Design Scoping Checklist

The Design Scoping Checklist is an attachment to N-FORM-10958, Modification Outline, if and when a standard modification is required. If a Reduced Risk and Approvals Modification (RRAM) is justified, this checklist may be used, at the discretion of the Section Manager, as an attachment to N-FORM-10958.

(1) ADMINISTRATIVE DETAILS

EC#: 88528 **EC Rev #:** 000

EC Title: 0-38000-MASTER- NEW HEAVY WATER STORAGE FACILITY (PROJECT # 16-31555)

Owner: Vince Tzambazis **Project#:** 16-31555

This checklist prepared by: Michael Ferrarelli, Satya Mallampalli, Peter Moore

(2) WALKDOWN and CONFIGURATION MANAGEMENT REVIEW

2.1 Confirm Stakeholder Involvement Attribute and Issue Tracking File have been set up. **Yes** ☒

2.2 **Walkdown**

Document results of walkdown(s) and all configuration management issues in the Issue Tracking Files and summarize in 'Walkdown Results' box below. List SCRs created for identified configuration management issues.

Questions and things to consider:

(a) If no walkdown was possible due to unit conditions, has consideration been given to other risk mitigation tools? (for example, review alternate unit, flexible design approach)

(b) Were any discrepancies with issued design drawings or other design basis documents uncovered? List SCRs generated due to such issues.

Walkdown Results: Walkdowns were completed in Q1 and Q2 of 2011 for scoping activities related to the scope of work for the RFP; N-LT-2011-002. The walkdown identified the following configuration management issues:

1) Construction pipes on buried services drawings, including NK38-D1H-10249-1343, are not believed to be in service

2) Bulk oxygen pipe from storage tank west of HWMB is no longer connected to the station units

3) The paved road indicated on NK38-D1H-10249-1343 is only half paved

4) Existing plant drawings need updating due to configuration management issues identified in Section 2.3.

An additional walkdown was held on Oct 26, 2011 and documented in NK38-REP-38000-10003.

2.3 **Configuration Management Review**

Review PASSPORT to identify any other ECs in progress on the same system or documents, with potential interactions.		Yes	No
(a) Were potentially interacting ECs dis□overed?		☒	☐
(b) If yes, were the issues discussed with the DTLs of the interfering ECs? Document discussions.	N/A ☐	☒	☐

Potential EC interactions:

DEC 88335 (Approved): "TRF & HWMB - 600V CL'S II, III, & IV", mostly drawing updates

MEC 112845 (Approved), DEC 114782 (Register), DEC 114781 (Register): "MASTER EC: FIRE PROTECTION CODE COMPLIANCE REQUIRED MODIFICATIONS - TRF, HWMB AND TRF ANNEX", installation of fire detection equipment such as smoke detectors and pull stations

MEC 113987 (Assigned): 0-38110 D2O SUPPLY RV58 OVERPRESSURE PROTECTION COMPLIANCE MOD, corrective action to mitigate reducer on outlet of S&I tank header PRV (ASME Sec III code violation). Contact with Shiva Habib, Assigned Engineer for MEC 113987 has been made. Further contact will be made during detailed design phase.

(3) DESIGN CONCERNS

(a) Each question requires a written justification. Include, when possible, a listing of relevant documents or references.

(b) The Design Section Manager's signature on the Modification Outline indicates approval of the justifications written below, and includes acceptance that Subject Matter Expert (SME) consultations were performed or not.

(1) If SME consultation is required but the SME is unknown, contact the Section Manager of the appropriate organization to determine the identity of an SME.

(2) **If** an SME is consulted to contribute to the answer of a question, the SME should concur that their recommendation or comments have been accurately transcribed. Concurrence may be documented in one of two ways:

(i) SME signature on final hard copy of this form, in space beside "SME concurrence".

(ii) Documented evidence (for example, e-mail, PDF) stored in Master EC Stakeholder Involvement Attribute (SIA), with "see SIA" written on final hard copy of this form in space beside "SME concurrence".

(3) **If** no consultation was performed to develop the justification, "Not Applicable" should be input to the SME name box (to document that a consultation did not occur).

3.1 **Operating Experience**

What operating experience review was done? What were the results? Discuss with site OPEX SPOC as necessary.	Yes	No
(a) Search the SCR system for other relevant information. Refer to N-PROC-RA-0022, Processing Station Condition Records.	☒	☐
(b) Discussions with operations and maintenance staff as to why change is needed and best way to implement change.	☒	☐
(c) Review of outside industry experience to decide on vendors for service or materials. Refer for N-PROC-RA-0035, Operating Experience Process	☒	☐
(d) Review of WANO/EPRI/INPO/COG web-sites for relevant information.	☐	☐
(e) Request an OPEX search from OPEX section for any non-routine work.	☐	☒
(f) Human Factors OPEX REVIEW (may be required if there is a human factors engineering program plan [HFEPP])?	☐	☒

If unsure, consult OPEX SPOC.
If yes, summarize and justify, and include details in design/issue tracking file.
If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification:

NK38-DRT-38000-10001 captures OPEX previously searched by Nuclear Safety Solutions, for the previous project of 400 Mg storage and Drum Handling, up to Nov 23, 2007.

D-2008-10401, D-2009-14480, D-2010-07199, D-2010-08206 are all SCRs related to improper use of station procedures for drum handling of D2O. Documentation does not seem to be clear, and appropriate updates can be covered in the project EC for this modification.

D-2003-06812, identifies improper use of S&I storage tanks as they were used to store downgraded D2O (attempt to improve operational efficiency)

D-2003-08117, Loss of Class IV power from grid-wide 2003 outage; lead to safety related function impairment as the HWMB/TRF could not ship water to units to maintain required D2O inventories for heat sink

D-2006-01602 Functional Failure 0-53320-INC55 and D-2008-08265 TRF tripping due to loss of class 2 identify deficiencies in reliability of electrical power at the HWMB/TRF.

D-2009-06183, D-2009-08549, D-2011-00314 are all SCRs that identify operability restrictions on transferring water to the S&I system because of capacity issues. Many other SCRs were found that related to inability to transfer or store water because of varying isotopic and cleanliness, which would be remedied by more tanks for various compositions.

A review of DNGS OPEX identified a major issue with the electrical power supply. SCRs D-2006-01602 and D-2008-08265 identify deficiencies in the Class II Power system at the HWMB/TRF. There are limitations related to Class II Power; therefore, this modification will Supply Class II loads with Class IV power and provide an interruptible power supply (UPS) to ensure Class II reliability and safety requirements are met. Similarly, BU92 and BU94 in the HWMB/TRF are not expected to be able to support all of the Class IV loads in the new facility. Therefore, Project 10-

73821, DN Electrical Distribution System Upgrade, has been contacted to secure the anticipated power to satisfy the requirements of this modification. 1.5 MVA has been reserved in the scope of Project 10-73821, which would be provided from an external commercial supply via a new transformer.

Meetings with TRF Operations over manual/automatic control, electrical power needs and deficiencies, installation issues and office space issues have all been conducted. Meeting minutes have been documented and are stored in the Working Files.

