tracking #	Date
IIP-OI 001	D044 – Fire Alarm Systems (CSA N293-07 “Fire Protection for CANDU Nuclear Power Plants”)	The scope of the Integrated Safety Review (ISR) Issue covers new requirements for fire alarm systems. The outstanding actions are related to transfer of the Fire Alarm system to the Secondary Control Area (SCA), display of all unit alarms in the applicable unit SCA’s and some isolation modules were found to be missing from selected stairwells. Also CNSC has challenged the analysis to justify no fire alarm system in the CCW pump houses and Water Treatment plant.	1) Upgrade the station fire alarm system to allow transfer of the fire alarm to the secondary control areas where all applicable alarms will be displayed. 2) Add fault isolation modules where missing from stairwells. 3) The rationale in the analysis will be improved to justify no fire alarm system in the CCW pump houses and Water Treatment plant, or fire alarm systems will be added.	IP1220-5 IP1270-1 Complete [R-26]	U0: 2019 (U2 Refurbishment Outage Restart) U0: 2019 (U2 Refurbishment Outage Restart) 2015
IIP-OI 002	D045 – Fire Suppression (CSA N293-07 “Fire Protection for CANDU Nuclear Power Plants”)	The design criteria used for the existing fire suppression and extinguishing systems do not meet some of the modern design standards referenced in CSA-N293-07. Design requirements in modern codes are typically grandfathered for existing facilities however they are being re-evaluated as part of the Darlington Refurbishment. Upon completion of analysis it has been determined that there are 2 areas where corrective actions are required for refurbishment. Outdoor transformer protection and the fire loading in Central Services Area (CSA) storage area.	Additional Analysis complete and has resulted in the following two corrective actions: 1) Outdoor Transformer Protection • To prevent a Main Output Transformer (MOT) fire from damaging the Powerhouse wall or spreading fire into the Unit 0 lunchroom, the existing containment dikes in each unit will be filled with rock to reduce the risk of fire spread. • To prevent against a potential Unit Service Transformer or System Service Transformer fire from damaging the Powerhouse wall, the associated containment dikes will be filled with rock to reduce the risk of fire spread. 2) CSA Stores Sprinkler System Commodity Storage To avoid over taxing the existing CSA Stores Sprinkler systems in S-119 and S-219 the plastic storage bins will be removed and replaced with metal wire baskets or steel drawers.	Complete [R-27] IP1220-2 IP1470-1	Additional Analysis 2016 U2: 2022 U3: 2025 U1: 2026 U4: 2028 (Each Unit Planned Outage Restart) U2: 2019 (U2 Refurbishment Outage Restart)

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Tracking #	Date
IIP-OI 003	D046 - Fire Protection Seismic Requirements (CSA N293-07 “Fire Protection for CANDU Nuclear Power Plants”)	This ISR Issue addresses the seismic restraint requirements related to fire protection. The risk to the station is low and mitigating actions are not required. The installation of seismic restraints provides an additional level of safety at Darlington during seismic events, however the current configuration is compliant with existing requirements.	1) Complete an additional analysis to determine if seismic restraints are required for fire protection equipment located in the areas specified by this clause. 2) As a result of the additional analysis seismic restraints will be provided for fire extinguishers in the areas specified by this clause.	Complete [R-28] IP1220-6	2015 Modifications: U0: 2019 (U2 Refurbishment Outage Restart) U2: 2022 U3: 2025 U1: 2026 U4: 2028 (Each Unit Planned Outage Restart)
IIP-OI 004	D048 – Fire Protection Requirements for Storage Tanks (NFCC 2005 “National Fire Code of Canada”)	The scope of this ISR Issue covers requirements for combustible fuel oil tanks, associated piping and secondary containment construction. At Darlington, this applies to the Standby Generator and Emergency Power Supply Generator combustible fuel oil tanks.	Complete an evaluation of the existing SG combustible fuel oil tanks secondary containment dykes to confirm that the dyke's permeability is not deteriorating. Additionally, inspect the Standby Generator and Emergency Power Generator combustible fuel oil tanks secondary containment penetration locations to confirm their integrity is not deteriorating. Correct any deficiencies.	IP1220-14	Evaluation: 2016 Inspection/Repairs: U0: 2019 (U2 Refurbishment Restart)
IIP-OI 006	D080 – Fire Separation (CSA N293-07 “Fire Protection for CANDU Nuclear Power Plants” & NFCC 2005 “National Fire Code of Canada”)	No documentation or procedural requirements were found for fire separations.	Document the existing fire-stops for the following barrier types: Life safety barriers (i.e. exit stair-shafts), combustible storage rooms, radioactive storage rooms, Main Control Room Complex, Secondary Control Area rooms, and barriers separating redundant fire safe shutdown systems. In addition, update the applicable station procedures/ standards to ensure documentation of future Fire stops.	IP1220-3 IP1220-15	2016

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Tracking #	Date
IIP-OI 008	D116 – Fire Protection Requirements for Building Materials (CSA N293-07 “Fire Protection for CANDU Nuclear Power Plants”, NFCC 2005 “National Fire Code of Canada”)	No documentation found driving compliance with the new requirements for building materials which establish specific restrictions on combustible contents in building materials, fixtures, impermeable finishes, and epoxy linings.	1) Implement a technical specification for future purchases of carpet, drapes and decorative wall covering materials to ensure that new materials meet the requirements. 2) Revise paint specification to ensure future compliance.	Complete [R-29] IP1220-15	2015 2019
IIP-OI 009	D119 – Storage Tank Leak Detection(NFCC 2005 “National Fire Code of Canada”)	No evidence in the design documentation regarding requirements to monitor fuel storage tanks for leakage, to take remedial action to repair leaks, to record all leak testing and to conduct reconciliations of the fuel oil inventory.	Implement predefines and develop procedures to limit the probability that defects in storage tanks, sumps or piping systems or the escape of liquid will go unnoticed.	IP1140-1	2017[10]
IIP-OI 010	D167 – Ventilation Systems Disconnect Switch Testing (NFCC 2005 “National Fire Code of Canada”)	No documentation found regarding the testing of disconnect switches for mechanical air-conditioning and ventilating systems to ensure operation at intervals not greater than 12 months to establish that the system can be shut down in an emergency	Implement a procedure to ensure the disconnect switches for mechanical air conditioning and ventilating systems are tested at 12 month intervals or implement an alternate compliance.	IP1140-1	2017[10]
IIP-OI 011	D170 – Fire Safety Plan Requirements (NFCC 2005 “National Fire Code of Canada”)	The DNGS fire safety plan does not include the indoor storage the following indoor storage information: a) product classification, b) storage method including aisle widths for rack storage, c) maximum permitted storage height and area	Update the Fire Safety Plan and Pre-Fire Plans to incorporate the missing information related to a) Product classification, b) Storage method including aisle widths for rack storage, c) Maximum permitted storage height and area and signage.	IP1140-1	2017[10]
IIP-OI 012	D181 – Fire Safety Training Requirements (NFCC 2005 “National Fire Code of Canada”)	No documentation found outlining requirements for all employees concerned with transfer operations involving transfer of flammable or combustible liquids.	Revise the operating procedures and training associated with the transfer of liquid fuel to require that a Fire Watch Qualified staff member is to be present during fuel transfer operations or implement an alternate compliance.	IP1140-1	2017[10]

[10] Code of Record Gap [R-30], the IIP date should be viewed as the latest possible completion date for code of record action. Where it is possible that the resolution of a code of record gap may lead to a modification, the IIP dates include additional time to accommodate this contingency.

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Tracking #	Date
IIP-OI 015	D225 – Fire Protection Water Supply (CSA N293-07 “Fire Protection for CANDU Nuclear Power Plants” & RD-337 “Design of New Nuclear Power Plants”)	Non-compliances identified with the requirements related to design requirements for the fire protection water supply, and the interconnection between the Fire Protection water supply and the Emergency Service Water system.	Perform an assessment of the Fire Protection Water supply loop to evaluate current condition with additional demands and verify that fire protection system demands can still be achieved. In addition, increase the system demands to include an additional 500 USgpm. Complete a modification to provide a new supply of Fire Protection Water separate from the ESW system.	IP1220-19 IP1220-2 IP1220-12	Assessment: 2016 Modification: 2019
IIP-OI 016	D227 – Fire Hydrant Requirement (CSA N293-07 “Fire Protection for CANDU Nuclear Power Plants” & NFPA-24-2007 “Standard for the Installation of Private Service Mains and Their Appurtenances”)	Markings on fire hydrants are not addressed in NK38-DM-78100, “Fire Protection Water Supply and Distribution System”.	Perform flow testing and marking of the hydrants in accordance with NFPA 291 and fit the yard hydrants with a sign to indicate the need for pumping out after usage.	IP1220-20 IP1220-16 IP1320-1	2018
IIP-OI 018	D428 – Detection of Significant Fire Hazards (CSA N293-07 “Fire Protection for CANDU Nuclear Power Plants”)	Significant Fires need to be quickly detected.	1) Develop a justification for all screen 2 and 3 rooms which do not have automatic detection installed. 2) Install automatic Fire detection in rooms with Major Fire hazard rooms as identified in the FHA table 4-1.1 In NK38-REP-78000-10002 R001. 3) Install detection in high Fire hazard rooms Rx-109 and Rx-121.	Complete [R-31] IP1280-1 IP1280-1	Justification: 2016 Modifications: U0-U4: 2022 (U2 Planned Outage Restart)

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Tracking #	Date
IIP-OI 019	D429 – Fire Separation Corrective Actions(NFCC 2005 “National Fire Code of Canada”, NBCC 2005 “National Building Code of Canada”, & CSA N293-07 “Fire Protection for CANDU Nuclear Power Plants”)	A review of Darlington Nuclear Generating Station against fire separation requirements identified that Door S-213A to the laundry shaft and room R3-241 do not meet the requirements.	Replace door S-213A to the laundry shaft in room S-213 with a listed and labelled fire door having a rating of not less than 45 minutes. Remove the storage from room R3-241, construct a vestibule as a 1 h fire separation so that the storage area does not open directly into the stair or implement an alternate compliance to justify the existing room configuration.	IP1220-3 IP1220-15 IP1140-1 IP1220-2	U0: 2019 (U2 Refurbishment Outage Restart) U3: 2025[10] (U3 Planned Outage Restart)
IIP-OI 022	D436 – Emergency Lighting in airlocks and Transfer Chambers (CSA N293-07 “Fire Protection for CANDU Nuclear Power Plants”)	A Transfer Chamber was found to not be provided with Class II lighting or emergency backup.	Provide emergency lighting in Fuel Handling Transfer Chamber S120.	IP1220-4 IP1220-15	U0: 2019 (U2 Refurbishment Outage Restart)
IIP-OI 023	D442 – Fire Endurance of Fire Alarm Cable (CSA N293-07 “Fire Protection for CANDU Nuclear Power Plants”)	This issue is related to the endurance of Fire Alarm cables. While the original station cables do not meet the 1 hour requirement additional analysis has shown that the only location where the loss of a Fire Alarm signal is at risk is above the unit instrument air compressors where the unit Fire Alarm system truck cable is located.	Protect the Fire and Smoke Detection system cabling located above the unit instrument air compressors in R-108.	IP1220-18	U2: 2022 U3: 2025 U1: 2026 U4: 2028 (Each Unit Planned Outage Restart)
IIP-OI 024	D444 – Fire Stopping (CSA N293-07 “Fire Protection for CANDU Nuclear Power Plants”)	A material used for fire-stopping (Sikaflex) at the Darlington Nuclear Generating Station does not meet acceptance criteria outlined in Clause 3.1.5.2 of the NBCC for use in a building of non-combustible construction.	Perform a review of penetration seals larger than a single cable, a single tube, or 13 mm wide construction joint seal, in required fire separations, to confirm that listed fire stopping materials are used. Replace unlisted materials if they have been used.	IP1220-3	Review and replacement: U0: 2019 (U2 Refurbishment Outage Restart) U2: 2022 U3: 2025 U1: 2026 U4: 2028 (Each Unit Planned Outage Restart)

[10] Code of Record Gap [R-30], the IIP date should be viewed as the latest possible completion date for code of record action. Where it is possible that the resolution of a code of record gap may lead to a modification, the IIP dates include additional time to accommodate this contingency.

