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Title:
SCOPE OF WORK FOR EPC CONTRACT FOR THE DARLINGTON HEAVY WATER MANAGEMENT BUILDING WEST ANNEX

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Scope of Work for EPC Contract for the Darlington Heavy Water Management Building West Annex

NK38-SOW-38000-10004-R000
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Revision Summary

Revision Number	Date	Comments
R000	2012-02-29	Initial issue.

1.0 INTRODUCTION

Ontario Power Generation (OPG) is seeking proposals to retain an Engineering/ Procurement/ Construction (EPC) Contractor ("Contractor", hereafter), for the design, procurement, construction, and commissioning of a new Heavy Water Management Building (HWMB) West Annex located at the Darlington Nuclear Generating Station (DNGS) in the municipality of Clarington, Ontario. OPG will be the Constructor under the OH&SA.

2.0 BACKGROUND

2.1 Scope

A new HWMB West Annex with Heavy Water (D2O) drum handling capability and office space is required to be built at DNGS to provide additional D2O storage on site to support Darlington Refurbishment as well as Tritium Removal Facility (TRF) and Darlington operational improvements.

The new facility will address the following business needs:

- Transfer and store the full volume of Moderator, Primary Heat Transport (PHT) and PHT auxiliary systems for two units.
- Additional storage capacity to facilitate operational improvement initiatives:
  - Improve efficiency of the TRF by increasing operational flexibility.
  - Enable a buffer of TRF product to be stored for continued detritiation for OPG and customers during TRF outages.
  - Enable complex TRF life extension scope to be implemented during extended TRF outages.
  - Increase the flexibility of heavy water management to ensure OPG detritiation needs and customer needs are met to 2055 by a life extended TRF. (Reference: NK38-CORR-39000-0412581)
- Equipment and systems for the handling, cleaning, testing, and disposal of D2O storage drums to reduce OPG Nuclear's drum backlog and improve station efficiency and safety.
- Permanent office space to accommodate Heavy Water Management Building/Tritium Removal Facility (HWMB/TRF) personnel. (Reference: NK38-CORR-38000-0400715)

The scope is more thoroughly described in the Design Requirements (DR) NK38-DR-38000-10001 and the Conceptual Design Report (CDR) NK38-REP-38000-10002.

The requirements in the DR/CDR, and also in the project charters listed below:

(a) N-PCH-09701-10001 (Refurbishment, Operational Improvements and Long Term D2O Storage)

(b) N-PCH-03800-10000 (Adding Heavy Water Storage / Drum Handling Facilities)

To meet the needs of Darlington refurbishment the new HWMB West Annex with D2O drum handling and office space must be made Available for Service (AFS) no later than April 15, 2015.

2.2 Legacy Project

An existing project had already been started to build an extension to the west of the existing HWMB (Heavy Water Management Building) to house 400m^3 of additional D2O storage capacity for TRF and Darlington operational improvements along with space for drum handling and offices. This project was placed in deferral status during preliminary engineering as it was determined that it would be more economical for OPG to wait until a decision on Darlington refurbishment was made.

OPG received a technical evaluation package from two separate Design Agencies as part of the contracting strategy at the time. The technical evaluation packages, which can be made available to the successful proponent upon request, consisted of the following information:

(a) Preliminary design requirements

(b) Preliminary design description

(c) Preliminary building layout, systems and equipment drawings

(d) Draft engineering change papers for existing OPG drawings

(e) OPEX report

(f) Draft system classification lists

(g) Preliminary site preparation report

(h) Preliminary licensing plan

(i) Preliminary quality plan

(j) Preliminary nuclear safety assessment

2.3 Value Engineering Study

A Value Engineering workshop was held during the week of April 11, 2011 to seek OPG stakeholder input on where on the DNGS site the new HWMB West Annex should be built. The Value Engineering workshop looked at three potential building locations on site as per Appendix F (Proposed Building Location).

(a) Area immediately west of the HWMB (Site "A") **(the selected site)**

(b) Area behind the Standby Generators (SG) oil tanks (Site "B")

(c) Area east of the powerhouse (Site "C")

After the Value Engineering workshop OPG made a decision that the area behind the Standby Generator (SG) oil tanks would not be a practical site to build the new HWMB West Annex; therefore, it has been removed from the list of potential site locations. Site "C" is also not preferred due to distance from HWMB transfer lines, and cost.