OPEX from trips to Bruce (N-2011-04605) and Pickering Nuclear Stations have been documented in descriptive meeting minutes also in the Working Files. Major concerns identified include overpressure protection, construction interference with continued operations and recall times for heavy water transfers.

OPEX from Point Lepreau and Wolsong D2O storage projects has been considered. Relevant major technical OPEX includes:

Spent Resin Storage Tanks (SRST) - Wolsong uses a separated D2O S&I system that a central set of 4 tanks at 70 m3 each and two local tanks designated for sharing between U1/2 and U3/4. For refurbishment, Wolsong modified the 190 m3 SRST tanks by connecting the PHT transfer line to the tanks for a full PHT drain. Point Lepreau also used this approach as they stored moderator water for refurbishment in the S&I tanks, but stored PHT water in the SRSTs. Again, a connection to the PHT transfer system and disconnection from the spent resin system had to be made. This solution is not feasible for this modification at DNGS as the SRSTs comprise 2 x 28.5 m3 tanks, this would produce high radiation fields during the modification installation, and classification of the tanks is at risk based on tritium levels in the moderator system.

A Human Factors OPEX review will be completed as part of the Human Factors Engineering Program Plan (HFEPP) in detailed design.

3.2 **Current Design**

Are there other problems with the current design that should be considered when implementing this design? (Refer to ECR if one exists.)	**Yes** ☒	**No** ☐

If unsure, consult SE, ECR preparer, or Maintenance.

If yes, summarize and justify, and include details in design/issue tracking file.

If no, justify.

Subject Matter Expert (if consulted):
Print Name: T. Wong / G. Barton
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: Level indication and alarm of storage tanks under SCI 38110 is currently problematic. Should one tank reach the high level and the annunciation is received in the TRF control room, another tank reaching this level would not be identified in the control room (ie. masking of any other level alarms).

As well, the truck ramp at the existing facility limits the manoeuvrability of operations staff when receiving D2O shipments. There is limited space between the loading bay door and the parallel wall.

The building's overall design is very compartmentalized and challenging to operate and maintain. Limited space has required multiple other modifications to improve accessibility (ie. set of two doors installed on a corridor wall to access flange directly on the other side of the wall).

3.3 **Repeat Design**

Is this a repeat design? What went well and what went wrong during design, installation, maintenance, and operation? What reviews were done to ensure we are not repeating mistakes? Note that OPEX on previous designs is very important.	**Yes** ☐	**No** ☒

If unsure, consult appropriate system Performance Engineering staff, or DTL who prepared the previous design.

If yes, summarize and justify, and include details in design/issue tracking file.

If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: Construction of a new Heavy Water Storage Facility at Darlington has not been completed before. The specific requirements for this new facility are unique to the applications: Refurbishment and TRF Operation Improvements. There have been two similar projects completed at Pickering Nuclear and Bruce Nuclear sites in support of their refurbishment project's in 2000 and 2010, respectively. Extensive OPEX reviews including site visits and interviews with relevant staff have been completed at both Pickering and Bruce Nuclear sites.

3.4	**Industry Standard**		
	Is this an industry standard design?	**Yes** ☒	**No** ☐
	If unsure, consult appropriate system Plant Design staff. If yes, justify. If no, what additional design steps will be used to ensure the design meets requirements? Summarize and justify, and include details in design/issue tracking file.	Subject Matter Expert (if consulted): Print Name: _____ (input 'Not Applicable' if SME not consulted) SME concurrence: _____	
	Justification: The design will be standard to Nuclear Class III and Conventional Class VI systems using the appropriate design codes & standards.		

3.5	**Obsolescence**		
	Could replacement of obsolete systems, structures, or components introduce changes that may affect operating performance?	**Yes** ☐	**No** ☒
	If unsure, consult appropriate system Plant Design staff. If yes, summarize and justify, and include details in design/issue tracking file. If no, justify.	Subject Matter Expert (if consulted): Print Name: _____ (input 'Not Applicable' if SME not consulted) SME concurrence: _____	
	Justification: This modification does not include replacement of obsolete SSCs. Upgrades to the HWMB/TRF DCUs may be required, but changes will be integrated into the existing distributed control system.		

3.6	**New Technology**		
	Is new technology being interfaced with existing plant systems? That is, could new technology introduce changes that may affect operating performance?	**Yes** ☒	**No** ☐
	If unsure, consult appropriate SME. If yes, discuss below how risk is being managed and consider potential for: • Enhanced factory acceptance testing (FAT). **Note:** If FAT parts that will experience factory heat soaks or factory stress testing will be installed as part of a modification, include details in the issue tracking file and justify. • Enhanced on-site mock-up testing. • Staged implementation. • Changes to control responses or parameters. Summarize and justify, and include details in design/issue tracking file. If no, justify.	Subject Matter Expert (if consulted): Print Name: _____ (input 'Not Applicable' if SME not consulted) SME concurrence: _____	
	Justification: The drum handling facility that will be constructed in this modification provides new technology for cleaning, testing and disposing of the existing D2O drum inventory. Craning equipment, pneumatic hoses and transportation mechanisms such as drum carts are expected to improve operating performance as they will streamline the currently manual process and reduce the backlog of drums. Based on the age of the current facility, most of the process and support systems are expected to be of advanced new technology.		

3.7	**Single Point of Vulnerability**		
	Does this modification create a potential for Single Point Vulnerability (SPV) as defined in N-PROC-MA-0077, Critical Equipment Identification and Categorization? That is, failure of a component will directly result in:	**Yes**	**No**
	(a) Reactor or turbine trip	☐	☒
	(b) Unit power de-rating greater than 10% full power?	☐	☒
	(c) Unit or station outage within 24 hours?	☐	☒
	NOTE: Components which support the operation of SPV components are also SPVs.		
	If unsure, consult appropriate SME.	Subject Matter Expert (if consulted):	

Print Name: Thomas Wong
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: The conceptual design report, NK38-REP-38000-10002 details the expected impacts on the HWMB/TRF existing support systems such as ventilation, effluent monitoring, and electrical power systems, through recommendations of various alternatives. The new West Annex storage and process equipment is not expected to impact on the above listed events. The interfacing systems shall be designed for independent operation such that failure would not force a TRF/HWMB shutdown. For example, with the exception of 0-38110-P1/2/3/4, the new D2O storage system shall be isolated from the existing S&I inventory such that a failure of the storage volumes will not impede the operation of SCI 38110.

3.8 **Foreign Material Exclusion**

Could Foreign material be left inside major equipment?	**Yes** ☒	**No** ☐

If unsure, consult appropriate SME.
If yes, summarize and justify, and include details in design/issue tracking file.
If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: The new storage volumes are large tanks that will be connected to safety related systems such as D2O S&I, Downgraded D2O transfer and the TRF feed and product systems. During execution, OPG's FME program as per N-PROC-MA-0018 will be followed.

3.9 **Ergonomics**

Could the tasks for operations or maintenance involve or increase the potential for a musculoskeletal injury to workers?	**Yes**	**No**
(a) Potential for overexertion or cumulative trauma	☒	☐
(b) Forceful physical handling such as lifting, lowering, pushing, pulling, or carrying for long distances.	☒	☐
(c) Objects are >4.5 kg and handled from seated position.	☐	☒
(d) Objects are >16 kg and manually handled.	☒	☐
(e) Potential for overexposure to vibration from hand tools, seat, or floors.	☐	☒

If unsure, consult Ergonomist.
If yes, summarize and justify, and include details in design/issue tracking file.
If no, justify.