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Tracking #	Date
IIP-OI 025	D448 – Fire Dampers (NBCC 2005 “National Building Code of Canada”)	Some fire separations in the plant require appropriately rated fire dampers to be installed as per Code requirements.	Install fire dampers in ducts penetrating Service Shafts S-289 and S-290 on the 107.5m and 110.9m elevations of the CSA, in the normally occupied areas.	IP1220-2	U0: 2019 (U2 Refurbishment Outage Restart)
IIP-OI 026	D461 – Means of Egress (NBCC 2005 “National Building Code of Canada”)	The scope of this ISR issue covers egress requirements which were found to not meet the requirements for numbers of exits in S-510 and S-141.	Provide an additional means of egress from room S-141, preferably at the west end of the room. Also provide a second means of egress from room S-510 or implement an alternate compliance.	IP1140-1	Alternate Compliance 2016[10] Modifications if required U0: 2019 (U2 Refurbishment Outage Restart)
IIP-OI 027	D467 – Vertical Service Shafts (NBCC 2005 “National Building Code of Canada”)	This issue addresses concerns with the fire separations for vertical spaces in the Central Services Area.	- Install fire dampers at the duct penetrations of vertical service shafts S-289 and S-290 between the Central Services Area 107.5m and 110.9m elevations in normally occupied areas and seal any penetrations. -Enclose the top of the two laundry shafts in rooms SM-215 and SM-208 by construction that would provide a 1 h fire separation.	IP1220-2	U0: 2019 (U2 Refurbishment Outage Restart)
IIP-OI 028	D469 – Inspection Testing and Maintenance Requirements (NFCC 2005 “National Fire Code of Canada”)	No documentation was found detailing testing requirements for the general oil transfer system piping valves, and there were findings regarding the inspection, testing and maintenance of water-based fire protection systems, in conformance with NFPA 25, “Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.”	Resolve Inspection Testing and Maintenance related deficiencies associated with fuel management system valves and safety devices and confirm that the previously identified deficiencies from report NK38-REP-78000-10047 "Third Party Review Fixed Fire Protection Systems Inspection Testing and Maintenance Review" are resolved.	IP1140-1	2016[10]
IIP-OI 029	D472 – Oil Storage Tank and Piping Requirements(NFCC 2005 “National Fire Code of Canada”)	No inspection reports were found for the Emergency Power Generators fuel tank or Turbine Generator lube oil storage tanks that would indicate compliance or operational suitability of the tanks for life extension	Complete an assessment of the Emergency Power Generators fuel tanks and Turbine Generator lube oil storage tanks existing conditions to confirm the tanks' suitability for the extended life of the Station. Correct any deficiencies.	IP1220-14	Assessment: 2016 Repairs: U0: 2019 (U2 Refurbishment Outage Restart)

[10] Code of Record Gap [R-30], the IIP date should be viewed as the latest possible completion date for code of record action. Where it is possible that the resolution of a code of record gap may lead to a modification, the IIP dates include additional time to accommodate this contingency.

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Tracking #	Date
IIP-OI 030	D475 – Valves Controlling Water Supplies (NFPA-24-2007 "Standard for the Installation of Private Service Mains and Their Appurtenances", NFPA-20-2007 "Standard for the Installation of Stationary Pumps for Fire Protection")	This issue is related to the requirements for valves controlling Fire Protection Water supplies.	Complete the following actions related to Valves Controlling Water Supplies: -Test all private fire service main control valves to confirm operability. -Replace the unlisted hose valves downstream of the fire pumps with listed devices that will have an appropriate pressure rating or implement an alternate compliance. -Disconnect the cross connection between ASW and Fire Protection Water on Elevation 107.5.	IP1220-1 IP1220-14	Tests: 2016 Modifications/Repairs: U0: 2019 (U2 Refurbishment Outage Restart) U2: 2022 U3: 2025 U1: 2026 U4: 2028 (Each Unit Planned Outage Restart)
IIP-OI 031	D476 – Underground Pipe (NFPA-24-2007 "Standard for the Installation of Private Service Mains and Their Appurtenances")	This issue is related to discrepancies associated the underground piping system for fire protection water supply between the Water Treatment plant and the unit pumphouses.	Conduct an inspection and assess the state of the buried steel pipe between the Water Treatment Plant and the Unit Pumphouses to determine if it is still suitable for life extension purposes. Replace pipes if necessary.	IP1140-1	Inspection & Assessment: 2016[10] Modifications: Between U1 and U2 CCW pipes: 2022[10] Between U3 and U4 CCW pipes: 2025[10]
IIP-OI 033	D482 – Monitoring of Fire Pump Alternate Power Source (NFPA-20-2007 "Standard for the Installation of Stationary Pumps for Fire Protection")	This issue is related to monitoring of the Fire protection Water booster pump power supplies for phase loss. Additionally, no documentation of the acceptance testing procedures was found to verify the pumps were operated for the required minimum of one hour.	Switch the Fire Pump Controller to its alternate position monthly in order to monitor the Fire Protection Water booster pump odd and even power supplies for phase loss on a bi-monthly basis. Also test run the Fire Protection Water booster pumps for a duration of 1 hour to meet a pump acceptance testing requirement.	IP1140-1	2016[10]

[10] Code of Record Gap [R-30], the IIP date should be viewed as the latest possible completion date for code of record action. Where it is possible that the resolution of a code of record gap may lead to a modification, the IIP dates include additional time to accommodate this contingency.

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Tracking #	Date
IIP-OI 034	D260 – Human Factors - Annunciation Improvements (NUREG 0700 “Human-System Interface Design Review Guidelines & IAEA NS-R-1 “Safety of Nuclear Power Plants: Design”)	An assessment was performed on the human-machine interface for the Emergency Coolant Injection system and the Annunciation system. Two areas for improvement were identified: 1. Improve annunciation conditioning capability to reduce the number of nuisance alarms in the annunciation system to minimize operator distraction. 2. Improve the control scheme for the annunciation acknowledge function.	OPG has already completed the work committed in D260 to reduce nuisance alarms. Nuisance alarms associated with shutdown, start-up, and turbine trip have been reduced by 85% and current levels are acceptable to operations and human factors engineering. This meets the intent of the first area for improvement identified in D260. The second area for improvement in D260 is in the control scheme for acknowledging annunciations in the control room. The current state is acceptable however some improvements will be made to further reduce the potential for error in acknowledging annunciations.	IP0430-2	U1: 2020 U2: 2022 U3: 2025 U4: 2028 (Each Unit Planned Outage Restart)
IIP-OI 035	D027 - Severe Accident and Beyond Design Basis Accident (BDBA) Analysis/ SAMG (IAEA NS-G-1.2 “Safety Assessment and Verification For Nuclear Power Plants”)	A systematic analysis of BDBA and Severe Accidents is required and Severe Accident Management Guidelines must be fully implemented.	-Implement the Safety Improvement Opportunities (SIOs) resulting from the Environmental Assessment. -Complete the Reg Doc 2.4.1 Compliance Activities. -Complete the remaining SAMG activities which involve enhancements to the suite of guidelines.	SIO’s: Refer to IIP-EA 009 AI 2014-OPG-5461 AR 28174352-02,05,09	SIO’s: Refer to IIP-EA 009 Reg Doc 2.4.1: 2024 SAMG: 2015
IIP-OI 036	D068 - Severe Accident and Beyond Design Basis Accident (BDBA) Design/ SAMG (IAEA NS-R-1 “Safety of Nuclear Power Plants: Design” & CNSC RD-337 “Design of New Nuclear Power Plants”)	The scope of this ISR issue covers the design requirements of the plant with respect to its capability to safely respond to Beyond Design Basis Accidents (BDBA) and Severe Accidents, and that will reduce any impact to the plant, during and after the accident. Although the clauses specify aspects of the design of a nuclear power plant, all of these Integrated Safety Review (ISR) gaps were declared because a Severe Accident Management Guidelines (SAMG) program has not been fully implemented at Darlington.	-Implement the Safety Improvement Opportunities (SIOs) resulting from the Environmental Assessment. -Complete the remaining SAMG activities which involve enhancements to the suite of guidelines. -Address equipment and instrument survivability under Severe Accident conditions. -Install Passive Autocatalytic Re-combiners (PARS) in all 4 Units at Darlington.	SIO’s: Refer to IIP-EA 009 AR 28174352-02,05,09 Complete [R-32] Complete [R-33]	SIO’s: Refer to IIP-EA 009 SAMG: 2015 Instrument Survivability PARS: 2015

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Tracking #	Date
IIP-OI 037	D143 - Severe Accident and Beyond Design Basis Accident (BDBA) Program/ SAMG (CNSC G-306 "Severe Accident Management Programs for Nuclear Reactors")	The scope of this Integrated Safety Review (ISR) Issue includes the requirements for Severe Accident Management Guidelines (SAMG) and their implementation at Darlington.	-Implement the Safety Improvement Opportunities (SIOs) resulting from the Environmental Assessment -Complete the remaining SAMG activities which involve enhancements to the suite of guidelines. -Address equipment and instrument survivability under Severe Accident conditions.	SIO's: Refer to IIP-EA 009 AR 27174352-02,05,09 Complete [R-32]	SIO's: Refer to IIP-EA 009 SAMG: 2015 Instrument Survivability: 2015
IIP-OI 038	D300 – Inspection Requirements for Safety-Related Structures (CSA N291-08 "Requirements for safety-related structures for CANDU nuclear power plants & RD-337 "Design of New Nuclear Power Plants")	There is a need to conduct regular in-service examinations of safety-related structures for evidence of degradation. The structures covered include: -Those that support, house or protect nuclear safety systems,-Components of structures required for the safe operation or reactor shutdown, and -Facilities for storage of irradiated fuel and other radioactive waste material.	Prepare and implement inspection programs for the following Safety Related Structures (SRS): - Reactor Building Structures - Reactor Building Internal Structures - Central Services Area Civil Structures - Central Control Area Civil Structures - Turbine Supporting Structures - Pumphouse Structures - Intake Pipes, Ducts & Encasements Structures - Emergency Power Supply and Emergency Service Water Complex - Turbine Hall and Turbine Auxiliary Bay - Central Services Area Buildings consisting of Workshop and Laydown Area and Service Auxiliary Bay - Reactor Auxiliary Bay Civil Structures - Fuelling Facilities Auxiliary Areas Civil Structures - Irradiated Fuel Area - Fuel Handling and Services Area - Forebay Intake System Structures - Emergency Coolant Injection Tanks - Standby Generator Buildings Perform repairs as required.	TS0510-1 through TS0510-12, TS0510-14, TS0510-15, TS0510-19, TS0510-20, TS0510-21, TS0510-25 TS0510-26 TS0510-27 TS0510-30 & TS2530-1	Inspections & Repairs 2019[4] (U2 Refurbishment Outage Restart)

[4] If safety significant defects are found as a result of inspections, they will be corrected by the date specified.

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Tracking #	Date
IIP-OI 039	D328 - Post Accident Monitoring - Configuration Management (CSA N290.6-2009, “Requirements for Monitoring and Display of Nuclear power Plant Safety Functions in the Event of an Accident”)	Less than adequate configuration management of the Post-Accident Monitoring (PAM) system exists. This has resulted in the design and design documents not adequately identifying the appropriate post accident information displays.	Revise the Post-Accident Monitoring (PAM) system Design Description [NK38-DD-60350 R002], Operational Safety Requirements [NK38-OSR-08131.02-10021-R02] and operating documentation [NK38-OM-09013A R005] to be consistent with the Design Basis Document [NK38-REP-03651-10010 R003]. If required, initiate a Design Modification to modify to the appropriate PAM indicators in the MCR and USCA panels as required to comply with NK38-REP-03651-10010 “Technical Basis Document for Environmental Qualification of Post-Accident Monitoring”.	IP1240-1	2019
IIP-OI 040	D345 - Consolidated Seismically Qualified Equipment List (CSA-N289.1-08, "General Requirements for Seismic Design and Qualification of CANDU Nuclear Power Plants" & NK38-REP-03680-10079 R001, "Darlington NGS Integrated Safety Review Equipment Qualification Safety Factor Report")	OPG does not have a single consolidated list that includes all the seismically qualified Systems, Structures and Components for Darlington Nuclear Generating Station. It is the responsibility of the owner/licensee to submit this list for acceptance by the regulatory authority. However, there is no evidence that OPG has created and submitted the list.	Develop a Consolidated Seismically Qualified Equipment List for Darlington Nuclear Generating Station.	A/R 28175244-01	2016

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Tracking #	Date
IIP-OI 041	D301 - Potential Impacts from Channel Defueling (NK38-REP-03680-10116, "Review of Licensing Issues for DNGS Integrated Safety Review")	The closed Station Specific Action Item 20021306 “Darlington NGS - Units 1 and 4, Feeder Vibration During Flow Defueling” was assessed as relevant and applicable to Refurbishment. This Action Item (AI) is concerned with the various potential impacts on the reactor of employing "flow defueling". The AI was closed and OPG has subsequently defueled a varying number of channels in other outages. For Refurbishment, the entire reactor will be defueled. As such, this issue may impact Refurbishment and is applicable and relevant to Refurbishment.	- Perform necessary nuclear safety analyses and develop a defueling plan to ensure reactor defueling is performed in a manner that ensures adequate fuel cooling at all times, taking into account relevant operating experience (OPEX). -Perform assessments to determine the defueling conditions under which pressure tube fracture (e.g. due to DHC, hydride overload, fatigue cracking) is not a concern. -Perform thermal hydraulic analysis to demonstrate flow evolution in channels during defueling, placement of Flow Restricting Outlet Bundles, and the number of dummy bundles required. -Perform required nuclear safety assessments to examine impact of defueling on feeder vibration, fuel channel vibration, and fuel bundle vibration. -Perform required nuclear safety analysis to determine neutron flux monitoring requirements and expected detector response as defueling proceeds.	SI0200-1	2016
IIP-OI 042	N/A – Heat Transport Liquid Relief Valve water hammer	The Global Assessment performed a review of the licensing issues addressed in the Integrated Safety Review (NK38-REP-03680-10104 Appendix H). The path forward on the Heat Transport Liquid Relief Valve (HT LRV) water hammer issue resulted in a design change.	Replace the Primary Heat Transport Liquid Relief Valves (LRVs) to limit the risk of water hammer loading. Retain sections of removed piping for a metallurgical assessment following replacement of the Liquid Relief Valves (LRVs) in the first refurbished unit. Complete the metallurgical assessment and report results to CNSC.	A/R 28116373-03 IP0010-1 AI20101307	Replacement: U2: 2019 U3: 2022 U1: 2024 U4: 2025 (Each Unit Refurbishment Outage Restart) Assessment: 2019