The Value Engineering report NK38-REF-38000-0388269 may be provided upon request. All of the outputs of the Value Engineering report have been incorporated in the Design Requirements and Conceptual Design Report.

The preferred option from all stakeholders is Site "A", assuming the tritium in groundwater risk can be managed. See Section 2.5 for more on the tritium risk.

2.4 Geotechnical Studies

OPG intends to provide to the Contractor, geotechnical evaluations based on five (5) bore holes on the preferred site.

A geotechnical analysis report NK38-REP-38000-10001 completed by EXP (formerly Trow Associates) has already been prepared based on three (3) geotechnical boreholes, two (2) of which are within the footprint of the preferred site.

OPG is undertaking to drill three (3) additional bore holes. The previous and proposed bore holes are shown in Appendix G. The boreholes will be drilled to bedrock at depths of about 12 metres below grade. The final report expected in Q2 2012.

The Contractor shall be responsible to evaluate the need for additional geotechnical studies and be responsible for undertaking such studies.

2.5 Tritium in Groundwater Risk

In December 2009, the Emergency Coolant Injection (ECI) Injection Water Storage Tank (IWST) overfilled, and approximately 200,000 L of light water with trace amounts of tritium was discharged to the environment. A portion of this spill entered the groundwater in the vicinity of the HWMB. In the Value Engineering report, Sites "A", "B", and "C" were investigated. There is concern regarding the constructability at Site

"A", if a design is chosen which excavates to bedrock (approx 87-m El). Dewatering and disposing / treating tritiated groundwater for the duration of the foundation construction would likely be cost and schedule prohibitive. This risk is what is driving OPG to consider Site "C". If not for this risk, the preferred option from all stakeholders would be Site "A". The OPG Project team, with OPG Environmental Compliance Department, has developed a strategy to investigate and characterize the extent of tritium contamination at Site "A", with the aim to develop a remediation plan, if necessary. The full investigation (Environmental Site Assessment Phase II) is expected to conclude in April 2013, however by April 2012, initial groundwater samples and Geotechnical Evaluation for Site "A" will be complete. An interim groundwater report will also be made available.

The Proponents should assume, for the purposes of this RFP, that there are no tritium concerns with Site "A".

2.6 Expected Tritium Levels in Process

For guidance, the new facility is expected to receive water with the following tritium levels. The proponent is required to verify all values in their proposals and design.

From NK38-OPP-03600, the concentration of tritium in the Darlington moderator shall be no higher than 15.0 Ci/kg, and the concentration of tritium in the Darlington heat transport system shall be no higher than 1.2 Ci/kg. Also, the tritium concentration of feed water at the inlet of the TRF feed treatment process shall not exceed 34 Ci/kg. Currently, this includes moderator water from external customers.

The current D2O downgraded heavy water transfer system, SCI 38500, contains water not exceeding 10.0 Ci/kg in tritium concentration as per CSA N285-95 and TRANS-TS-03459-TR18-0008. Connected to this system is the D2O cleanup system, SCI 38410, which may also contain tritiated water at levels up to 10 Ci/kg.

From NK30-OPP-03600 and NA44-OPP-03600, the tritium concentration in the Pickering moderator system shall not exceed 25.0 Ci/kg, and the tritium concentration in the Pickering heat transport system shall not exceed 2.5 Ci/kg.

3.0 SCHEDULE REQUIREMENTS

The estimated Award for Phase 1 Purchase Order is 6-Jun-2012. The Available for Service (AFS) date for the completed Project (Phase 2) shall be no later than April 15, 2015.

OPG requires 13 weeks after completion of Phase 1 below, for Refurbishment and Board of Directors approval to commence Phase 2 (Construction and Procurement of non-Long Lead Materials). During this time, it is expected that procurement of long lead materials and site preparation (relocation of underground services) may proceed.

The following table outlines the expected Schedule and Estimate submissions. For clarity, see Appendix I for definition of Schedule Levels. Estimate level definitions shall be as per Association for Advancement of Cost Engineering (AACE).