Subject Matter Expert (if consulted):
Print Name: Jocelyn Laviolette
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: Areas of possible impact are: Drum handling & cleaning; process system areas (awkward postures, lighting, gauges, forces to open valves, pump maintenance; Office areas (computer work only or work with drawings, shift environment with multiple users, adjustability of workstations, seating); Plastic suit use for emergencies (spills). Ergonomist to be engaged for COMS and walkdowns for further evaluation.

3.10 **Zoning**

Will this job impact on radiological zoning?	**Yes** ☒	**No** ☐

If unsure, consult Radiation Protection and/or Mechanical Design for heating, ventilation, and air conditioning (HVAC) issues.
If yes, summarize and justify, and include details in design/issue tracking file.
If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: The expected site for this modification, directly west of the HWMB/TRF, is classified as an unzoned area. The addition of a HWSF would require reclassification of zoning within the new building or annex, as a result of storing tritiated heavy water.

3.11	**Security**		
	Could the modification impact on the physical security of the plant and/or security systems? Consider potential for:	**Yes**	**No**
	(a) Affect or be installed near (within 5 metres of) any Security related building, structure or component?	☐	☒
	(b) Will new construction be installed such that it may be placed within the field of view of any security camera?	☒	☐
	(c) Affect traffic flows on site (Discuss with Nuclear Waste Management Division (NWMD) Transportation Officer as necessary)?	☒	☐

If unsure, consult Security Engineering. If yes, summarize and justify, and include details in design/issue tracking file. If no, justify.	Subject Matter Expert (if consulted): Print Name: Dave Flynn (input 'Not Applicable' if SME not consulted) SME concurrence:

Justification: The proposed modification will be constructed immediately West of the existing HWMB/TRF, and will be directly connected by breaking down the existing wall on column DA1. This will have multiple effects on site security including: relocation of existing cameras on HWMB wall, redirection of traffic flows North-South between SG Oil Storage Tanks and HWMB, and the related modifications required to ensure security of the HWMB/TRF with this new addition.

3.12	**Welding**		
	Will the modification involve welding or require procurement of welded components or welding services from contractors? (Refer to N-PROC-MA-0046, Performing Welding and Related Activities).	**Yes** ☒	**No** ☐

If unsure, consult Welding Engineering. If yes, summarize and justify, and include details in design/issue tracking file. If no, justify.	Subject Matter Expert (if consulted): Print Name: (input 'Not Applicable' if SME not consulted) SME concurrence:

Justification: Welding activities (design, materials, construction) will follow OPG's N-PROG-MA-0013 (Welding), N-PROG-MA-0018 (NDE), N-PROC-MP-0004 (Pressure boundary), N-PROC-MA-0046, as well as applicable codes and standards, such as N285.0, ASME B31.1, ASME Boiler & Pressure Vessel Code, CSA B51, etc.

3.13	**Environmental Qualification Program**		
	Could the change impact on Environmental Qualification Program?	**Yes**	**No**
	(a) Addition, deletion, abandonment, relocation, or modification of Equipment or Components or Cables in harsh environments?	☐	☒
	(b) Change in the normal or post accident conditions in the plant (temperature, humidity, pressure, radiation, flood levels, chemical conditions, etc.) as documented in the applicable Room Conditions Manual?	☐	☒
	(c) Addition, removal, replacement, modification, or impairment of environmental barriers or HVAC systems that protect and support Safety Related Systems, Equipment, or Components?	☐	☒
	(d) A change in safety classification, credited safety function of equipment, mission time or the addition of a component or cable that is located in a harsh environment area that has a credited Design Basis Accident function?	☐	☒
	(e) A change in service conditions (loading, energization status, assured position, temperature, duty cycle, voltage, etc.), for equipment of cables assessed by EQ Program?	☐	☒
	(f) A change in the power supplies or fault protection (breakers or fuses) for the equipment that is required to be environmentally qualified?	☐	☒
	(g) Affects penetrations through steam barrier (for example, steam protected rooms, doors and penetration seals) or impacts to the integrity of the steam barrier?	☐	☒

Guidance and criteria for these questions are provided in N-GUID-03651-10000, Sheet 00001 "Guide to Environmental Qualification Design Changes".

If unsure, discuss with EQ SPOC, Components and Equipment Engineering.
If yes, summarize and justify, and include details in design/issue tracking file.
If no, justify

Subject Matter Expert (if consulted):
Print Name: Allan Ghaforian
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: The existing HWMB/TRF is not exposed to harsh conditions as indicated in NK38-MAN-03651-10001. Based on existing EQ requirements for the HWMB, it is expected that the EQ Program will be unaffected by this modification.

3.14	**Passive Safety Barriers**		
	Will the modification involve or affect passive safety barriers (for example, flood barriers including doors, grating, kick plates, and pathways; tornado protection including doors and powerhouse cladding; structures)?	**Yes** ☒	**No** ☐

If unsure, consult Civil Design. For assistance with EQ credited barriers, contact EQ SPOC, Components and Equipment Engineering.
If yes, summarize and justify, and include details in design/issue tracking file.
If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: The new structure will impede on passive safety barriers in a number of ways.

3.15	**Containment Boundary Embedded Parts (EPs)**		
	Will this modification require new or affect existing Containment Boundary Embedded Parts (EPs)?	**Yes** ☐	**No** ☒

If unsure, consult Civil Design.
If yes, summarize and justify, and include details in design/issue tracking file.
If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: Connections to systems that penetrate the containment boundary including D2O S&I (SCI 38110) will be made outside of the containment boundary; therefore, eliminating the need for new EPs or modifications to existing EPs.

3.16	**National Building Code**		
	Does the National Building Code apply?	**Yes** ☒	**No** ☐
	If unsure, consult Civil Design. If yes, summarize and justify, and include details in design/issue tracking file. If no, justify.	Subject Matter Expert (if consulted): Print Name: _____ (input 'Not Applicable' if SME not consulted) SME concurrence: _____	
	Justification: This modification includes the construction of a building comprised of 2 or 3 above surface elevations. The new facility must meet the National Building Code standards.		

3.17	**Non-industrial Occupancy**		
	Is there design of a non-industrial occupancy structure?	**Yes** ☒	**No** ☐
	If unsure, consult Civil Design. If yes, summarize and justify, and include details in design/issue tracking file. If no, justify.	Subject Matter Expert (if consulted): Print Name: _____ (input 'Not Applicable' if SME not consulted) SME concurrence: _____	
	Justification: New permanent office space is part of this modification.		