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Tracking #	Date
IIP-OI 043	D028 - Systematic Analysis of Anticipated Operational Occurrences (AOO's) D030 - Identification and Classification of Events per CNSC RD-310 D332 - Reactor Control System Requirements for Anticipated Operation Occurrences (AOOs) D346 - Environmental Qualification of Equipment for Beyond Design Basis Accident (BDBA) Analysis D399 - Acceptance Criteria for Anticipated Operational Occurrences (AOO's) D400 - Deterministic Safety Analysis Uncertainties D424 - Anticipated Operational Occurrences (AOOs)	Comply with the new requirements of CNSC Reg Doc 2.4.1	Complete the Reg Doc 2.4.1 compliance activities which includes: 1) Carrying out a comprehensive review of Event Identification and Classification 2) Performing AOO analysis 3) Performing DBA analysis 4) Associated documentation updates 5) Developing analysis rules, coordinating with other COG members, and interactions on technical matters with the CNSC	AI 2014-OPG-5461	2024

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Tracking #	Date
IIP-OI 044	D416 - N285.4 Periodic Inspection Program (PIP) Governance References N285.4-05 not N285.4-09 UPD2 D420 - New Erosion and Corrosion Inspection Requirements in N285.4-09 UPD2 not Reflected in Current PIP Governance, D421 - Extended Life Inspection Schedules in N285.4-09 UPD2 are not Reflected in PIP Governance D422 - Assessment of Prior Operating Non-Conforming State is required when Dispositioning Inspection Results D423 - Governance does not Ensure that Qualifications of Examination Personnel are Included Within Inspection Reports (CSA N285.4 “Periodic Inspection for CANDU Power Plants”)	Perform compliance activities to meet CSA N285.4 including appropriate assessments and PIP updates.	When the Darlington licence is updated to include the 2014 edition of CSA N285.4, update the Darlington Periodic Inspection Plans (PIPs) for Piping and Components, Fuel Channels, Feeders and Steam Generators as necessary to address the requirements of N285.4.	A/R 28168387-02	2019
IIP-OI 046	D426 - Source Term Analysis Not Complete for BDBEs (IAEA-SSG-2-2009 “Deterministic Safety Analysis for Nuclear Power Plants”)	Assess Emergency Response Projection (ERP).	Assess the Emergency Response Program (ERP) for potential enhancements to address multi-unit BDBE (Beyond Design Basis Events) scenarios.	A/R 28175339-01	2016

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Tracking #	Date
IIP-OI 049	D356 - Compliance with ASME BPVC, Section III NF (CSA N285.0 “General Requirements for Pressure-Retaining Systems and Components in Nuclear Power Plants”	The jurisdictional boundary between ASME III and the building structure defined for Darlington NGS does not meet the current requirements of ASME Section III.	When the DNGS licence is updated to include the 2014 edition of CSA N285.4, update the DNGS Periodic Inspection Plans (PIPs) for Piping and Components to address the requirements of N285.4.	A/R 28168387-02	2019
IIP-OI 050	D370 - Qualification of Inspection Procedures and Demonstration of their Effectiveness (CSA N285.4 “Periodic Inspection of CANDU Nuclear Power Plant Components")	Periodic inspection procedures for volumetric inspections of pressure tubes are to be documented and proven capable of yielding results to a sensitivity that is appropriate for the system or components being inspected. All inspection procedures used in periodic inspections need to be qualified. Inspection procedures applied to pressure tube inspections are to be qualified by the CANDU Inspection Qualification Bureau (CIQB).	Complete initial Inspection Qualification process for applicable Darlington Major Components per CSA N285.4 (clauses 12, 13, and 14) requirements.	A/R 28169447-02	2019
IIP-OI 051	D344 - Self-Vented Pressure Regulating Valves (CSA N290.5, “Requirements for Electrical Power and Instrument Air Systems of CANDU Nuclear Power Plants”)	Self-vented pressure regulating valves are required to be used to supply air to components with design pressures lower than the air system design pressure. Evidence that Darlington NGS is compliant with this requirement is not readily available.	Verify that the equipment design pressures for Pressure Regulating Valves (PRV’s) that are not self-vented are not less than the design pressure of the air supply system or the equipment is otherwise provided with overpressure protection.	A/R 28175245-03	2016

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Tracking #	Date
IIP-OI 053	D397 - Time Limited Aging Analysis for Civil Structures and Components (NK38-REP-03680-10078 R001, "Darlington NGS Integrated Safety Review - Ageing and Actual Condition of Systems Structures and Components Safety Factor Report")	The acceptance criterion for fitness for service is based on Time Limited Aging Analysis (TLAA) which was generally established from the original safety analysis. The acceptance criterion for TLAA of the Safety Related SSCs for a nuclear station which undergoes refurbishment should be re-evaluated and re-established to demonstrate their continued validity that aging effects will be effectively managed.	An assessment of TLAAs for Darlington has been performed and it identified the following actions to be completed. 1. Inspect external concrete components for depth of concrete carbonation and develop corrective actions to mitigate degradation if required. 2. Review the design calculations for the reactor building, vacuum structure and steam turbine and auxiliary structure to determine if concrete creep and shrinkage loads were based on an assumed service life for these structures (e.g. 30 years) and if that assumption remains valid. Perform further analysis if required. 3. The civil structure inspection program at Darlington inspects for concrete degradation due to Alkali Aggregate Reactivity (AAR) and none has been observed at Darlington to date. These inspections will continue through the extended life of Darlington. In addition, the documentation from the construction of Darlington will be reviewed to determine how AAR was addressed in the selection of aggregates to provide further confirmation that AAR degradation will not occur at some point in the future.	IP1440-1	Inspection: 2019[4] (U2 Refurbishment Outage Restart) Review & Analysis: 2019
IIP-OI 054	D398 - Transient/Fatigue Monitoring Program (NK38-REP-03680-10078 R001, "Darlington NGS Integrated Safety Review - Ageing and Actual Condition of Systems Structures and Components Safety Factor Report")	While there is little evidence of fatigue induced degradation of Systems, Structures and Components (SSCs) during current life, fatigue is a time dependent mechanism and a fatigue monitoring program could be a valuable tool for problem characterization and the implementation of mitigation strategies during post refurbishment operation.	Develop, and implement a Transient/Fatigue Monitoring Program at Darlington.	IP1260-1	U2: 2019 U3: 2022 U1: 2024 U4: 2025
IIP-OI 055	D425 – No Best Estimate Analysis of Operational Events (IAEA-SSG-2-2009 “Deterministic Safety Analysis for Nuclear Power Plants”)	There was no evidence found that the best estimate approach is used for analysis of operational events.	Revise OPG Governing document N-MAN-03600-10005, Nuclear Safety Analysis to require the use of best estimate approach or a similarly conservative approach for analysis of operational events.	A/R 28175247-01	2019

[4] If safety significant defects are found as a result of inspections, they will be corrected by the date specified.

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Tracking #	Date
IIP-OI 056	D498 - Airflow from Zone 3 to Zone 2 Does not Meet Design Requirements(NS-G-1.13 “Radiation Protection Aspects of Design for Nuclear Power Plants”)	The as-built condition of the Powerhouse Ventilation System does not meet the following requirement: “The airflow in the ventilation system should be such that the pressure in a region of lower airborne contamination is higher than the pressure in a region of potentially higher contamination. Thus the airflow in the ventilation system should be directed from regions of lower airborne contamination to regions of higher contamination and air should be extracted from the latter. The airflow should be such as to minimize the re-suspension of contamination.”	Repair and return to service Units 1 and 3 supply fans and non-contaminated exhaust fans. Once returned to service in all units, conduct smoke tests to confirm inter-zonal airflow direction at the Zone 2/3 boundaries in all units.	IP1290-1	2019
IIP-OI 058	D502 - Foundation Steel Piling Condition Assessment for Life Extension (National Building Code of Canada (2005))	CNSC staff requested OPG to provide comprehensive site-specific assessment that can provide thorough information on the potential for pile corrosion at the Darlington site. Based on the available evidence, there is no immediate risk to the buried steel piles on the Darlington site. In addition, periodic civil structural inspections will identify the early warnings signs should there be any significant pile corrosion. As a result the safety risks associated with this IIP item are very low and no additional mitigating actions are necessary.	Evaluate options available to better characterise the corrosion of buried steel foundation piles, using conservative assumptions, to ensure that they can continue to fulfill their function for extended life. Options may include further analysis, testing, or inspections.	A/R 28175343-01	2028
IIP-OI 059	D504 – Electrical Equipment and Wiring (CSA N293-12 “Fire Protection for CANDU Nuclear Power Plants”)	Changes to the 2009 edition of the CSA C22.1 may impact protection from fire.	1) Perform a code refresh between the Canadian Electrical Code (CEC) Part 1 2006 Edition [R-34] and the 2009 edition [R-35]. 2) The code refresh concluded that there are no significant code changes that impact protection from fire. One minor modification is required: Replace the water tight conduit seals with explosion proof seals on the Heat Transport Hydrogen Addition system, units 1 to 4 -63352-FT6.	Complete [R-36] IP1460-1	Code Refresh: 2015 Modifications: U2: 2022 U3: 2025 U1: 2026 U4: 2028 (Each Unit Planned Outage Restart)

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Tracking #	Date
IIP-OI 060	D517 – Electrical Protections and Requirements for Fire Pump Systems (NFPA-20-2013 "Standard for the Installation of Stationary Pumps for Fire Protection")	This issue is related to the requirements for electrical protection of Fire Pump systems. As per the code requirement, ground fault interruption should not be installed in any fire pump control or power circuit. The existing installation includes a ground fault interruption on the Fire Protection Water booster pump. Also it could not be confirmed based on the documentation if the fire pump motor terminal boxes are a listed means of connection. This issue is low risk, mitigating actions are not required since the pumps are tested monthly, have redundant power supplies and in the unlikely event that the fire booster pump in one unit is unavailable, a fire booster pump in an adjacent unit can be used.	Modify the Fire Protection Water booster pump electrical installation to eliminate ground fault interruption and ensure the electrical connections at the fire pump motor terminal boxes are a listed means of connection.	IP1310-1	U0-U4: 2023
IIP-OI 061	D521 – Fire Safety Plan for Storage of Group A Plastics, Rubbers, Aerosols and Dangerous Goods (NFCC 2010 "National Fire Code of Canada")	The DNGS Fire Safety Plan, NK38-PLAN-08965.91-10001-R006, does not document the location or quantities of storage of Group A plastics, rubber products, Level 2 or 3 aerosols, or dangerous goods.	Update the Fire Safety Plan and the Pre-Fire Plans to the NFCC 2010 requirements to ensure that they are aligned and detail the location and quantity of all stored substances as required.	A/R 28175258-01	2016
IIP-OI 062	D522 – Tank Storage of Combustible Liquids (NFCC 2010 "National Fire Code of Canada")	These issues are related to the requirements for Fuel Oil storage tanks and the associated piping.	-Initiate predefines for continuous and periodic in-service monitoring of the SG and the EPG tanks and implement a Fuel Oil reconciliation process, in accordance with the requirements of the 2010 NFCC. - Revise N-PROC-MA-0088, Buried Piping Program Requirements, to use a graded approach for the replacement of single-walled piping with double walled material in instances of leakage, rather than "repair" or "accept as is". - Prepare an alternate compliance to justify the graded approach for the replacement of single-walled piping with double walled material in instances of leakage.	A/R 28175303-01, 04, 05	2019