	Schedule		Estimate	
	Phase 1	Overall Project	Phase 1	Overall Project
Contract Bid (confirmed with Contract Award)	Level 3	Level 2	Class 2	Class 5
75% Design Review	n/a	Level 3	n/a	Class 2
Detailed Design Complete	n/a	Level 3 (refined)	n/a	n/a

3.1 Contract Phase 1: Site Preparation, Completion of Modification Planning, Detailed Engineering, Specification and Ordering of Long Lead Materials

In suggested order, including but not limited to the following. For definition of "Acceptance Point", see Section 3.3.

(a) Project kick-off meeting

(b) Completion of Acceptance Point 1

(c) Review of design input documents including Engineering Change Control (ECC) governance

(d) Start of Scope Definition/Modification Planning

(e) Completion of Acceptance Points 2, 3, 4, 5, 6

(f) Master Engineering Change Approved

(g) Start of Detailed Design

(h) Completion of Relocation/Site Prep Design

(i) Completion of Acceptance Point7

(j) Human Factors Engineering Program Plan (HFEPP) complete

(k) Completion of all long lead material engineering/technical specifications

(l) Start issuing long lead materials purchase orders

(m) All long lead material purchase orders awarded

(n) Soil/solid waste disposal and de-watering management plan

(o) Start of relocation of Underground Services & Equipment, and removal of TRF Trailers

(p) Completion of Phase 1 (acceptance of final design package)

3.2 Contract Phase 2: Procurement, Construction, Commissioning, and Closeout

In suggested order, including but not limited to:

(a) Completion of Acceptance Point 8

(b) Site Mobilization

(c) Completion of relocation of Underground Services & Equipment (if not completed in Phase 1)

(d) Purchase orders issued for sub-contractors & bulk materials

(e) Completion of Acceptance Points #9, 10, 11

(f) Engineering support during construction/commissioning

(g) Demolition of existing truck dock

(h) Excavation and preparations for Foundations

(i) Foundations completed

(j) Tanks & other major equipment installed at foundation level

(k) Steel Structure erected

(l) Block Walls erected

(m) All long lead materials staged

(n) Installation of each process and support system

(o) D2O station system tie-ins

(p) Support system station tie-ins

(q) Electrical Power rough in

(r) HVAC and Plumbing Finishing

(s) Electrical power system live, and Lighting active

(t) Sprinkler system active

(u) Completion of Acceptance Point #12 (DEC rev as required)

(v) Provide Built drawings, Operating and Maintenance Manuals

(w) Commissioning & Turnover

(x) Completion of Acceptance Point #13 (Commissioning Report)

(y) Completion of Review Point #14 (AFS)

(z) Substantial Completion of Phase 2 (defined in Appendix 1 of the ES-MSA)

(aa) Completion of Review Point #15 (Closeout)

3.3 OPG Contractor Deliverables Review

OPG has established Acceptance Points covering all of the deliverables listed in Section 5 of this scope of work. "Acceptance point" refers to the formal transmittal of documentation from the Contractor to OPG, and is not necessarily meant to stop work by the Contractor, except where a hold point is required as per OPG governance or Contractor's QA program.

Consistent with INPO 09-002 "Excellence in Nuclear Project Management", reviews will be performed at several stages throughout the design process. The end users will be an integral part of the design reviews. Specifically, Design Review Meetings (DRM) shall be conducted by the Contractor for at the 50% and 75% detailed design schedule milestones to facilitate the description of deliverables requiring OPG review.

20 business days in advance of the detailed design phase midpoint (ie. 50% of the allotted schedule), the Contractor shall provide documentation relevant to every Design EC established in the Design EC Release Plan. The Contractor shall organize and chair a Design Review Meeting (DRM) following the 20 business day review by OPG. The Contractor shall allot 2 business days for the DRM.

20 business days in advance of the detailed design phase three-quarter point (ie. 75% of the allotted schedule), the Contractor shall provide documentation relevant to every Design EC established in the Design EC Release Plan. The Contractor shall organize and chair a Design Review Meeting (DRM) following the 20 business day review by OPG. The Contractor shall allot 2 business days for the DRM.

Should any review point render a deliverable of unacceptable quality, the deliverable shall be returned to the Contractor for re-work, and the submittal shall not count as a review cycle.