3.18	**Civil Design Concerns**		
	Will the building structure or use be modified? Consider potential for:	**Yes**	**No**
	(a) Floor loading	☒	☐
	(b) Walls and access ways, doors, exits, travel distance.	☒	☐
	(c) Ventilation requirements.	☒	☐
	(d) Civil impacts of mechanical modifications such as new structural loading (CSA N285 issue)	☒	☐
	(e) Fire separations. Discuss with Fire Protection Engineer as necessary.	☒	☐
	(f) Building and Operating permits	☒	☐
	If unsure, consult Civil Design. If yes, summarize and justify, and include details in design/issue tracking file. If no, justify.	Subject Matter Expert (if consulted): Print Name: _____ (input 'Not Applicable' if SME not consulted) SME concurrence: _____	
	Justification: A new structure shall be built directly adjacent to the HWMB/TRF. Connections to the existing HWMB/TRF can impact loading of the existing facility, as well as access and permitry. Outside of the typical National Fire Code requirements, the proximity of the proposed new facility to the existing Standby Generator (SG) Oil Tanks increases the risk of fire; therefore, the separation of a building from the crest of the SG fuel tank dykes shall be greater than or equal to 9 m.		

3.19	**Craning or Rigging**	**Yes**	**No**
	(a) Will the equipment being installed require craning or rigging to install or maintain it?	☒	☐
	(b) Is there potential for craning or rigging operations to impact on critical equipment or structures?	☐	☒

Refer to Section 3.20 for seismic impacts.
If unsure, consult Civil Design or Components and Equipment Engineering.
If yes, summarize and justify, and include details in design/issue tracking file.
If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: The installation of the new facility will likely require construction crane(s). Placing major equipment such as the storage tanks, piping, ventilation units, concrete substructures and steel beans will require craning operations.

The finished facility will have two sources of continuing craning operations. Primarily, the drum handling facility will include dedicated lifting devices / monorails for location and transportation of 200 L D2O drums, which will be most frequently used in the facility. In addition, equipment required for continued maintenance of the D2O storage tanks and ventilation systems are also required.

3.20	**Seismic Qualification**		
	Could there be an impact on Seismic Qualification?	**Yes**	**No**
	(a) Modifies a seismically qualified system, structure, or component (SSC).	☒	☐
	(b) Modifies, adds, or removes a non-seismically qualified SSC in or adjacent to a station area containing seismically qualified SSC(s) or seismically assessed SSC(s). Consider potential impacts of the completed modification as well as construction activities (such as craning, rigging, excavation, movement of heavy equipment, and installation).	☐	☒
	(c) Is the seismic route impacted, including entry or exit from doors on the route?	☐	☒

Pickering users, including for systems common to A and B, may refer to NA44-DG-03650-00001, Seismic Design Guide for Seismic Qualification of Pickering NGS A Success Path Structures, Systems and Components, and NA44-REP-03650-00002, Pickering A – Administrative Controls for Seismic Qualification.

Darlington Users may refer to DG-91-01040-1-39113, Design Guide – Design Requirements, Criteria, and Methods for Seismic Qualification of CANDU Nuclear Power Plants.

If unsure, discuss with Civil Design or Mechanical Design.
If yes, summarize and justify, and include details in design/issue tracking file.
If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: The portion of the existing HWMB/TRF that encloses the Heavy Water storage tanks is currently seismically qualified according to a DBE category D, as stated in NK38-DG-03650.2B. The design guide requires the same qualification for the new Heavy Water Storage Facility, and any impact on seismic qualification of the existing HWMB, for example joining a new seismically qualified dike with the existing dike, will be resolved in this modification.

3.21 **Equipment, Ground, or Floor Condition**

Have critical site or equipment conditions been investigated/validated and risks been mitigated? Consider potential for:	Yes	No
(a) Sub-surface or embedded interferences	☒	☐
(b) Poor soil conditions	☒	☐
(c) Clogged piping, sumps	☐	☒
(d) Broken supports	☐	☒
(e) Poor water quality	☒	☐
(f) Aging effects (vibration, radiation, wear)	☐	☒
(g) Flooding of any area (for example, enclosed areas, basement elevations)	☐	☒
(h) Wetting or physical damage of equipment due to dripping, splashing, spraying, immersion, water deluge (that could wet the equipment) or water jet (that could damage the equipment or equipment enclosure), etc.	☐	☒
(i) Floors or installation surfaces uneven, or not level (If yes, or unsure Shims or levelling may be required)	☐	☒
(j) Ground stability (include seismic concerns)	☐	☒

If unsure, consult Civil Design or Mechanical Design.
If yes, summarize and justify, and include details in design/issue tracking file.
If no, justify.

Subject Matter Expert (if consulted):
Print Name: Soo Chae
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: Site A, which is the area between the HWMB/TRF and the SG Oil Tanks, is the proposed site for this location. Based on buried service drawing NK38-D1H-10249-1343, there are a number of operational systems underground that will require relocation as a result of this modification. These services include:

1. TRF Helium Supply pipe, ½" (SCI 75540)
2. Fire Protection water, 10" (SCI 78110)
3. Yard drainage piping, 600 mm (SCI 15200)
4. Yard drainage piping, 450 mm (SCI 15200)
5. Fire Protection water, unknown (SCI 78110)
6. Catch basin CB483 and Manhole MH415 (SCI 15200)
7. Drain Line 6" (SCI 79110)
8. Drain Line 150 mm (SCI 15200)
9. Drain Line 300 mm (SCI 15200)
10. TRF Argon supply tank and pipe (SCI 75550)
11. TRF Oxygen supply tank and pipe (SCI 75510)
12. SG electrical cable duct (SCI 57500)
13. LAN / PA cables for Reactor Maintenance Building (29) and CCTV trailer (30).

"Poor soil conditions" and "Poor water quality" are checked "Yes" as a result of groundwater at the proposed site indicating higher than normal levels of tritium, which are considered a result of the IWST spill in 2009 (D-2009-14668, D-2010-13419). Project 16-38940 is currently being executed to assess the impact of the tritium in the groundwater and develop a strategy to mitigate any environmental risk from this modification. See NK38-PLAN-10140-10001, "Mitigation Strategy: IWST Spill Impact to Groundwater"

3.22 **Electrical**

Thing to consider:	Yes	No
(a) Will the modification impact on electrical equipment?	☒	☐
(b) Does the modification need power?	☒	☐
(c) Does the Ontario Electrical Safety Code apply? (See N-REP-ELECINSP, General Application Principles for Electrical Inspections at OPG Facilities.) (Available in PassPort Records module or through PowerSearch.) Document any requirement for Electrical Safety Authority (ESA) inspection, review, or approval.	☒	☐
(d) Are arc flash calculations impacted by the modification?	☒	☐
(e) Is modification performance impacted by unit or system (grid) conditions, including shutdown states, normal full power operating states, mega volt amperes reactive (MVAR) manoeuvring (generator terminal voltage changes) , grid voltage fluctuations, and transition states between shutdown and full power operation?	☐	☒

If unsure, consult Plant Design, Electrical or Projects Design, Electrical.
If yes, summarize and justify, and include details in design/issue tracking file.
If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: As identified in the conceptual design report NK38-REP-38000-10002. the facility will require sources of power and backup power. At this conceptual stage, power from the municipality Utility is currently recommended over station power due to supply concerns. This should be investigated during detailed design, especially if the total load is determined to be less than the currently, conservatively estimated 1.5MVA.