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Tracking #	Date
IIP-OI 063	D523 – Piping System Requirements (NFCC 2010 “National Fire Code of Canada”)	These issues are related to the requirement to replace single wall fuel oil piping with double wall piping if degraded buried piping is found.	Revise N-PROC-MA-0088, Buried Piping Program Requirements, to use a graded approach for the replacement of single-walled piping with double walled material in instances of leakage, rather than “repair” or “accept as is”. - Prepare an alternate compliance to justify the graded approach for the replacement of single-walled piping with double walled material in instances of leakage.	A/R 28175307-01, 04	2019
IIP-OI 064	D565- Implementation of Severe Accident Management Guidelines (SAMG) Validation and Refinement (CNSC Regulatory Document REGDOC-2.3.2, “Accident Management: Severe Accident Management Programs for Nuclear Reactors”)	The implementation of Severe Accident Management Guidelines (SAMG) at Darlington is ongoing.	There is already a project in progress to complete SAMG at Darlington. The majority of the work has been completed, guidelines are in place and staff have been trained and exercises are conducted using SAMG. The remaining work involves enhancements to the suite of guidelines and for IFB and multi-units guidelines.	AR 28174352-02,05,09	2016
IIP-OI 066	D607 - Severe Accident and Beyond Design Basis Accident (BDBA) Design Severe Accident Management Guidelines (SAMG) (CSA N290.3 “Requirements for the Containment System of Nuclear Power Plants”)	CSA N290.3 requirements for new build are a Containment Filtered Venting System to protect containment integrity, Shield Tank Overpressure Protection to promote In-Vessel Retention of corium to prevent Core Concrete Interaction, and Severe Accident Management Guides to monitor hydrogen.	-Implement the Safety Improvement Opportunities (SIOs) resulting from the Environmental Assessment. -Complete the remaining SAMG activities which involve enhancements to the suite of guidelines. -Install Post Autocatalytic Re-combiners (PARS) in all 4 Units at Darlington.	SIO’s: Refer to IIP-EA 009 AR 28174352-02,05,09 Complete [R-33]	SIO’s: Refer to IIP IIIP-EA 009 SAMG: 2015 2015
IIP-OI 069	D612 - Containment Boundary Report Open Items (CSA N290.3-11 “Requirements for the Containment System of Nuclear Power Plants”)	The following open Design Guide (DG-7) exceptions were found in the Containment Boundary Report: Powerhouse Service Air System V234 listed as Containment Boundary (CB) on the flow sheets. D20 Leakage Collection System containment boundary for L82-D2 is not being met.	Retrieve and review NK38-CORR-34280-{123889} and NK38-CORR-34280-{123891} to determine whether the requirements of Clause 12.1.2 and Annex A.2 Figure A.1, respectively of CSA 290.3 have been met. Determine if a design guide exception is required and if so, prepare the design guide exception.	A/R 28175283-01 ,02	2017

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Tracking #	Date
IIP-OI 071	D618 - Soil Liquefaction Potential (N289.3" Design Procedures for Seismic Qualification of CANDU Nuclear Power Plants")	No evidence was found that the identification and evaluation of the potential for soil liquefaction at Darlington site was completed.	Review the available information to verify that the liquefaction potential for fill materials in the Protected Area related to safety related systems and structures is low. Otherwise, complete a liquefaction assessment study.	A/R 28175301-01	2019
IIP-OI 072	D619 - Control of Combustible Liquids (CSA N293-07 "Fire Protection for CANDU Nuclear Power Plants")	Combustible liquids must be controlled where uncontrolled leakage could jeopardize FSSA systems.	Install 25ft squared dykes around all 4 Emergency Service Water (ESW) pumps to contain a potential spill/fire of the 135L of oil contained in each ESW pump motor to the pump motor of origin.	IP1280-1	U0: 2019 (U2 Refurbishment Outage Restart)

Appendix B: Completed Activities

Table 5: EA (Completed Activities)

IIP Item Number	Environmental Component (Reference)	Mitigation Objective (In design and Additional Mitigation Measures)	Action Plan	Completion Reference
0002	Atmospheric, Geology, Hydrology, Surface Water, Terrestrial CNSC Screening Report – page 79, 80, 83, 84, 85, 100, 101, 102, 104, 105, 110 and 111. (also in EIS Table 5.15)	Demonstrate that implementation of good industry management practices are effective in minimizing air, soil and water quality effects on humans and biota.	1) Incorporate applicable Good Industry Management Practices as suggested in the EA and include consideration for enhancing wildlife crossings where feasible, in the “Nuclear Projects – Environmental Requirements Guideline,” N-GUID-09701-10013. Issue document for contractors to develop and implement project-specific Environmental Protection Plans. 2) Establish environmental oversight and monitoring requirements for Nuclear Projects. Environmental oversight and monitoring specified in “Darlington Refurbishment – Environmental Program Management Plan”, NK38-NR-PLAN-09701-10001 Sh. 004 Section 2.5. 3) Incorporate consideration of Good Industry Management Practices in all projects which may have an environmental impact. The Project Charter Template (N-TMP-10117-R005), which defines the need for a project, was revised to include the Environmental Impact Worksheet (N-FORM-10422). After the project has been approved a Project Management Plan is developed (PMP-TMP-00001-R002) which references N-GUID-09701-10013 Nuclear Projects – Environmental Requirements Guideline in Section 1.5	[R-37] [R-38] [R-39] [R-40] [R-37]
0004	Land Use CNSC Screening Report – page 106 (also in EIS Table 5.15)	Monitor and consult municipalities on land use policies and future developments proposed in the vicinity of DN site with focus on sensitive land uses (e.g. hospitals, schools) which may result in incompatible uses and effects on implementation of the emergency plans.	Update emergency management governance to include a statement that Real Estate Services (RES) is the Primary OPG Department responsible for monitoring of land use activities and policies in proximity to DNGS. The wording of the update will include the fact that EP supports this activity when required, including providing information on risk of incompatible uses with respect to implementation of nuclear emergency plans.	[R-41]
0007	Physical and Cultural Heritage CNSC Screening Report, page 112	Protect and avoid the potential impact on the Van Camp cemetery which has archaeological and cultural heritage resource interest.	• OPG Guide “Excavation, Concrete Drilling, and Anchoring Process,” N-GUID-01983-10001, section 1.13.5 provides the approximate location of the Van Camp cemetery and actions to be taken to protect the cemetery should it be encountered. The Guide is referenced in OPG Procedure “Identification of Buried or Embedded Services”, OPG-PROC-0138 and Engineering Design Standard “Excavation and Backfill Practices”, N-STC-02110-10000.	[R-42] [R-43] [R-44]
0008	Malfunctions and Accidents CNSC Screening Report, page 123, 124, 126, 127, 145 and 146	Maintain emergency response procedures to protect the health and safety of people and the environment.	OPG has the following emergency response procedures to protect the health and safety of people and the environment. • “Consolidated Nuclear Emergency Plan,” N-PROG-RA-0001 and • “Abnormal Waterborne Tritium Emission Response,” N-PROC-OP-0038.	[R-45] [R-46]

Table 6: CCAs (R001 Completed Activities)

IIP R000 Item Number	CCA	System	Description	Condition	Activity Description	Completion Reference
0063	2547	G.31 Powerhouse Ventilation System, USI# 73220, System #: 0050	HVAC Fan(F)-Non R/S	Satisfactory	Replace remaining non-contaminated fans found with low speed blades.	[R-47]

Table 7: CCAs (R002 Completed Activities)

IIP R001 Item Number	CCA	System	Description	Condition	Activity Description	Completion Reference
IIP-CC 012	729	Digital Control Computers System, USI# 69000, System #: 0016	Interprocess Communication & Transfer of Control	Satisfactory	Assess I/O subsystems WIBA terminal blocks. Replace terminal blocks based on assessment.	[R-48]
IIP-CC 013	1441	Emergency Coolant Injection System, USI# 34320, System #: 0018	ECI Water Storage Tank	Satisfactory	Inspect civil structure of ECI Storage tank and repair as required.	[R-49]
IIP-CC 030	585	Moisture Separator Reheater System, USI# 41800, System #: 0043	Motorized Valves	Satisfactory	Perform internal inspection for a representative sample of system MOVs.	[R-50]
IIP-CC 038	153	PHT Pressure and Inventory Control System, USI# 33300, System #: 0054	Pressurizer	Satisfactory	Extend inspection of the pressurizer to all units as required.	[R-51]
IIP-CC 058	2964	Shutdown System Process System, USI# 68300, System #: 0071	LISS Injection & Mixing Tanks	Good	Perform video/visual inspection on 1-34710-TK4 during outage conditions to provide baseline inspections for the LISS tanks.	[R-52]
IIP-CC 066	83	Structures - Reactor Building and Fueling Facilities, USI# 21000, System #: 0080	Central Service Area - Nuclear	Good	Perform inspections on the civil structures located in Central Service Area-Nuclear. Perform repairs based on inspection results.	[R-53]
IIP-CC 068	85	Structures - Powerhouse System, USI# 22000, System #: 0081	Central Service Area - Conventional Part	Good	Perform required inspections for Central Service Area (CSA) buildings consisting of Workshop and Laydown Area (WLA) and Service Auxiliary Bay (SAB). Perform repairs based on inspection results.	[R-54]
IIP-CC 070	87	Structures - Powerhouse System, USI# 22000, System #: 0081	Steam Turbine Supporting Structures	Satisfactory	Perform inspections on the Turbine Supporting Structures. Perform repairs based on inspection results. (Excludes trombik supports)	[R-55]

Table 8: Code Gaps (R001 Completed Activities)

IIP R000 Item Number	Issue Number & Title	Issue Description	Action Plan	Completion Reference
0149	D081 – Radioactive Material Storage (CSA N293-07 “Fire Protection for CANDU Nuclear Power Plants”)	The scope of this issue covers the requirements for the storage of radioactive materials.	Implement a radioactive material storage evaluation and approval process to ensure that the intended level of safety is not compromised in the event of changes in the location, nature and/or loading of radioactive materials related to the analyzed conditions under the FHA.	[R-56]
0178 0179 0180 0181 0182 0183	D251 – Fire Protection Requirements for Air-Cleaning Units (ASME N509-2002 “Nuclear Power Plant Air-Cleaning Units and Components”)	This Issue covers fire protection requirements for air cleaning systems listed in ASME N509-2002. There is no evidence in Darlington Nuclear Generating Station documentation as to whether or not the requirements are being met.	Analyze charcoal filter hazards to determine appropriate protection measures.	[R-57]
0279	D445 - Combustible Insulation (NBCC 2005 “National Building Code of Canada”)	Documentation could not be found to confirm that if foamed plastic insulation was present in vertical service shafts, or if it was properly protected.	Investigate vertical service shafts S-289 and S-290 to determine if foamed plastic insulation exists in the spaces. If so, initiate a modification to either remove or protect it by the appropriate thermal barrier.	[R-58]
0280 0281	D446 - Combustible Material In Ducts (NBCC 2005 “National Building Code of Canada”)	Insufficient evidence was found to confirm if combustible coverings and linings on vibration isolation connectors and ducts are interrupted at fire separations.	Confirm the type of duct linings and coverings. If combustible, confirm that the criteria of Sentences 3.6.5.4.(2), (4) and (5) below are satisfied. Initiate a modification to remove any foamed plastic insulation found. Evaluate others for continued use based on their properties.	[R-59]
0283	D452 – Spatial Separation and Exposed Building Face (NBCC 2005 “National Building Code of Canada”)	Documentation could not be found to confirm that foamed plastic insulation is not used in exterior walls of the buildings within the scope of the review, and if it is, that the wall assembly meets the requirement for protection on the exterior side.	Confirm the type of insulation used in the metal panel exterior walls. If the insulation is foamed plastic, confirm that the panels comply with the testing criteria indicated in clause b). If the panels do not conform to clause b), complete an evaluation of the potential fire impact.	[R-60]
0287 0288	D464 – Signage Requirements (NBCC 2005 “National Building Code of Canada”, NFCC 2005 “National Fire Code of Canada”)	There are no signs posted in the Powerhouse on elevation 100 in exit stair indicating that that level is the level of exit discharge, and the Cafeteria in Unit 0 is an assembly occupancy and the occupant load exceeds 60 persons, but no documentation was found indicating the occupant load sign is posted.	Provide appropriate signs at the exit discharge level of exit stairs that do not terminate and discharge to the exterior at El. 100, but continue on to lower elevations.	[R-61]
0292	D468 - Pipe Insulation Requirements (NBCC 2005 “National Building Code of Canada”)	Insufficient evidence was found to confirm if pipes reach 120°C, and if they do, if insulation meets the ASTM C 411 "Hot-Surface Performance of High-Temperature Thermal Insulation".	Post appropriate signage as required by Clause 2.7.1.4 of NFCC – 2005 in the Cafeteria.	[R-62]
0295	D469 - Inspection, Testing and Maintenance Requirements (NFCC 2005 “National Fire Code of Canada”)	Testing of emergency power systems is carried out on the battery banks, but it has not been confirmed whether the Standby Generators are adequately tested to the CAN/CSA-C282 standard.	Update the existing Preventative Maintenance Identification (PMID) or create a new one for the SG for inspection and testing as per the requirements of CAN/CSA-C282, “Emergency Electrical Power Supply for Buildings”.	[R-63]