Reviews completed by the OPG Design Authority (ie. Approval of Modification Outline) are not included in the table below.

OPG Review Timelines			
Accept -ance Point #	ECC Process	Deliverable	OPG Review Time (business days)
1	Phase 1 Contract Planning	Contract Planning documents, finalized from initial Proposal, such as: Project Management Plan, Quality Management Plan, Level 4 Schedule for Phase 1, AACE Class 5 overall cost estimate	As per ES MSA *(see note)
2	Scope Definition	Master EC, Modification Outline, Design Scoping Checklist and related forms	As per ES MSA*
3	Modification Planning	Modification Design Requirements	20 days per MDR **(see note)
4		Design Plan & EC Release Plan	As per ES MSA*
5		Walkdown Report & COMS	As per ES MSA*
6		Engineering Specifications and supporting calculations for Long Lead Material	As per ES MSA*, up to 4 specifications at one time**
7	Detailed Design	Final Acceptance	As per ES MSA* up to 4 DECs at once**

Accept -ance Point #	ECC Process	Deliverable	OPG Review Time (business days)
8	Phase 2 Contract Planning	Phase 2 Contract Planning documents such as: Project Site Specific Safety Plan (PSSSP), Site Specific Environmental Management Plan (SSEMP), Project Management Plan (updated), Quality Management Plan (updated), Construction Specification, Class 1/2 AACE Estimate, Level 4 Schedule (updated) for Phase 2, Statement of Work, Procurement Plan	As per ES MSA*
9	Installation and Commissioning Planning	Installation Workplans and Instructions	As per ES MSA* up to 4 documents at once**
10		Commissioning Specifications	20 days per CS**
11		Commissioning Requirements, Commissioning Workplans, Site Acceptance Tests, Training Plan	As per ES MSA* up to 4 documents at once**
12	Installation and Commissioning	DEC Intent Revisions	As per ES MSA* up to 2 DECs at once**
13		Commissioning Report, Final QA/QC documentation	As per ES MSA*
14	AFS/Ops Acceptance	All deliverables prior to AFS/Ops Acceptance	As per ES MSA*
15	Close Out	All deliverables prior to DEC close out.	As per ES MSA* up to 4 DECs at once**

* 10 business days as per ES-MSA

** Acceptance time accumulates with submissions greater than those stated in this table (i.e. 5 DEC submissions at Acceptance Point #7 require 20 business days for OPG review)

4.0 TECHNICAL REQUIREMENTS

For technical requirements, refer to NK38-DR-38000-10001 "Design Requirements for the Darlington Heavy Water Management Building West Annex", and NK38-REP-38000-10002 "Conceptual Design Report for the Darlington Heavy Water Management Building West Annex".

5.0 DETAILED DESCRIPTION OF WORK

The scope of the Contractor's work includes the engineering, procurement and construction of the HWMB West Annex. The scope of work will include completion of scope definition/modification planning (already started by OPG), detailed design, site preparation, procurement, construction, commissioning and close-out. It will be released to the Contractor in two phases as follows:

Phase 1: Site Preparation, Completion of Scope Definition/Modification Planning, Detailed Engineering, Specification and Ordering of Long Lead Materials

Phase 2: Procurement, Construction and Commissioning and Turnover to OPG.

The following modification planning documents provide descriptions of the scope of the project, technical requirements as well as proposed tank layout and tie-in locations. The Contractor shall verify the data presented in these documents and use them as design input data.

a) NK38·DR·38000·10001 Rev 000: Preliminary Design Requirements for the Darlington Heavy Water Management Building West Annex

b) NK38-REP-38000-10002 Rev 000: Conceptual Design Report for the Heavy Water Management Building West Annex

c) ECC process Scope Definition deliverables (except for the Design Plan). The major items include Modification Outline, Design Scoping Checklist, and associated forms

The Contractor shall also support OPG with the Environmental Assessment for Darlington Refurbishment as required. The COMS process will be used to identify and incorporate Environmental Assessment comments.

5.1 General Requirements & Deliverables

5.1.1 The Contractor shall submit within 20 business days of contract award, a Project Management Plan including a final Risk Management Plan and Change Management Plan.