3.23 **Electrical Power Class**

Does the modification impact on Class I, II, III electrical power? **Yes** ☒ **No** ☐

If unsure, consult Plant Design, Electrical or Projects Design, Electrical.
If yes, summarize and justify, and include details in design/issue tracking file.
If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: Conceptual backup power requirements are identified in NK38-REP-38000-10002. At this conceptual stage, power from the municipality Utility with local backup sources of power are currently recommended over station power due to supply concerns. This question is conservatively marked "Yes" since the question of utilizing Class II/III power should be further investigated during detailed design as a value for money exercise, as load requirements become better defined. Utilizing Class II/III power, if feasible, would be more cost effective than providing an independent source of backup power for the facility.

3.24 **ETAP**

Is the Design Basis Electrical Analysis (ETAP) impacted? **Yes** ☒ **No** ☐

If unsure, consult Plant Design, Electrical or Projects Design, Electrical.
If yes, summarize and justify, and include details in design/issue tracking file.
If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification:

3.25 **Other Electrical Concerns**

Will the modification impact any of the following areas?	Yes	No
(a) Market Registration	☐	☒
(b) Revenue metering (to meet the requirements of subsection II (1) of Ref 494/01 under the Electricity Act, 1998)	☒	☐
(c) Market Rules or compliances to market rules	☐	☒
(d) NPCC/NERC rules	☐	☒
(e) Hydro One data for transmission connection agreements	☐	☒

If unsure, consult Performance Engineering, Electrical.
If yes, summarize and justify, and include details in design/issue tracking file.
If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: The facility is proposed to be powered from the municipality Utility, and therefore the electricity consumption must be metered to determine the associated costs to meet the Electricity Act of 1998.

3.26 **Gains, Setpoints, DCC**

Where equipment is being replaced or upgraded, are corresponding adjustments to applicable parameters (for example, gains, setpoint, DCC Annunciations, DCC inputs/outputs, etc.) in the associated control or monitoring devices required? **Yes** ☒ **No** ☐

If unsure, consult I&C Design or Computers & Control Design
If yes, summarize and justify, and include details in design/issue tracking file.
If no, justify.

Subject Matter Expert (if consulted):
Print Name: Andy Zupan
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: TRF DCUs will be modified to allow for at least one annunciation related to D2O leak detection. A Software Requirements Specification as per N-STI-69000-10004 "Category II/III Software Requirements Specification" will be created in the detailed design phase of this modification, which will be used as a deliverable to Project 16-31436, Computer Upgrade for HWMS. This project is executed by the Darlington Control Computers Design group, which will be required to ensure this design item is covered.

3.27 **Control Systems**

Will mechanical changes change control system response? **Yes** ☐ **No** ☒

If unsure, consult I&C Design or Computers & Control Design.
If yes, summarize and justify, and include details in design/issue tracking file.
If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: No tie-ins to existing systems that would affect a control system response are expected.

3.28 **Determination of Potential System or Equipment Interactions or Failures**

Will this modification require a Systematic Approach to Technical Problem Solving or other type of Failure Mode & Effects Analysis (FMEA) to assist in determination of interactions and potential system or equipment failures? **Yes** ☒ **No** ☐

If unsure, consult Station Reactor Safety.
If yes, summarize and justify, and include details in design/issue tracking file, including requirement to reference any resulting report on the EC Ref Docs panel.
If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: For storage volumes, this analysis will not be required, but for higher complexity systems such as SCI HWMB (SCI 23800), D2O Clean up (SCI 38410) and Liquid Poison Addition (SCI 32710), this analysis will be required.

3.29	**Redundancy**		
	Will the modification affect more than one train of redundant Electrical, Instrumentation & Control or Mechanical components?	**Yes** ☐	**No** ☒
	If unsure, consult Performance Engineering and/or Station Reactor Safety. If yes, summarize and justify, and include details in design/issue tracking file. If no, justify.	Subject Matter Expert (if consulted): Print Name: _____ (input 'Not Applicable' if SME not consulted) SME concurrence: _____	
	Justification: This modification will affect one train of redundant electrical backup power and possibly one train of redundant HVAC equipment, depending on reliability requirements.		

3.30	**Separation of Safety Related Systems**		
	Will the modification impact on location or separation requirements for safety related systems?	**Yes** ☐	**No** ☒
	If unsure, consult Performance Engineering and Station Reactor Safety. If yes, summarize and justify, and include details in design/issue tracking file. If no, justify.	Subject Matter Expert (if consulted): Print Name: _____ (input 'Not Applicable' if SME not consulted) SME concurrence: _____	
	Justification: This modification will impact safety related systems, but it will not alter the existing design basis as it relates to separation of location of such systems. For example, the D2O S&I system will remain in place, but will be augmented with a connection to additional unaccredited heavy water storage capacity.		

3.31	**System Testing**		
	Consider if system testing is affected:	**Yes**	**No**
	(a) Did Performance Engineering initiate the change?	☐	☒
	(b) Is there a potential reactivity management impact?	☐	☒
	(c) Is there a potential impact on system testing, especially Safety System Tests and Safety-Related System Tests?	☒	☐
	If unsure, consult Performance Engineering. NOTE: If there is a potential impact on system testing, Performance Engineer should identify affected system tests and review if modified system can be tested effectively (for example, identify potential isolation and testing problems). For modifications to the system OR revisions to systems tests, consider validation of the tests (notably Safety System Tests and Safety-Related System Tests) on the simulator (operations simulator or desktop simulator) **if** the tests can be performed without modifications to or re-programming of the simulator(s). If yes, summarize and justify, and include details in design/issue tracking file. If no, justify.	Subject Matter Expert (if consulted): Print Name: _____ (input 'Not Applicable' if SME not consulted) SME concurrence: _____	
	Justification: As a result of this modification, new system tests will be required. New equipment and systems will require testing similar to the existing established tests. Modifications to existing systems; mainly, an expected change to the pumping capacity of 0-38110-P1/2 will induce trivial changes to the existing tests (ie. documented changes to set points, flow rates, indications, etc).		

3.32 **Inspection Programs**

Does the change impact on the station inspection programs?	Yes	No
(a) Boiler Inspections	☐	☒
(b) Fuel channel inspections	☐	☒
(c) Pipe Wall Thinning	☐	☒
(d) Rotating Equipment Monitoring	☐	☒
(e) Periodic Inspection	☐	☒
(f) Pressure Relief Valve Test Program	☒	☐
(g) Valve & Heat Exchanger Programs	☒	☐
(h) Valve Monitoring	☒	☐
(i) Steam Barrier Inspection	☐	☒

If unsure, consult Components and Equipment Engineering.
If yes, summarize and justify, and include details in design/issue tracking file and ensure program is updated.
If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: Some of the new equipment is major in scope: tanks, pumps, automated valves, cranes, etc. All of this equipment will require an inspection according to the station inspection program.

3.33 **New Materials**

Are any new materials being introduced into the system? **Yes** ☐ **No** ☒

If unsure, consult the appropriate Material SPOC.
If yes, summarize and justify, and include details in design/issue tracking file.
If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: Consistency with existing specifications and Cat IDs will be pursued as much as possible. All of the equipment being procured has been purchased by OPG in the past, and material selection is not expected to fall outside of the existing availability.