IIP R000 Item Number	Issue Number & Title	Issue Description	Action Plan	Completion Reference
0297 0298 0299	D472 - Oil Storage Tank and Piping Requirements (NFCC 2005 “National Fire Code of Canada”)	This Integrated Safety Review (ISR) issue covers the requirements of oil storage tanks and their associated piping as per the fire protection codes and standards. The requirements such as tank construction and ventilation, piping installation, foundations and supports, shut-off valves, locations and clearances, maximum quantities of stored materials and manual fire protection provided.	Complete an assessment of the EPG and Lube Oil tanks existing tank conditions to confirm the tanks' suitability for the extended life of the Station. Correct any deficiencies.	[R-64]
0300 0301	D473 – Documentation (NFPA-24-2007 “Standard for the Installation of Private Service Mains and Their Appurtenances”)	Hose Houses have been deleted as per PCP 84900. However, Drawing NK38-F5H-78110-0004-R019 still shows a hose house symbol adjacent to Hy-10.	Revise documentation to eliminate the hose house references from NK38-F5H-78110-0004 and the design manual NK38-DM-78100 as the Hose Houses have been previously removed in the field as approved by PCP84900.	[R-65]
0311 0312	D477 - Size of Bypass(NFPA-20-2007 “Standard for the Installation of Stationary Pumps for Fire Protection”)	The bypass is 4” which does not meet the requirement of the discharge pipe being a minimum 5" in size.	Perform a hydraulic analysis to compare the friction losses in the 4 inch diameter bypass to the required 5 inch diameter pipe to demonstrate that the 4 inch pipe is sufficient.	[R-66]
0320	D484 - Magnetic Locks (NBCC 2005 “National Building Code of Canada”)	Documentation on the operation of the electromagnetic locking devices could not be found.	Review the operation of the electromagnetic locking devices with all main control room staff to confirm that they are comfortable with their operation and the risks involved should the locks not comply with the requirements of NBCC Clause 3.4.6.15 (4).	[R-67]
0352 0353 0354 0355 0356 0357 0358 0359 0360 0361	D247 - In-service Testing of Air Treatment Systems (ASME N510 - “Testing of Nuclear Air Treatment Systems”)	Routine practices are not followed for tests which would determine; filter housing leakage, filter bypass leakage, degradation of filter media following inadvertent exposure degradation agents (solvents, paints, or other organic fumes or water intrusion).	Adopt CSA N288.3.4, "Performance Testing of Nuclear Air Cleaning Systems at Nuclear Facilities" which was issued in April 2013. Review CSA N288.3.4 as part of the ISR Code Refresh process and resolve any gaps.	[R-68]
0463	D027 - Severe Accident and Beyond Design Basis Accident (BDBA) Analysis/ Severe Accident Management Guidelines (SAMG) (IAEA NS-G-1.2 “Safety Assessment and Verification for Nuclear Power Plants”)	The safety analysis should aim to quantify a plant safety margin and demonstrate that a degree of defence is provided for this class of accidents.	The SAMG Guides make use of insights from the Level 2 analysis to guide the emergency response on-site to prevent/control the progression of severe accidents and limit releases of radioactive material. It has been issued and the validation is in progress. Several SAM exercise drills have already been performed. Off-site emergency response is managed by the provincial emergency response organization. The Level 2 analysis demonstrates that there is an acceptable risk associated with all severe accident scenarios. No further action is required.	[R-69]

IIP R000 Item Number	Issue Number & Title	Issue Description	Action Plan	Completion Reference
0477 0478 0479 0480 0481 0482 0483 0484 0485 0486 0487 0488	D337 – No Governance Reference for Zone Definitions (Province of Ontario Nuclear Emergency Plan (PNEP))	There is no suitable governance reference for Zone Definitions, Zone Radii, Zone Response Sectors, Primary Zone Response Sector Pattern, Primary Zone Response Sector Demarcation, Secondary Sub Zones, Actual Zones and Response Sectors, Restricted and Buffer Zones, delineated by Field monitoring, DNGS Contiguous Zone definition, DNGS Primary Zone definition, DNGS Secondary Zone definition and DNGS Primary Zone Response Sectors.	Revise OPG Program, N-PROG-RA-0001 R010, “Consolidated Nuclear Emergency Plan” and/or N-STD-RA-0004, “Emergency Off-Site Radiological Monitoring Process for Airborne Releases of Radioactive Materials” to reference Zone Definitions, Zone Radii, Response Sector Boundaries, Desirable Pattern of Response Sectors, Secondary Sub Zones, Actual Zones and Response Sectors, Restricted and Buffer Zones, delineated by Field monitoring, DNGS Contiguous Zone definition, DNGS Primary Zone definition, DNGS Secondary Zone definition and DNGS Primary Zone Response Sectors.	[R-70]
0489	D338 - No Governance to Maintain 5 MDUs (Province of Ontario Nuclear Emergency Plan (PNEP))	There is no governance reference to demonstrate that OPG will continue to retain and maintain the 5 MDUs as required by the PNERP.	Revise N-PROG-RA-0001, Consolidated Nuclear Emergency Plan (CNEP) to comply with the requirements of Ontario Provincial Nuclear Emergency Response Plan (PNERP), 2009 Clause 4.7.5 with regard to radiation monitoring and decontamination units (MDUs).	[R-71]
0490	D339 - Radiological Event Monitoring Support for Non-OPG Events (Province of Ontario Nuclear Emergency Plan (PNEP))	PNERP requires OPG to provide a radiation monitoring service to the Emergency Management Ontario (EMO) Environmental Radiation Monitoring Group for a non-OPG radiological event.	Prepare and issue a Letter of Understanding to EMO that will confirm and define OPG’s responsibility to provide radiological event monitoring support for a non OPG event.	[R-72]
0491	D115 - Fire Protection Requirements for Laboratories (NFCC 2005 “National Fire Code of Canada”)	Available documentation could not verify compliance with the requirements for ignition sources and combustible material control in a laboratory, including the requirements for high temperature limit switches for heating equipment, and restrictions when an ignition source is used in conjunction with flammable and combustible liquids.	Evaluate the use of the heaters to confirm whether they will be used in unattended applications, and whether overheating of the heater could cause a fire or explosion. If so, equip the heater with an audible alarm or some other type of alarm notification that would alert personnel to the fault.	[R-73]
0495	D460 – Fuel Supply Shut Off Valves (NBCC 2005 “National Building Code of Canada”)	An emergency fuel shut off valve for engines or turbines used for an emergency electric power supply must be provided and have a sign.	Add the required signs or revise Pre-Fire Plans.	[R-74]
0496	D482 – Monitoring of Fire Pump Alternate Power Source (NFPA-20-2007 “Standard for the Installation of Stationary Pumps for Fire Protection”)	The power to the monitoring loop is drawn from only two of the three phases with no evidence that a signal would be initiated on loss of control power. Also, no documentation has been found indicating the phase loss signal is monitored for each of the feeds	Review the existing MCC current tap relay should be reviewed to confirm that it is fail safe. If it is not, install an alternative circuit separate from the MCC circuit. Review and confirm both the primary and alternate power sources.	[R-75]
0502	D266 - Lack of ALARA & Radiation Protection Training for Plant Design Staff (NK38-REP-03680-10077 “Darlington NGS-A Integrated Safety Review Plant Design Safety Factor”)	The current program provides no specific training course or Computer Based Training (CBT) to ensure staff applies As Low As Reasonably Achievable (ALARA) to radiation protection within the design process.	Complete the following activities: - The creation of the CAL - The implementation of the CAL	[R-76]

IIP R000 Item Number	Issue Number & Title	Issue Description	Action Plan	Completion Reference
0503	D303 - Extension of the Containment Envelope Requirements (CNSC R-7 “Requirements for Containment Systems for CANDU Nuclear Power Plants", DG-38-03650-7 “Nuclear Safety Design Guide - Darlington NGS Extensions of the Containment Envelope")	CNSC staff has requested that OPG provide evidence that the calculation and analysis was completed to support the statement as presented in the Design Guide Exception that "For large, fluid filled structures such as the Shield tank extension, the internal design pressure is not indicative of its capacity to withstand the external pressure resulting from Loss of Containment Accident (LOCA) (48 kPa(g). Such a structure can withstand external pressures significantly higher than the limiting internal pressures. The Shield tank assembly has been analyzed for a containment positive pressure test of 111 kPa(g) and the stresses are well within the acceptable limit."	Either retrieve the required documents from CANDUEnergy or recreate the documents / analysis required to close the gap.	[R-77]
0504	D304 - Change to Extension of the Containment Envelope (CNSC R-7 “Requirements for Containment Systems for CANDU Nuclear Power Plants", DG-38-03650-7 "Nuclear Safety Design Guide - Darlington NGS Extensions of the Containment Envelope"	CNSC have requested OPG to provide the reference document to support the following statement made in the Design Guide Exception: "The maximum pressure (in Line 12) following an accident would be 98 psia (static 85 psia pressure rinse in the vacuum structure of about 13 psia). This small incremental pressure rise from the normal operating pressure is unlikely to affect the integrity of the piping, as it is still well below the piping design pressure."	Either retrieve the required documentation or recreate the documents / analysis required to close the gap.	[R-78]
0505	D321 - Threaded Connections (CSA N285.2 “Requirements for Class 1 C, 2C and 3C Pressure-Retaining Components and Supports in CANDU Nuclear Power Plants")	Threaded connections to Fuelling Machine Class 1 vessel walls do not meet all of the requirements of Clause 9.5 of CSA N285.2-99.	Perform additional analysis of threaded connections in Fuelling Machine Extension Tube and Drive Housing. Verify that reinforcement of the threaded connections meets the requirements of Paragraph NB-3300 of the ASME Boiler and Pressure Vessel Code, or that the stresses at the threaded connections meet the requirements of ASME Section III Subsection NB.	[R-79]
0508	D355 - Library Functions (N286.7-99, "Quality Assurance of Analytical, Scientific, and Design Computer Programs for Nuclear Power Plants")	The applicable OPG governing document, N-PROC-MP-0095, does not include the requirement that the design description include library functions.	Revise Table 2 “Graded Application for Design and Development Tasks” of N-PROC-MP-0095 to require that library functions are included in the design description. Incorporate this requirement into N-PROC-MP-0095 at the first opportunity to revise this governing document.	[R-80]
0511	D412 - Predicted Failure mode of Anchorage Systems (CSA N287.3 "Design Requirements for Concrete Containment Structures for CANDU Nuclear Power Plants")	There is a lack of documentation requiring anchorage systems to be designed to exhibit ductile behaviour in safety related structures.	Perform calculations and/or finite element limit load analysis for selected anchorage/support configurations using actual material properties for the anchorage system to demonstrate that the predicted failure mode is a ductile failure.	[R-81]
0512	D413 - Concrete Cover for Reinforcement (CSA N287.3 "Design Requirements for Concrete Containment Structures for CANDU Nuclear Power Plants")	There is a lack of accounting for the design requirements for actual concrete cover of containment structures in relation to actual environment conditions (humidity, temperature, chemicals, etc.).	Undertake an assessment on actual concrete cover of safety-related structures in relation to actual environment conditions (humidity, temperature, chemicals, etc.).	[R-82]

IIP R000 Item Number	Issue Number & Title	Issue Description	Action Plan	Completion Reference
0515	D500 - Adequacy of the N289.3-M81 Code Review Report (CSA-N289.3 “Design Procedures for Seismic Qualification of CANDU Nuclear Power Plants”)	There is a lack of a listing of systems and structures that were considered in the N289.3-M81 code review report.	Clearly identify the systems and structures including SCI/USI in the code refresh review for the 2010 edition CSA N289.3. Also describe the methodology that was used to identify the systems and structures that are within the scope. When assessing compliance against the clauses in CSA N289.3-201 0, demonstrate compliance for all of the systems and structures within the scope of the review.	[R-83]
0517	N/A – Life Extension Activities resulting from CCA Adequacy Review and CCA Recovery Project	Review the results of the Component Condition Assessment (CCA) Adequacy Review and CCA Recovery Project for potential actions required for life extension.	Update the Integrated Implementation Plan (IIP) with the results of the CCA Adequacy Review and CCA Recovery Project.	The following line items have been added to Appendix A of the IIP R001: IIP-CC 008 IIP-CC 009 IIP-CC 016 IIP-CC 017 IIP-CC 023 IIP-CC 038 IIP-CC 040 IIP-CC 043 IIP-CC 051 IIP-CC 075 IIP-CC 076 IIP-CC 077
0518	N/A- Improve the Aging Management Process documentation	The Global Assessment identified a recommendation to improve the Aging Management Process documented in N-PROC-MP-0060 to better address consideration for life extension.	Modify the Aging Management Program governance to address life extension.	[R-8]

Table 9: Code Gaps (R002 Completed Activities)