5.1.2 The Contractor shall submit within 20 business days of contract award, a Design Quality Assurance Plan, outlining the review, verification and approval process that will be followed, the applicable standards, codes and regulations, and the qualification requirements of the work participants.

5.1.3 The contractor shall submit a Level 3 schedule for the overall project at the 50% Design Review.

5.1.4 Performance of timely and sufficient walkdowns is one of the most important factors to delivering an appropriate design, identifying issues early, and preventing rework. The

Contractor shall plan to conduct walkdowns whenever necessary to achieve the end goal of meeting expected level of quality expected by the end users. During the design phase the vendor will notify the Project Representative (or delegate) prior to each site visit.

5.1.5 The following is a summary of anticipated meeting requirements.

Meeting Description	Frequency	Duration (each instance)
Available for Service (AFS) Meeting	Dependent on Contractor's Operations Turnover Plan	1-3 hours
COMS	Twice: Preliminary & Final	3-8 hours each
Project Team Meeting	Weekly	1 hour
Risk Management Meeting	Once per quarter	2 hours
Project Definition Risk Index (PDRI)	Three times: Mod Planning, Detailed Design, Construction	4 hours
Contract Close-out / Lessons Learned	Once	1-8 hours
Contractor Supervision Oral Review Board (ORB)	Once per supervisor	1 hour
Design Review meetings	As per Section 3.3	2-4 hours
Orientation/Kickoff meeting	Once	2-4 hours
Post-Job Debrief (Engineering)	Per major work evolution	15-30 min
Pre-Job Brief (Engineering)	Per major work evolution	15-30 min
Project Control Centre (PCC)	Daily – during field execution	45 min
Recovery Plan	As required	1-3 hours

Challenge Meetings	Six estimated – during field execution	1-2 hours
Safety Orientation	Once	1-2 hours
Scorecard review	Monthly	1 hour

5.2 Contract Phase 1: Site Preparation, Completion of Modification Planning, Detailed Engineering, Specification and Ordering of Long Lead Materials

OPG has completed the Project Initiation deliverables from the Engineering Change Control Process (for reference see N-FORM-11443). The major items include the initial walkdown report, Master EC created (not approved), and Conceptual Design Report and Value Engineering Report. Note, this does not include item #13 from N-FORM-11443, long lead material list.

OPG has drafted the Scope Definition deliverables (except for the Design Plan), in order to help identify design rigor and scope for the purposes of the RFP. The major items include Modification Outline, Design Scoping Checklist, and associated forms, and population of Passport EC panels.

The Contractor shall provide engineering services for completion of Scope Definition, Modification Planning, and Detailed Design. All activities shall be conducted in accordance with N-PROC-MP-0090, Modification Process and N-DAI-00150-10000, Contractor/Owner Interface Requirements (IR) including the List of Deviations in D-DAI-38000-10001.Scope Definition

5.2.1 Scope Definition

5.2.1.1 The Contractor shall complete Scope Definition as per N-PROC-MP-0090 (Modification Process) and N-GUID-00700-10000 (Guide to Modification Procedure), N-DAI-00150-10000 (Contractor/Owner Interface Requirements), and D-DAI-38000-10001 (List of Deviations).

5.2.1.2 The Scope Definition deliverables (forms and checklists) that have been drafted by OPG need to be verified, revised, and expanded on as necessary. The Contractor will have final responsibility as preparer of these forms.

5.2.1.3 Scope Definition shall consider demolition and underground services removal and re-routing.

5.2.2 Modification Planning

5.2.2.1 The Contractor shall complete Modification Planning as per N-PROC-MP-0090 (Modification Process) and N-GUID-00700-10000 (Guide to Modification Procedure),

N-DAI-00150-10000 (Contractor/Owner Interface Requirements), and D-DAI-38000-10001 (List of Deviations).

5.2.2.2 For additional information on Contractor responsibilities during Modification Planning, see Appendix B (Human Factors Engineering) and Appendix C (Software Procurement Planning).

5.2.2.3 For the OPEX Review Report, the Contractor shall include as a minimum:

(a) A review of internal and external OPEX will be conducted via the SCR database and the OPEX intranet database to identify any impact on the modification. This is to include a review of OPEX from outside OPG, such as COG, INPO, and WANO.