3.34 **Maintenance Programs**

Does the modification take into consideration or affect the requirements of the predictive maintenance programs as outlined in:	Yes	No
(a) N-ED-09183-10000, Predictive Maintenance Lubricant Screening Program?	☐	☒
(b) N-ED-09183-10001, Predictive Maintenance Infrared Thermography Program?	☐	☒
(c) N-ED-09183-10002, Predictive Maintenance Vibration Monitoring Program?	☐	☒
(d) Will any coupling guard design block access for vibration readings (for example, interfere with the ability of placing an accelerometer on the equipment to perform axial, horizontal, and vertical readings?	☐	☒
(e) Will the modification introduce unapproved lubricants (refer to approved Station Lubrication List) or change lubricant use? (If yes, contact Station Lubrication Specialist for recommendation of approved lubricants, in accordance with N-INS-08125-10001, Lubricant Selection Process).	☐	☒

If unsure, consult Components and Equipment Engineering.
If yes, summarize and justify, and include details in design/issue tracking file.
If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: Functionally, no new equipment is being introduced to the station (ie. storage tanks, pumps, IX columns, drum handling equipment is all currently in use).

3.35	**Maintenance Strategy**		
	Does the existing equipment have a maintenance strategy (that is, is NISP flag set on Passport D041 panel)?	**Yes** ☐	**No** ☒
	If unsure, consult Maintenance Assessing, Nuclear Integrated Supply Planning (NISP). If yes, contact NISP to ensure the strategy gets updated to reflect the modification, summarize and justify, and include details in design/issue tracking file. If no, justify.	Subject Matter Expert (if consulted): Print Name: _____ (input 'Not Applicable' if SME not consulted) SME concurrence: _____	
	Justification: Existing equipment is not affected in terms of maintenance strategy. New equipment will be procured and a new maintenance strategy for all systems will need to be developed.		

3.36	**New Equipment**		
	Is equipment new? That is, will equipment codes need to be created for this modification?	**Yes** ☒	**No** ☐
	If unsure, consult Maintenance Assessing (NISP). If yes, contact Maintenance Assessing to initiate a maintenance strategy if required, summarize and justify, and include details in design/issue tracking file. If no, justify.	Subject Matter Expert (if consulted): Print Name: _____ (input 'Not Applicable' if SME not consulted) SME concurrence: _____	
	Justification: The majority of this modification is related to the design and installation of new systems.		

3.37	**Emergency Response**		
	Does the change have the potential to adversely impact on an Emergency Response Plan?	**Yes** ☒	**No** ☐
	If unsure, consult Emergency Preparedness or Fire Protection, as appropriate. If yes, consult Emergency Preparedness or Fire Protection (as appropriate), summarize and justify, and include details in design/issue tracking file. If no, justify.	Subject Matter Expert (if consulted): Print Name: Anca McGee (input 'Not Applicable' if SME not consulted) SME concurrence: _____	
	Justification: The new West Annex with the expected proximity to the SG Oil Storage Tanks and blockage of the current north-south road will require changes to the fire fighting plan for the HWMB / West Annex.		

3.38 **Environmental Considerations**

Does this modification or its installation have an impact on the environment? Impact may include or involve:	Yes	No
(a) Is the modification or its installation outdoors?	☒	☐
(b) Air emissions through dedicated ventilation	☒	☐
(c) Noise or odour detectable off-site.	☐	☒
(d) Discharges to water.	☒	☐
(e) Non-radioactive waste and by-products (for example, hazardous waste, re-usable or recyclable material).	☐	☒
(f) Radioactive waste (for example, production of new radioactive waste, or a change in the volume of radioactive waste produced).	☐	☒
(g) Potential for a spill to the environment (for example, spill of chemical, oil, or solvent to air, land, or water).	☒	☐
(h) Natural resource use (for example, water, salt)	☐	☒
(i) Does the installation of the modification involve construction generators, construction boilers, construction heaters, or heavy construction equipment?	☒	☐
(j) The domestic water system?	☒	☐
(k) Changes to area lighting?	☒	☐
(l) Installation or replacement of motors or pumps?	☒	☐
(m) Storage tanks?	☒	☐

If unsure, consult Environmental Compliance.

If yes, consult Environmental Compliance and complete N-FORM-10422, Environmental Impact Work Sheet, summarize and justify, and include details in design/issue tracking file.

If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: This modification has a number of environmental impacts as follows:

1) Tritiated ground water from IWST spill in 2009
2) Major removal of soil, also potentially tritiated
3) Storage of Heavy Water
4) Building located in expected flood plain
5) New tie ins to sewage, active & inactive drainage
6) New air effluent stack & monitoring
7) Domestic water needed for emergency eye wash and shower
8) Heavy construction equipment (backhoes, cranes, generators, concrete trucks, etc)
9) New lights indoors are required and outdoor lamp-posts will require relocation
10) Motors/pumps for transfer of heavy water will be installed
11) Construction schedule can affect migratory bird breeding season

3.39 **Hazardous Materials**

Consider the following:	Yes	No
(a) Are hazardous materials or chemicals a concern?	☐	☒
(b) Does the work involve material containing a designated substance?	☐	☒
(c) Does the work involve material that could be considered hazardous?	☐	☒

If unsure consult the SME.

If yes, consult with Industrial Hygienist, summarize and justify, and include details in design/issue tracking file. If modification may introduce a new hazardous material to the system, complete and submit N-FORM-10672, Request for Review and/or Approval of Hazardous Materials, during the design phase once sufficient information is available.

If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: No hazardous or designated substances are foreseen in construction or operations at this conceptual stage, but will need to be further evaluated in detailed design, work plans, Job Safety Analyses.

3.40 **Personal Protection Equipment**

Does the modification trigger the need for new types of PPE for hazard control? (If the need for new PPE need can't be avoided, involve employee safety. For example, arc flash is a PPE issue for electrical equipment. For the arc flash example, electrical designers should refer to CSA Z462 for arc flash to determine PPE requirements).	Yes ☐	No ☒

If unsure, consult Safety Officer.

If yes, summarize and justify, and include details in design/issue tracking file.

If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: PPE for operation of the existing HWMB/TRF is in place. Mainly, "olive" coveralls are in use at the facility, and all anticipated hazards are conventional in nature. Existing PPE can be used to operate the new facility. PPE used during construction will be as per OH&SA.

3.41 **Operational Impact and Complexity**

Thing to consider:	Yes	No
(a) Does the modification depend or behave differently based on unit conditions (for example, startup, shutdown, or transitional states)?	☐	☒
(b) Does the modification depend or behave differently based on factors external to the power plant (for example, electrical system [grid] conditions [refer to 3.22 d above], external utility supplies or interfaces [for example, air, power, water, auxiliary heating, sewers, or water treatment])?	☒	☐

If unsure, consult whatever SME is appropriate.

If yes, summarize and justify, and include details in design/issue tracking file.

If no, justify.

Subject Matter Expert (if consulted):
Print Name: _____
(input 'Not Applicable' if SME not consulted)
SME concurrence: _____

Justification: The current recommended option for power is from the municipal Utility. Therefore, the real possibility of power outages will need to be taken into account in the design of the electrical power supply.