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Completion Reference
IIP-OI 005	D059 – Lightning Protection (CSA N293-07 “Fire Protection for CANDU Nuclear Power Plants”)	The scope of this ISR Issue covers the protection of all structures and equipment from lightning. This includes buildings, above ground tanks, stacks construction cranes, and meteorological towers.	Complete a review of the current lightning protection at the Station to determine if it is compliant with NFPA 780 - 2004. Install upgrades where required to achieve compliance with NFPA 780 – 2004.	[R-84]
IIP-OI 007	D115 – Fire Protection Requirements for Laboratories (Powerhouse) (NFCC 2005 “National Fire Code of Canada”)	Documentation could not be located to demonstrate compliance with requirements for cleaning, inspection and maintenance of electrical equipment, mechanical systems, piping, valves, automatic and manual control and safety devices, and ventilation systems within laboratories.	Implement Inspection Testing and Maintenance requirements for the mechanical, electrical and control systems in the Chemical laboratories.	[R-85][5]
IIP-OI 013	D182 – Thermal Insulating Materials (CSA N293-07 “Fire Protection for CANDU Nuclear Power Plants”)	Existing documentation does not provide requirements for protection, inspection and replacement of thermal insulating materials to prevent them from becoming fire hazards.	Revise procedures to ensure compliance with the requirements for protection, inspection and replacement of thermal insulating materials to prevent them from becoming fire hazards.	[R-86][5]
IIP-OI 014	D184 – Fire Protection Program Audit (CSA N293-07 “Fire Protection for CANDU Nuclear Power Plants”)	The following review elements are not covered in the current scope of the Performance Improvement and Nuclear Oversight (PINO) annual fire protection audits: -Fire protection procedure for inclusion of industry OPEX and evolving industry standards; -A sample of plant modifications to ensure compliance with National Building Code of Canada (NBCC) and National Fire Code of Canada (NFCC), as well as to ensure that the impact on the Fire Safe Shutdown Analysis (FSSA) has been evaluated; -At least one emergency response team drill;	Review Nuclear Oversight audit scope for 2012, 2013, 2014 pertaining to CSA N293-07 compliance elements documented in gap D184. If gaps related to audit scope per D184 are identified, re-scope future audit plans per N-PROC-RA-0048 to ensure appropriate elements are audited once every 3 years to close D184 gap and to adhere to CSA N293-07 requirements.	[R-87]
IIP-OI 017	D297 – Fire Protection Air Filter Media Requirements (CSA N293-07 “Fire Protection for CANDU Nuclear Power Plants”)	The system Design Manual does not confirm that the originally installed pre-filter meets the combustibility requirements of Class 1, per CAN/ULC-S111or that the HEPA filters meet the combustibility requirements of ANSI/UL-586.	Ensure replacement pre-filters used in the main Powerhouse and supporting out buildings comply with the Class 1 requirements in accordance with CAN/ULC-S111, where available. Also ensure replacement HEPA filters used in the main powerhouse and supporting out buildings comply with the combustibility requirements in accordance with ANSI/UL-586. Implement applicable station procedures regarding the air handling systems and the HEPA filters to drive compliance with this clause.	[R-88]

[5] Code of Record Gap [R-30]

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Completion Reference
IIP-OI 020	D116, D226, D430, D431, D439, D441, D445, D466, D503 Resolution of issues tied to the CCR, FHA and FSSA (CSA N293-07 “Fire Protection for CANDU Nuclear Power Plants”, CSA N293-12 “Fire Protection for Nuclear Power Plants” NBCC 2005 “National Building Code of Canada”, NK38-REP-03680-10179, “Fire Protection Specialists Review of the Fire Protection Issues Identified through the Darlington Integrated Safety Review”)	Scope of these ISR issues covers issues tied to analysis of code compliance review requirements for facilities licensed for operation prior to the publication of CAN/CSA N293-07, and analysis of potential fire hazards and the impacts and consequences of such fires on the safety objectives of the Station.	Review the agreement on the Code Compliance Review (CCR), FHA and FSSA reached between the station and CNSC and determine if the actions when implemented will close these issues. If not, utilize data extracted from the FHA and FSSA to document an assessment on how the FHA and FSSA goals for the station can be met without additional modifications or develop and implement an action plan to close the gaps.	[R-89]
IIP-OI 021	D432 – Canadian Electrical Code Review for Changes Impacting Fire Protection (CSA N293-07 “Fire Protection for CANDU Nuclear Power Plants”)	There is a lack of gap analysis between the 2006 Canadian Electrical Code [R-34] and the edition of the Code at the time of station design and construction. For any major changes implement upgrades.	Review the changes between the CEC Part 1 code of record and the 2006 Edition to verify there are no major code changes that impact protection from fire. If required, implement any modifications.	[R-90]
IIP-OI 032	D479 – Fire Pump Disconnecting Means (NFPA-20-2007 “Standard for the Installation of Stationary Pumps for Fire Protection”)	This issue is related to the requirements for fire pump controller disconnection means, signage and seals or locks	Add the required seals or locks and the prescribed signage to the Fire Protection booster pumps power supply as described in the NFPA 20-2007.	[R-91][5]
IIP-OI 045	D013 - Long Term Control of Hydrogen in Containment (IAEA NS-R-1 “Safety of Nuclear Power Plants: Design” & CNSC RD-337 “Design of New Nuclear Power Plants”)	There is a need for systems to control the fission products, hydrogen, oxygen, and other substances that could be released into containment.	Install Passive Autocatalytic Re-combiners (PARS) in all 4 Units at Darlington which will provide an additional capability to reduce hydrogen concentration.	[R-33]
IIP-OI 047	D141 – Fire Protection Requirements for Indoor Fuel Oil Systems (NFCC 2005 “National Fire Code of Canada”)	No documentation found indicating compliance with the requirement for signs indicating the location of valves used for operation of fire protection equipment and manual emergency shut-off valves to be posted in conspicuous locations.	Install signs in conspicuous locations indicating the location of valves used for the operation of fire protection equipment and manual emergency shut-off of fuel oil.	[R-92]
IIP-OI 048	D011 - Changes to In-Service Examination and Testing Requirements for Concrete Containment Structures (RD-337, “Design of New Nuclear Power Plants”)	Darlington is not fully compliant with the requirement to provide a list of requirements for design to facilitate inspection of civil structures.	Create a high level document for leakage rate testing and update the Periodic Inspection Programs for Concrete Containment Structures.	[R-93]

[5] Code of Record Gap [R-30]

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Completion Reference
IIP-OI 052	D352- Time History Compatibility with the Design Ground Response Spectrum (N289.3" Design Procedures for Seismic Qualification of CANDU Nuclear Power Plants") D617 - Seismic Time History Requirements (CSA N289.3 "Design Procedures for Seismic Qualification of Nuclear Power Plants")	Documented evidence in the form of a calculation to show that the generated time history correctly represents the design ground response spectrum within the prescribed requirements have not been provided.	Verify that the time histories used in seismic analyses of safety-related System, Structure and Components (SSCs) comply with the original and recent versions of N289.3.	[R-94]
IIP-OI 057	D501 - Aging and Actual Conditions of SSCs SFR - CNSC Type II Inspection of CCAs (NK38-REP-03680-10078 R01, "Ageing and Actual Condition of Systems, Structures and Components (SSC) Safety Factor Report")	There are quality issues with the Component Condition Assessments (CCAs) as identified in self-assessment D13-000070 and the preliminary findings of the CNSC Staff Type II Plant Condition Assessment Compliance Inspection.	Address all of the findings from the CNSC Type II Inspection report. Outstanding activities include: - N-PROC-MP-0060 Roll Out - N-PROC-MA-0077 Update - Effectiveness Review	[R-95]
IIP-OI 065	D606 - Darlington's Non-compliance with Hygrometer Probe Requirements(CSA N287.7 "In-service Examination and Testing Requirements for Concrete Containment Structures for CANDU Nuclear Power Plants"	Darlington is not compliant with the dewpoint requirements initially stated in the 2008 version of the standard.	Evaluate options and if required procure higher accuracy probes that will meet the dewpoint requirements or request a concession letter to the CNSC to use existing hygrometers.	[R-96]
IIP-OI 067	D610 - Long Term Control of Hydrogen In Containment (CSA N290.3 "Requirements for the Containment System of Nuclear Power Plants")	There is a lack of Post Autocatalytic Re-combiners (PARs) for long term hydrogen control.	Install Passive Autocatalytic Re-combiners (PARS) in all 4 Units at Darlington which will provide an additional capability to reduce hydrogen concentration.	[R-33]
IIP-OI 068	D611 - Coatings and Coverings Within Containment System (CSA N290.3 "Requirements for the Containment System of Nuclear Power Plants")	There is no evidence to confirm that post-accident conditions inside containment were considered when choosing the coating for civil structures and steel lined reactor structures. The interaction of some coatings in containment with the post-accident environment has the potential to produce hydrogen.	Install Passive Autocatalytic Re-combiners (PARS) in all 4 Units at Darlington which will provide an additional capability to reduce hydrogen concentration.	[R-33]
IIP-OI 070	D616 - Equipment Qualification for Beyond Design Basis Accidents (BDBAs) (CSA N290.0, "General Requirements for Safety Systems of Nuclear Power Plants")	There is a lack of completed qualification assessments for instrumentation and equipment required following a Beyond Design Basis Accident (BDBA).	Complete the instrumentation and equipment qualification assessments for Beyond Design Basis Accidents (BDBAs) (related to external initiating events) as part of the Fukushima follow-up work.	[R-32]

IIP Item Number	Issue Number & Title	Issue Description	Action Plan	Completion Reference
IIP-OI 073	D620 - Section 5 of the CSA N289.5-12 Code Refresh (CSA N289.5-12 “Seismic instrumentation requirements for nuclear power plants and nuclear facilities")	The code refresh report for CSA N289.5-12 did not include a review of Section 5 of the code. Section 5 is titled ‘New nuclear power plants and on-site nuclear facilities’ and although it would not normally be applicable to an existing station, it is a requirement for the review of modern codes and standards for the Darlington Integrated Safety Review.	Perform a review of Section 5 of CSA N289.5-12. If any gaps are identified as a result of the review they will be resolved in accordance with N-INS-00770-10004, “Nuclear Refurbishment Gap Resolution Process – Darlington”.	[R-97]

Appendix C: IIP Mapping

EA IIP Items

IIP R000 Item Number	IIP R001 Item Number	Status	IIP Appendix or Reference
0001	IIP-EA 001	Open	Appendix A
0002	IIP-EA 002	Complete	Appendix B
0003	IIP-EA 003	Open	Appendix A
0004	IIP-EA 004	Complete	Appendix B
0005	IIP-EA 005	Open	Appendix A
0006	IIP-EA 006	Open	Appendix A
0007	IIP-EA 007	Complete	Appendix B
0008	IIP-EA 008	Complete	Appendix B
0009	IIP-EA 009	Open	Appendix A
0010	IIP-EA 010	Open	Appendix A
0011	IIP-EA 011	Open	Appendix A
0012	IIP-EA 012	Open	Appendix A
0013	IIP-EA 013	Open	Appendix A
0014	IIP-EA 014	Open	Appendix A
0015	IIP-EA 015	Open	Appendix A

CCA IIP Items

IIP R000 Item Number	IIP R001 Item Number	Status	IIP Appendix or Reference
0016	IIP-CC 001	Open	Appendix A
0017	IIP-CC 002	Open	Appendix A
0018	IIP-CC 003	Open	Appendix A
0019	IIP-CC 004	Open	Appendix A
0020	IIP-CC 005	Open	Appendix A
0021	IIP-CC 006	Open	Appendix A
0022	IIP-CC 007	Open	Appendix A
0023	N/A	Asset Preservation	NK38-CORR-00531-16866
0024	N/A	Asset Preservation	NK38-CORR-00531-16866
0025	N/A	Asset Preservation	NK38-CORR-00531-16866
0026	N/A	Asset Preservation	NK38-CORR-00531-16866
0027	N/A	Asset Preservation	NK38-CORR-00531-16866
0028	IIP-CC 010	Open	Appendix A
0029	IIP-CC 011	Open	Appendix A
0030	IIP-CC 012	Complete	Appendix B
0031	IIP-CC 013	Complete	Appendix B
0032	IIP-CC 014	Open	Appendix A
0033	N/A	Asset Preservation	NK38-CORR-00531-16866
0034	N/A	Asset Preservation	NK38-CORR-00531-16866
0035	IIP-CC 015	Open	Appendix A
0036	N/A	Asset Preservation	NK38-CORR-00531-16866
0037	IIP-CC 018	Open	Appendix A
0038	N/A	Asset Preservation	NK38-CORR-00531-16866
0039	N/A	Asset Preservation	NK38-CORR-00531-16866
0040	N/A	Asset Preservation	NK38-CORR-00531-16866
0041	N/A	Asset Preservation	NK38-CORR-00531-16866
0042	IIP-CC 019	Open	Appendix A
0043	IIP-CC 020	Open	Appendix A
0044	N/A	Asset Preservation	NK38-CORR-00531-16866
0045	IIP-CC 021	Open	Appendix A
0046	IIP-CC 022	Open	Appendix A
0047	N/A	Asset Preservation	NK38-CORR-00531-16866
0048	N/A	Asset Preservation	NK38-CORR-00531-16866
0049	N/A	Asset Preservation	NK38-CORR-00531-16866
0050	IIP-CC 024	Open	Appendix A
0051	N/A	Asset Preservation	NK38-CORR-00531-16866
0052	IIP-CC 025	Open	Appendix A
0053	IIP-CC 026	Open	Appendix A
0054	IIP-CC 027	Open	Appendix A
0055	N/A	Asset Preservation	NK38-CORR-00531-16866
0056	IIP-CC 028	Open	Appendix A
0057	IIP-CC 029	Open	Appendix A