3.42	**Other Issues**		
	Are there other issues of concern? If yes, document these.	**Yes** ☒	**No** ☐
	If unsure, consult whatever SME is appropriate. If yes, summarize and justify, and include details in design/issue tracking file. If no, justify.	Subject Matter Expert (if consulted): Print Name: Soo Chae/ Susan Bragg (input 'Not Applicable' if SME not consulted) SME concurrence: _____	

Justification: In 2009, an IWST spill occurred and approximately 200,000 L of slightly tritiated light water was discharged to the environment. A portion of this spill entered the groundwater in the vicinity of the HWMB. Dewatering and disposing / treating tritiated groundwater for the duration of the foundation construction would be costly and likely impact schedule. Project #16-38940 is underway to assess the condition of the soil and groundwater, and recommend mitigation options (Environmental Site Assessment Phase II).

(4) STAKEHOLDER/SPECIALIST REVIEW (used to identify a list of stakeholders, as determined by Modification Outline and the above Design Concerns). Check if the stakeholder will need to provide input or consultation during Preliminary or Detailed Design.

☒	Chemistry	☒	EQ (Environmental Qualification)	☒	HVAC Design	☐	NWMD Transportation	☒	Safety Officer
☒	Civil Design	☒	Ergonomist	☐	Industrial Hygiene	☒	Operations	☒	Security Engineering
☒	Components & Equipment Engineering	☒	Fire Protection	☒	Instrumentation &Control Design	☐	OPEX	☐	Simulator
☒	Computers & Control Design	☒	Fire Safe Shutdown Analysis	☒	Maintenance	☒	Other Project's DTL(s)	☒	Supply Chain Contracts Management
☒	Electrical Design	☐	Fuel Handling Technical	☐	Margin Management	☐	Performance Engineering	☒	Training
☒	Emergency Preparedness	☒	Health Physics	☐	Mechanical Design	☒	Radiation Protection	☒	Welding Engineering
☒	Environmental Compliance	☒	Human Factors	☐	NISP	☒	Reactor Safety	☐	
	Other:	☒	TRF Technical	☒	TRF Operations	☐		☐	

(5)	**DESIGN ALTERNATIVES**
	List alternatives evaluated prior to choosing proposed solution. If a study report was made, reference the document number.

HIGH LEVEL DESIGN ALTERNATIVES

Previous iterations of this project and scoping activities like value engineering have established conceptual solutions for these gaps. In no particular order, these concepts have been considered to support Nuclear Refurbishment of the 4 Darlington units and operational improvements at the TRF:

1) Use of Pickering U2/U3 dump tanks – Most of the required equipment is in place, but significant items such as dryers for tank venting and the cover gas system are decommissioned. Transportation requires roughly 35 TDO trips, which increases risk of D2O spill and cost.

2) AECL's La Prade storage facility in Quebec – Low capital cost, but will pay premiums on rental space and transportation to/from Quebec. Transportation issues similar to option 1), one, would exist. Unknown status of the facility (commissioned/decommissioned), and may have to detritiate water before shipment, which can significantly affect cost and schedule.

3) Modify the Moderator Sump Rooms (R-009 and R-010) of each unit – Unknown licensing, feasibility and mobility issues. Reconfiguring the room could impair operation of the unit or would require a lengthy outage immediately prior to the unit outage. Very close to reactors and temporary solution.

4) Construct a new building, or annex to existing HWMB, west of the HWMB/TRF (Site A) – Best option for direct access of HWMB/TRF personnel. Best option for tie-ins to current process systems (S&I, D2O Cleanup, TRF feed and product, etc). Elevated risk of tritiated ground water from IWST spill in 2009. Fire protection concerns over proximity to SG oil storage tanks.

5) Construct a new facility south of the SG Oil Tanks, 0-77200-TK1/2 (Site B) – Expected lower risk of tritiated ground water, but possibly more contaminated due to proximity to Lake Ontario. Greater limitations on space and constructability. Not directly connected to HWMB/TRF. Major Nuclear Security implications due to proximity to security fence. Fire protection concerns over proximity to SG oil storage tanks.

6) Construct a new facility east of the Powerhouse at Unit 4 (Site C) – Similar to option 5), five, with major benefits being no risk of tritiated groundwater, less impact on ongoing operations during construction and more constructible. Major constraints include proximity to HWMB/TRF for operations and for process system connections.

7) Construct a new facility outside of the protected area (Site D) – Reduced costs related to ECC process such as design rigour and construction delays. Significant licensing implications as this configuration affects the safety report and would have tritiated water outside of the protected area. Most challenging for current operations as rounds and response would require access/egress from protected area.

8) Construct a new facility for storing Refurbishment water at Site C, and a new facility for equipment related to the operational improvements of the TRF at Site A – Provides for benefits of Site A and C (increased constructability and maintaining proximity of HWMB/TRF personnel to TRF Operational Improvement equipment), but increases the cost as a result building two separate facilities with separate tie-ins to existing services.

9) Reconfigure the East end of the Turbine Hall, between Col X and Y to store Refurbishment water (Site T) and a new facility at Site A for TRF Operational Improvement equipment– Reduce capital cost as building is in place. Increased nuclear safety risk by placing Class 3 and Class 6 systems near turbines (increased consequences resulting from T/G fire or explosion). Far from HWMB/TRF operators, but close to units and tie-ins to support services.

Option #4 is the proposed solution for this modification. Construction of a new building or annex that will provide adequate D2O storage for refurbishment (1700 m3), TRF operational improvements (400 m3), and a drum handling facility ensures the most value for this project. A value engineering study completed in Q2 2011, NK38-REF-38000-0388269, established this proposed solution as the second of two preferred options. The higher ranked proposal was driven by constructability issues, and the solution in this modification outline is considered a favourable option by all major stakeholders.

SYSTEMS LEVEL DESIGN ALTERNATIVES (OPTIONS for SOLUTION #4)

Evaluation of design alternatives within Option #4 (preferred option) above, are detailed in the Conceptual DesignReport NK38-REP-38000-10002.

(6)	**INSTALLATION PLAN**			
		Yes	**No**	**Comments**
6.1	When will the modification package be installed?			TRF outages will be required for multiple D2O transfer line tie-ins. Gas supply (He, Ar) outage of the TRF to allow for demolition and connections to process/support systems will be required.
	• Outage?	☒	☐	
	• On-line?	☒	☐	
	• Under special operating configuration?	☐	☒	
6.2	What are the commissioning activities?			Certain systems (for example, civil components related to seismic qualification) may be non-commissionable. Therefore enhanced AFS/COMS for the particular Design EC is required.
	• Is the modification non-commissionable? (If yes, complete Section 7.5 below)	☒	☐	
	• **If** modification **is** commissionable:			
	○ Is commissioning required?	☒	☐	
	▪ **If** commissioning is not required, will Post Maintenance Testing be done?	☐	☐	
	○ Will the plant be in an unusual state?	☒	☐	
	○ Could commissioning affect production?	☒	☐	

(7)	**RIGOUR REQUIRED DURING PRELIMINARY OR DETAILED DESIGN PHASE.** **Risk classifications referenced below are as determined by N-FORM-10958.** **Add actions determined to be required to the Issues Tracking File.**			
7.1	Complete-N-FORM-10521, Document Scoping Checklist, to identify documents that should be input on the Design/Project EC Affected Document List (ADLs). Once completed, N-FORM-10521 should be retained in the working files. Comments:			
		Yes	**No**	**Action**
7.2	Will Formal Modification Design Requirements in accordance with N-INS-00700-10002, Updating of Legacy Design Manuals and Production of Modification Design Requirements, be prepared?	☒	☐	Note: Formal Modification Design Requirements may be done for lower risk modifications at the discretion of the DTL or Section Manager. As per the Refurbishment Design Authority, NK38-DR-38000-10001 meets the intent of the MDR. No further MDR is required.
	Required if:			
	• Environmental Risk is 1, 2, or 3.	☒	☐	
	• Nuclear Safety Risk is 1, 2, or 3.	☒	☐	
	• Production Risk is 1, 2, or 3.	☒	☐	
	• Security Risk is 1 or 2.	☐	☒	
	• SOE Margin is 1 or 2.	☐	☒	
	• System Impact is 1, 2, or 3.	☒	☐	
	• IAEA Safeguards is yes.	☐	☒	

7.3	Are there known to be field conditions or other design assumptions that cannot be validated as part of the detailed design?	☐	☒	Identify assumptions and actions needed by field staff to validate such conditions and/or assumptions in the PASSPORT "ASSUMPTION VALIDATN" Topic Note for each applicable Design EC.
7.4	(a) Is a technical review in accordance with N-PROC-MP-0047, Design Verification, required?	☒	☐	Note: Technical reviews may be done for lower risk modifications at the discretion of the DTL or Section Manager.
	Required if:			
	• Environmental Risk is 1, 2.	☐	☒	
	• Nuclear Safety Risk is 1, 2.	☐	☒	
	• Equipment Risk is 1, 2.	☐	☒	
	• Production Risk is 1 or 2.	☒	☐	
	• Security Risk is 1.	☐	☒	
	• SOE Margin is 1 or 2.	☐	☒	
	• IAEA Safeguards is yes.	☐	☒	
	(b) Is a third party Review (by an external agency or other OPG division) required?	☐	☒	
	Required if:			
	• Technical Review is required (see above) **AND**	☒	☐	
	• Nuclear Safety Risk is 1 **OR** Environmental Risk is 1.	☐	☒	
7.5	Is the modification non-commissionable (that is, full commissioning is not possible or practicable)? (See Question 6.2 above).	☒	☐	As per N-PROC-MP-0090 clause 1.4.9, perform the following and document in PASSPORT "NON-COMM" attributes for each Design EC that is non-commissionable: • Identification of responsible individuals. • Critical attributes assessment. • Enhanced COMS, in accordance with N-PROC-MP-0083, Constructability, Operability, Maintainability, and Safety (COMS). **Note:** Enhanced COMS for a non-commissionable modification may not be waived in Part 5B of the Modification Outline.
7.6	Are a Detailed Commissioning Specification and a subsequent Commissioning Report, in accordance with N-INS-00960-10000, Detailed Commissioning Specifications and Commissioning Reports, required?	☒	☐	Note: Detailed Commissioning Specifications and Commissioning Reports may be done for lower risk modifications at the discretion of the DTL or Section Manager.
	Required if:			
	• Environmental Risk is 1, 2, or 3.	☒	☐	
	• Nuclear Safety Risk is 1, 2, or 3.	☒	☐	
	• Production Risk is 1, 2, or 3.	☒	☐	
	• Security Risk is 1 or 2.	☒	☐	
	• SOE Margin is 1 or 2.	☐	☒	
	• System Impact is 1, 2, or 3.	☒	☐	
	• If new technology (that is, not previously installed in OPGN) or unproven methodology will be used.	☐	☒	
	• IAEA Safeguards is yes.	☐	☒	

		Yes	No	Action
7.7	Is a Design Plan, in accordance with N-PROC-MP-0074, Design Plan, required?	☒	☐	Note: Design plans may be done for lower risk modifications at the discretion of the DTL or Section Manager.
	Required if:			
	• Modification impacts equipment in a safety related or S-98 system.	☒	☐	
	• Environmental Risk is 1, 2, or 3.	☒	☐	
	• Nuclear Safety Risk is 1, 2, or 3.	☒	☐	
	• Equipment Risk is 1, 2, or 3.	☒	☐	
	• Production Risk is 1, 2, or 3.	☒	☐	
	• Security Risk is 1 or 2.	☒	☐	
	• SOE Margin is 1 or 2.	☐	☒	
	• System Impact is 1, 2, or 3.	☒	☐	
	• IAEA Safeguards is yes.	☐	☒	
7.8	Was nuclear safety risk classified as 1, 2, or 3?	☒	☐	If yes, complete N-FORM-10529 Reactor Safety Designer's Checklist. If system is S-98 or special safety system, Reactor Safety review of the Master EC, with milestone completion, is required.
7.9	Was SOE Margin classified as 1, 2, or 3?	☒	☐	If yes, complete the following: • Add as design concern to issue tracking file • Optimize margin in design phase • Implement in margin management program • Obtain Reactor Safety approval of the Master EC with milestone completion. • Safety report and change paper issued as part of Project or Design EC/OP Manual/AIMs

(8)	**OPERATIONS TURNOVER PLAN**			
	How should Operations accept the package? (Pick one of [a], [b], or [c]. Note that [d] may be chosen in addition to any of [a], [b], or [c].)	**Yes**	**No**	**Comments:**
	(a) With Operations Acceptance?	☐	☒	
	(b) With an Available For Service (AFS) declaration?	☒	☐	
	• Required If:			
	i. Environmental risk is 1, 2, or 3.	☒	☐	
	ii. Nuclear Safety risk is 1, 2, or 3.	☒	☐	
	iii. Production risk is 1, 2, or 3.	☒	☐	
	iv. Security risk is 1 or 2.	☒	☐	
	v. SOE Margin is 1 or 2.	☐	☒	
	vi. System Impact is 1, 2, or 3.	☒	☐	
	vii. IAEA Safeguards is yes.	☐	☒	
	(c) With Enhanced AFS? • Required if commissioning is not possible or practicable as per 6.2 and 7.5 above.	☒	☐	
	(d) With more than one turnover to Operations?	☒	☐	

(9)	**OVERSIGHT**			
		Yes	**No**	**Comments**
	Reviews and milestones required for the Design EC release(s):			
	• Design Authority (DA) If any of Employee Safety, Environmental, Nuclear Safety, Equipment, Production, Security, or SOE Margin are rated as Risk 1, 2, or 3.	☒	☐	
	• Safety Manager If Employee Safety Risk is 1 or 2.	☒	☐	
	• Stratum IV manager responsible for Environmental If Environmental Risk is 1 or 2.	☐	☒	
	• Reactor Safety Manager – If Nuclear Safety Risk is 1 or 2 **or** if SOE Margin classified as 1 or 2.	☐	☒	

(10)	**RATIONALE FOR A GENERIC MODIFICATION (GMOD) (if requested)**