IIP R000 Item Number	IIP R001 Item Number	Status	IIP Appendix or Reference
0058	IIP-CC 030	Complete	Appendix B
0059	IIP-CC 031	Open	Appendix A
0060	IIP-CC 032	Open	Appendix A
0061	IIP-CC 033	Open	Appendix A
0062	IIP-CC 034	Open	Appendix A
0063	0063	Complete	Appendix B
0064	IIP-CC 035	Open	Appendix A
0065	IIP-CC 036	Open	Appendix A
0066	IIP-CC 037	Open	Appendix A
0067	IIP-CC 038	Complete	Appendix B
0068	IIP-CC 041	Open	Appendix A
0069	N/A	Asset Preservation	NK38-CORR-00531-16866
0070	IIP-CC 0423	Open	Appendix A
0071	IIP-CC 044	Open	Appendix A
0072	IIP-CC 045	Open	Appendix A
0073	N/A	Asset Preservation	NK38-CORR-00531-16866
0074	IIP-CC 046	Open	Appendix A
0075	IIP-CC 047	Open	Appendix A
0076	IIP-CC 048	Open	Appendix A
0077	N/A	Asset Preservation	NK38-CORR-00531-16866
0078	N/A	Asset Preservation	NK38-CORR-00531-16866
0079	N/A	Asset Preservation	NK38-CORR-00531-16866
0080	IIP-CC 049	Open	Appendix A
0081	IIP-CC 050	Open	Appendix A
0082	N/A	Asset Preservation	NK38-CORR-00531-16866
0083	IIP-CC 052	Open	Appendix A
0084	IIP-CC 052	Open	Appendix A
0085	IIP-CC 052	Open	Appendix A
0086	IIP-CC 052	Open	Appendix A
0087	IIP-CC 052	Open	Appendix A
0088	IIP-CC 053	Open	Appendix A
0089	N/A	Asset Preservation	NK38-CORR-00531-16866
0090	N/A	Asset Preservation	NK38-CORR-00531-16866
0091	IIP-CC 054	Open	Appendix A
0092	IIP-CC 055	Open	Appendix A
0093	IIP-CC 055	Open	Appendix A
0094	IIP-CC 055	Open	Appendix A
0095	IIP-CC 055	Open	Appendix A
0096	IIP-CC 055	Open	Appendix A
0097	IIP-CC 055	Open	Appendix A
0098	N/A	Asset Preservation	NK38-CORR-00531-16866
0099	IIP-CC 056	Open	Appendix A
0100	IIP-CC 057	Open	Appendix A
0101	N/A	Asset Preservation	NK38-CORR-00531-16866

IIP R000 Item Number	IIP R001 Item Number	Status	IIP Appendix or Reference
0102	IIP-CC 058	Complete	Appendix B
0103	N/A	Asset Preservation	NK38-CORR-00531-16866
0104	IIP-CC 059	Open	Appendix A
0105	N/A	Asset Preservation	NK38-CORR-00531-16866
0106	IIP-CC 060	Open	Appendix A
0107	IIP-CC 061	Open	Appendix A
0108	IIP-CC 062	Open	Appendix A
0109	IIP-CC 063	Open	Appendix A
0110	IIP-CC 064	Open	Appendix A
0111	IIP-CC 065	Open	Appendix A
0112	IIP-CC 066	Complete	Appendix B
0113	IIP-CC 067	Open	Appendix A
0114	IIP-CC 068	Complete	Appendix B
0115	IIP-CC 069	Open	Appendix A
0116	IIP-CC 070	Complete	Appendix B
0117	IIP-CC 071	Open	Appendix A
0118	IIP-CC 072	Open	Appendix A
0119	IIP-CC 073	Open	Appendix A
0120	IIP-CC 074	Open	Appendix A
0121	N/A	Asset Preservation	NK38-CORR-00531-16866
0122	N/A	Asset Preservation	NK38-CORR-00531-16866
0123	N/A	Asset Preservation	NK38-CORR-00531-16866
0124	N/A	Asset Preservation	NK38-CORR-00531-16866
0125	N/A	Asset Preservation	NK38-CORR-00531-16866
0126	IIP-CC 078	Open	Appendix A
New Item	IIP-CC 008	Open	Appendix A
New Item	IIP-CC 009	Open	Appendix A
New Item	IIP-CC 016	Open	Appendix A
New Item	IIP-CC 017	Open	Appendix A
New Item	IIP-CC 023	Open	Appendix A
New Item	IIP-CC 039	Open	Appendix A
New Item	IIP-CC 040	Open	Appendix A
New Item	IIP-CC 042	Open	Appendix A
New Item	IIP-CC 051	Open	Appendix A
New Item	IIP-CC 075	Open	Appendix A
New Item	IIP-CC 076	Open	Appendix A
New Item	IIP-CC 077	Open	Appendix A

Code Gaps IIP Items

IIP R000 Item Number	IIP R001 Item Number	Status	IIP Appendix or Reference
0127	IIP-OI 001	Open	Appendix A
0128	IIP-OI 001	Open	Appendix A
0129	IIP-OI 001	Open	Appendix A
0130	IIP-OI 001	Open	Appendix A
0131	IIP-OI 001	Open	Appendix A
0132	IIP-OI 002	Open	Appendix A
0133	IIP-OI 002	Open	Appendix A
0134	IIP-OI 002	Open	Appendix A
0135	IIP-OI 002	Open	Appendix A
0136	IIP-OI 002	Open	Appendix A
0137	IIP-OI 002	Open	Appendix A
0138	IIP-OI 002	Open	Appendix A
0139	IIP-OI 002	Open	Appendix A
0140	IIP-OI 002	Open	Appendix A
0141	IIP-OI 003	Open	Appendix A
0142	IIP-OI 003	Open	Appendix A
0143	N/A	Asset Preservation	NK38-CORR-00531-16866
0144	IIP-OI 004	Open	Appendix A
0145	IIP-OI 005	Complete	Appendix B
0146	IIP-OI 005	Complete	Appendix B
0147	IIP-OI 006	Open	Appendix A
0148	IIP-OI 006	Open	Appendix A
0149	N/A	Complete	Appendix B
0150	IIP-OI 007	Complete	Appendix B
0151	IIP-OI 007	Complete	Appendix B
0152	IIP-OI 007	Complete	Appendix B
0153	IIP-OI 008	Open	Appendix A
0154	IIP-OI 008	Open	Appendix A
0155	IIP-OI 009	Open	Appendix A
0156	IIP-OI 009	Open	Appendix A
0157	IIP-OI 009	Open	Appendix A
0158	IIP-OI 010	Open	Appendix A
0159	IIP-OI 011	Open	Appendix A
0160	IIP-OI 012	Open	Appendix A
0161	IIP-OI 013	Complete	Appendix B
0162	IIP-OI 013	Complete	Appendix B
0163	IIP-OI 013	Complete	Appendix B
0164	IIP-OI 014	Complete	Appendix B
0165	N/A	Asset Preservation	NK38-CORR-00531-16866
0166	N/A	Asset Preservation	NK38-CORR-00531-16866
0167	N/A	Asset Preservation	NK38-CORR-00531-16866
0168	N/A	Asset Preservation	NK38-CORR-00531-16866

IIP R000 Item Number	IIP R001 Item Number	Status	IIP Appendix or Reference
0169	IIP-OI 015	Open	Appendix A
0170	IIP-OI 015	Open	Appendix A
0171	IIP-OI 015	Open	Appendix A
0172	IIP-OI 015	Open	Appendix A
0173	N/A	Asset Preservation	NK38-CORR-00531-16866
0174	N/A	Asset Preservation	NK38-CORR-00531-16866
0175	IIP-OI 016	Open	Appendix A
0176	IIP-OI 016	Open	Appendix A
0177	N/A	Asset Preservation	NK38-CORR-00531-16866
0178	0178	Complete	Appendix B
0179	0179	Complete	Appendix B
0180	0180	Complete	Appendix B
0181	0181	Complete	Appendix B
0182	0182	Complete	Appendix B
0183	0183	Complete	Appendix B
0184	IIP-OI 017	Complete	Appendix B
0185	IIP-OI 017	Complete	Appendix B
0186	IIP-OI 018	Open	Appendix A
0187	IIP-OI 018	Open	Appendix A
0188	IIP-OI 019	Open	Appendix A
0189	IIP-OI 019	Open	Appendix A
0190	IIP-OI 019	Open	Appendix A
0191	IIP-OI 019	Open	Appendix A
0192	IIP-OI 019	Open	Appendix A
0193	IIP-OI 019	Open	Appendix A
0194	IIP-OI 020	Complete	Appendix B
0195	IIP-OI 020	Complete	Appendix B
0196	IIP-OI 020	Complete	Appendix B
0197	IIP-OI 020	Complete	Appendix B
0198	IIP-OI 020	Complete	Appendix B
0199	IIP-OI 020	Complete	Appendix B
0200	IIP-OI 020	Complete	Appendix B
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0203	IIP-OI 020	Complete	Appendix B
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0206	IIP-OI 020	Complete	Appendix B
0207	IIP-OI 020	Complete	Appendix B
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0213	IIP-OI 020	Complete	Appendix B
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0217	IIP-OI 020	Complete	Appendix B
0218	IIP-OI 020	Complete	Appendix B
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0223	IIP-OI 020	Complete	Appendix B
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0228	IIP-OI 020	Complete	Appendix B
0229	IIP-OI 020	Complete	Appendix B
0230	IIP-OI 020	Complete	Appendix B
0231	IIP-OI 020	Complete	Appendix B
0232	IIP-OI 020	Complete	Appendix B
0233	IIP-OI 020	Complete	Appendix B
0234	IIP-OI 020	Complete	Appendix B
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0253	IIP-OI 020	Complete	Appendix B
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0256	IIP-OI 020	Complete	Appendix B

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0261	IIP-OI 020	Complete	Appendix B
0262	IIP-OI 020	Complete	Appendix B
0263	IIP-OI 020	Complete	Appendix B
0264	IIP-OI 020	Complete	Appendix B
0265	IIP-OI 020	Complete	Appendix B
0266	IIP-OI 021	Complete	Appendix B
0267	IIP-OI 021	Complete	Appendix B
0268	IIP-OI 022	Open	Appendix A
0269	IIP-OI 020	Complete	Appendix B
0270	IIP-OI 020	Complete	Appendix B
0271	IIP-OI 020	Complete	Appendix B
0272	IIP-OI 020	Complete	Appendix B
0273	IIP-OI 020	Complete	Appendix B
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0275	IIP-OI 023	Open	Appendix A
0276	IIP-OI 023	Open	Appendix A
0277	IIP-OI 024	Open	Appendix A
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0279	0279	Complete	Appendix B
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0282	IIP-OI 025	Open	Appendix A
0283	0283	Complete	Appendix B
0284	N/A	Asset Preservation	NK38-CORR-00531-16866
0285	IIP-OI 026	Open	Appendix A
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0287	0287	Complete	Appendix B
0288	0288	Complete	Appendix B
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0290	IIP-OI 020	Open	Appendix A
0291	IIP-OI 027	Open	Appendix A
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0293	IIP-OI 028	Open	Appendix A
0294	IIP-OI 028	Open	Appendix A
0295	0295	Complete	Appendix B
0296	IIP-OI 029	Open	Appendix A
0297	0297	Complete	Appendix B
0298	0298	Complete	Appendix B
0299	0299	Complete	Appendix B
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0306	IIP-OI 031	Open	Appendix A
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0309	IIP-OI 031	Open	Appendix A
0310	IIP-OI 031	Open	Appendix A
0311	0311	Complete	Appendix B
0312	0312	Complete	Appendix B
0313	IIP-OI 032	Complete	Appendix B
0314	IIP-OI 032	Complete	Appendix B
0315	IIP-OI 033	Open	Appendix A
0316	IIP-OI 033	Open	Appendix A
0317	IIP-OI 033	Open	Appendix A
0318	IIP-OI 033	Open	Appendix A
0319	IIP-OI 033	Open	Appendix A
0320	0320	Complete	Appendix B
0321	IIP-OI 034	Open	Appendix A
0322	IIP-OI 034	Open	Appendix A
0323	IIP-OI 034	Open	Appendix A
0324	IIP-OI 034	Open	Appendix A
0325	IIP-OI 034	Open	Appendix A
0326	IIP-OI 034	Open	Appendix A
0327	IIP-OI 034	Open	Appendix A
0328	IIP-OI 034	Open	Appendix A
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0330	IIP-OI 034	Open	Appendix A
0331	IIP-OI 034	Open	Appendix A
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0333	IIP-OI 034	Open	Appendix A
0334	IIP-OI 035	Open	Appendix A
0335	IIP-OI 035	Open	Appendix A
0336	IIP-OI 035	Open	Appendix A
0337	IIP-OI 036	Open	Appendix A
0338	IIP-OI 036	Open	Appendix A
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0341	IIP-OI 036	Open	Appendix A
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0350	IIP-OI 037	Open	Appendix A
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0357	0357	Complete	Appendix B
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0363	IIP-OI 038	Open	Appendix A
0364	IIP-OI 038	Open	Appendix A
0365	IIP-OI 038	Open	Appendix A
0366	IIP-OI 038	Open	Appendix A
0367	IIP-OI 038	Open	Appendix A
0368	IIP-OI 039	Open	Appendix A
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0370	IIP-OI 039	Open	Appendix A
0371	IIP-OI 040	Open	Appendix A
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0374	IIP-OI 041	Open	Appendix A
0375	IIP-OI 042	Open	Appendix A
0376	IIP-OI 035	Open	Appendix A
0377	IIP-OI 035	Open	Appendix A
0378	IIP-OI 043	Open	Appendix A
0379	IIP-OI 043	Open	Appendix A
0380	IIP-OI 043	Open	Appendix A
0381	IIP-OI 043	Open	Appendix A
0382	IIP-OI 043	Open	Appendix A
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0429	IIP-OI 044	Open	Appendix A
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0431	IIP-OI 044	Open	Appendix A
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0466	IIP-OI 036	Open	Appendix A
0467	IIP-OI 036	Open	Appendix A
0468	IIP-OI 036	Open	Appendix A
0469	IIP-OI 036	Open	Appendix A
0470	IIP-OI 036	Open	Appendix A
0471	IIP-OI 036	Open	Appendix A
0472	IIP-OI 037	Open	Appendix A
0473	IIP-OI 037	Open	Appendix A
0474	IIP-OI 037	Open	Appendix A
0475	IIP-OI 037	Open	Appendix A
0476	IIP-OI 046	Open	Appendix A

IIP R000 Item Number	IIP R001 Item Number	Status	IIP Appendix or Reference
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0480	0480	Complete	Appendix B
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0483	0483	Complete	Appendix B
0484	0484	Complete	Appendix B
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0490	0490	Complete	Appendix B
0491	0491	Complete	Appendix B
0492	IIP-OI 009	Open	Appendix A
0493	IIP-OI 009	Open	Appendix A
0494	IIP-OI 047	Complete	Appendix B
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0496	0496	Complete	Appendix B
0497	IIP-OI 048	Complete	Appendix B
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0508	0508	Complete	Appendix B
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0512	0512	Complete	Appendix B
0513	IIP-OI 055	Open	Appendix A
0514	IIP-OI 056	Open	Appendix A
0515	0515	Complete	Appendix B
0516	IIP-OI 057	Complete	Appendix B
0517	0517	Complete	Appendix B
0518	0518	Complete	Appendix B
New Item	IIP-OI 058	Open	Appendix A
New Item	IIP-OI 059	Open	Appendix A

IIP R000 Item Number	IIP R001 Item Number	Status	IIP Appendix or Reference
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New Item	IIP-OI 061	Open	Appendix A
New Item	IIP-OI 062	Open	Appendix A
New Item	IIP-OI 063	Open	Appendix A
New Item	IIP-OI 064	Open	Appendix A
New Item	IIP-OI 065	Complete	Appendix B
New Item	IIP-OI 066	Open	Appendix A
New Item	IIP-OI 067	Complete	Appendix B
New Item	IIP-OI 068	Complete	Appendix B
New Item	IIP-OI 069	Open	Appendix A
New Item	IIP-OI 070	Complete	Appendix B
New Item	IIP-OI 071	Open	Appendix A
New Item	IIP-OI 072	Open	Appendix A
New Item	IIP-OI 073	Complete	Appendix B

Appendix D: Integrated Aging Management Program

Aging management practices at Darlington Nuclear Generating Station (NGS) are managed through the implementation of an integrated set of managed systems and programs. These programs ensure that aging of critical equipment is managed such that the operation of Darlington NGS remains within the licensing basis and allows for station operational goals to be met. The Integrated Aging Management (IAM) Program ensures that the condition of critical equipment is understood and that activities are in place to ensure the health of these components and systems while the plant ages. The IAM program was developed on the basis of IAEA NS-G-2.12 which is in alignment with CNSC Reg Doc 2.6.3 and there are 4 elements which ensure success of the IAM program.

Element 1: Program Direction

OPG has developed an IAM Program on the basis of IAEA NS-G-2.12 which is in alignment with CNSC Reg Doc 2.6.3. The program integrates aging management functions that reside in a number of implementing work groups such as equipment reliability, safety analysis, maintenance, supply chain and work management.

Element 2: Equipment Reliability

OPG has implemented an extensive Equipment Reliability program in place for several years based on nuclear industry best practices. The Equipment Reliability Program applies a programmatic approach to the following elements: Scoping & Identification of Components, Performance Monitoring, Corrective Action, Continuing Equipment Reliability Improvement, Long-Term Planning & Life Cycle Management and Preventive Maintenance (PM) Implementation.

For components applicable to the IIP safety goals, *Scoping & Identification of Components* is based on the 58 Safety Related Systems identified in the ISR. Components whose failure results in a full or partial impairment of a System Important to Safety (SIS) are considered critical components and they receive high priority in maintenance, inspection, monitoring and replacement activities. All other components are prioritized based on other parameters which support the nuclear power plant's generation goals.

Performance Monitoring is evaluated through the monitoring of system and component performance and a comparison to the overall performance goals. The objective is to look for trends in overall performance and put action plans in place to address any issues to maintain or improve performance. These action plans are documented and prioritized in system health reports which are communicated to station stakeholders to support the improvement of the systems' performance. Should a failure or degradation be discovered through Performance Monitoring activities, appropriate *Corrective Actions* are taken to ensure the system or component performs to its intended safety function.

Continuing Equipment Reliability Improvements occur through continuous reviews of PM activities, industry OPEX, inspection and maintenance activities of components where frequencies and scope of activities are optimized to ensure high component reliability.

Long Term Planning & Life Cycle Management is an ongoing process to create a long-term strategy which integrates long-term plans with the overall station business plan. These strategies prioritize improvement activities based on station need. These strategies are incorporated into the business plan and the appropriate system or component health reports. Most recently, Component Condition Assessments were completed which identified and evaluated degradation mechanisms to determine the extent of degradation, and identify long range asset preservation activities such as replacements of components that are required to address aging and reliability.

The objective of the *Preventive Maintenance program* is to prevent or minimize equipment breakdown and to maintain equipment in a satisfactory condition for normal or emergency use. The output results in the identification of the optimal level of PM tasks necessary to achieve a balance between equipment performance and effective resources used. This involves the specification, scheduling and execution of time-based maintenance on systems and components to ensure continued reliable operation. Condition-based and predictive based activities are also included in the integrated approach used at OPG.

Element 3: Parts Availability

Supply chain personnel work with station organizations to maintain inventories of equipment and components that support plant reliability and nuclear safety. A spare parts process is in place which defines the criteria for identifying a component as a critical spare and to develop a strategy to mitigate obsolescence issues and lengthy lead times.

Element 4: Work Management

OPG's Work Management processes are based on Nuclear Industry best practices. Specific Work Management processes are in place for the work completed during a unit outage, a Refurbishment outage, or on-power. The work management processes specify how work is prioritized based on nuclear safety implications, regulatory requirements, preservation of special safety systems or systems important to safety, and threats to electrical generation.

Appendix E: Glossary

Asset Preservation activities are activities required to ensure long term preservation of equipment to achieve the greatest financial return and service life.

Component Condition Assessment (CCA) provides:

1. An assessment of the current condition of the safety system components
2. An assessment of component life, given the status of the current programs for inspection and maintenance
3. Recommendation of actions required for the components to reach the target extended plant life.

Component Condition Assessment (CCA) Recommendations are recommendations that fall into one of the following four broad implementation activity categories:

1. Improving the condition of components through replacement, refurbishment or repair.
2. Determining the condition of components through inspection or testing, followed by remedial actions if the components are found to be aged.
3. Improving the aging management practices to mitigate the effects of future aging through an adjustment to the Preventative Maintenance Program.
4. Addressing obsolescence.

Contingency Actions are repair or replace activities resulting from inspections.

Environmental Assessment (EA) is an assessment carried out under the Canadian Environmental Assessment Act to identify whether a specific project is likely to cause significant environmental effects.

Final ISR Report is the document that summarizes the results and major findings of all the Safety Factors, the ISR Aggregate Review and the disposition of all gaps that were identified.

Global Assessment provides an overall risk judgement on the acceptability of continued plant operation based on the significant ISR results and the EA mitigation measures and follow-up program elements, including plant strengths. The Global Assessment takes into account the safety improvements to address the issues identified in the EA and the ISR and the safety improvements resulting from identified opportunities to reduce the overall plant risk. The Global Assessment also incorporates the results of the Defense-in-Depth assessment.

Global Assessment Report (GAR) summarizes the results of the Global Assessment by providing a high level summary of the ISR and EA and an overall judgement on Nuclear Safety.

Integrated Implementation Plan (IIP) is the integrated result of the EA and ISR, identifying all necessary safety improvements, proposed plant modifications, safety

upgrades, compensatory measures and improvements to operation and management programs that will apply to the project and to long term operation.

Integrated Safety Review (ISR) is a comprehensive assessment of an existing nuclear generating station in order to determine:

1. Extent to which the plant conforms to modern high-level safety goals and requirements.
2. Extent to which Licensing Basis remains valid.
3. Adequacy and effectiveness of arrangements that are in place to maintain plant safety for long-term operation.
4. Safety improvements to address gaps with respect to modern safety requirements identified during the assessment.

ISR Gap is a clause for which a safety requirement in a code or standard is not met or for which the intent of the clause is not met depending on the type of code or standard. ISR Gaps exist for:

1. PROL Codes and Standards - the review finds that the safety requirement of a clause has not been met.
2. Non-PROL Codes and Standards – the review finds that it does not meet either the safety requirement or the intent of a clause (or set of clauses).
3. Review Task - the assessment of the Review Task finds that it does not meet either the safety requirement or the intent of the Review Task.

ISR Issue is a compilation of ISR Gaps with similar scope. The categorization, prioritization and resolution of an ISR Issue shall encompass all the included ISR Gaps.

Life Extension is a set of activities for extending the safe operating life of a nuclear power plant beyond its design life. It involves the replacement or refurbishment of major components (e.g. pressure tubes) or substantial modifications to the plant, or both.

Reactor Safety 1 (RS1) is an Operational Safety Requirement (OSR) system that is also a System Important to Safety (SIS) whose failure results in a Total Loss of Redundancy (TLR) or System Unavailability impairment condition.

Reactor Safety 2 (RS2) is an OSR system that is also a SIS whose failure results in a Partial Loss of Redundancy (PLR) impairment condition, or is an OSR system that is also a non-SIS system whose failure results in a Total Loss of Redundancy or System Unavailability impairment condition.

Safety Improvements are changes to processes or plant to address the issues identified in the EA, the ISR, and the safety improvements resulting from identified opportunities to reduce the overall plant risk.

Safety Related Systems are those systems, components and structures which, by virtue of their failure to perform in accordance with the design intent, would have the potential to impact on the radiological safety of the public or plant personnel from operation of the NPP.

Appendix F: References

[R-1] NK38-REP-03680-10186 R000, “Darlington NGS Global Assessment Report”, 2013.

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[R-4] NK38-CORR-00531-16265, Louise Levert to Mr. Dietmar Reiner, “Record of Proceedings – Environmental Assessment on the Refurbishment and Continued Operation of the Darlington Nuclear Generating Station”, March 14, 2013, E-DOC: 4105440.

[R-5] N-PROC-LE-0005 R003, “Nuclear Refurbishment Integrated Safety Review – Darlington”, April 2013.

[R-6] NK38-CORR-00531-16792, F. Rinfret to Mr. Dietmar Reiner, “Request for CNSC Acceptance of the Darlington NGS Global Assessment Report (GAR) and Integrated Implementation Plan (IIP)”, April 17, 2014.

[R-7] NK38-CORR-00531-17187, F. Rinfret to Mr. Dietmar Reiner, “Darlington NGS: Request for CNSC Acceptance of Integrated Implementation Plan (IIP) Revision 001”, December 22, 2014.

[R-8] N-PROC-MP-0060 R005A, “Aging Management Process”, November 2014.

[R-9] N-INS-00770-10005 R002, “Nuclear Refurbishment Issue Prioritization Process – Darlington”, December 2014.

[R-10] N-PROG-MP-0008 R005, “Integrated Aging Management”, May, 2011.

[R-11] N-PROC-MP-0045 R007, “Technical Operability Evaluation”, January 2012.

[R-12] NK38-CORR-00531-16991, Dietmar Reiner and Brian Duncan to F. Rinfret, “Darlington NGS ‘A’ – Integrated Implementation Plan (IIP) Change Control Process Principles”, November 2014.

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