(b) It is expected that the review will cover the system or equipment to be modified and/or similar systems or equipment to ensure the following:

(1) Past problems are corrected or not exacerbated

(1) Important lessons learned are applied in designing the modification

(2) Known problems are prevented from re-occurring

(c) It is expected that Operations and Maintenance staff will be consulted regarding the reason for the change and the best way to implement it.

(d) The successful proponent may use the existing OPEX from the legacy project in the report, for example, NK38-DRT-38000-10001.

5.2.2.4 The Contractor shall prepare the System Classification List to be submitted for Regulatory Approvals.

5.2.2.5 The Contractor is accountable for draft versions of the following design documentation as required, to prepare long lead technical specifications, and meet the intent of N-GUID-00700-10000 Section 1.3.7.7, which states in part, "Sufficient engineering should be performed to provide confidence that appropriate quantities or units of long lead items are ordered." This includes, but is not limited to:

(a) Design Description(s) for new systems

(b) Mark-ups of existing Design Manual(s)

(c) Flow Diagram(s)

(d) Control Logic Diagram(s)

(e) Single Line Diagram(s), and

(f) Major Equipment Layout(s)

(g) Calculations

5.2.2.6 The Contractor shall prepare/verify/approve Engineering Calculations as required to support Modification Planning.

5.2.2.7 Modification Design Requirement(s) shall be prepared as per the Contract/Owner Interface Requirement, using the preliminary requirements NK38-DR-38000-10001 as a basis. The Contractor shall be responsible to validate the assumptions listed in the DR / CDR during the design process.

5.2.2.8 Modification Planning shall consider demolition and underground services removal and re-routing.

5.2.3 Detailed Design

5.2.3.1 The Contractor shall complete Detailed Design as per N-PROC-MP-0090 (Modification Process) and N-GUID-00700-10000 (Guide to Modification Procedure), N-DAI-00150-10000 (Contractor/Owner Interface Requirements), and D-DAI-38000-10001 (List of Deviations).

5.2.3.2 The Contractor shall be responsible to validate the technical requirements while preparing the Detailed Design.

5.2.3.3 Field walk downs with OPG stakeholders throughout detailed design are required by N-PROC-MP-0090 (Modification Process). Field walk down reports shall be provided to the OPG Representative after each walk down.

5.2.3.4 The Contractor DTL and/or DE(s) shall be responsible to perform any field walk downs and obtain OPG stakeholder involvement that would be required to ensure that each Design ECs will be suitable for construction.

5.2.3.5 The Contractor is responsible to incorporate Human Factors into the design process as per N-PROC-MP-0090. See Appendix B (Human Factors Engineering).

5.2.3.6 The Contractor is responsible for Software Qualification, Software Procurement Planning, and Software Maintenance Planning (see Appendix C).

5.2.3.7 The Contractor is responsible to verify assumptions and the design basis listed in the Conceptual Design Report NK38-REP-38000-10002.

5.2.3.8 The Conceptual Design Report NK38-REP-38000-10002 provides recommendations based on conceptual design. The Contractor should not simply follow the recommendations unquestioningly in the design phase. The Contractor is expected to investigate each area of the recommendations for improvements and value for money, as the actual load requirements for various systems (electrical, air, water, etc) become better defined during detailed design.

5.2.3.9 The Conceptual Design Report NK38-REP-38000-10002 states that the current recommended electrical power supply for the West Annex should be fed from the municipality of Clarington through the DN Electrical Distribution Upgrade Project, #10-73821. Power will be supplied through 13.8 kV cables rather than 8.3 kV cables as stated on Section 6.3.2 of the Conceptual Design Report NK38-REP-38000-10002. The termination point for this connection will be at a new substation, which is currently proposed to be installed inside the protected area, south of the EPG Fuel Management Building (southwest of the D2O West Annex site). The successful proponent is responsible for the design of the HWMB West Annex electrical distribution system up to and including a connection with a circuit breaker assigned for the D2O Storage Facility in the new substation. **The new substation is expected to be ready 6 months prior to Available for Service (Oct 15, 2014).**

5.2.3.10 The design will need to include accommodations for construction power supply. The contractor will be accountable for any tie-ins or modifications (per N-PROC-MP-0090) required for the construction of the new facility.

5.2.3.11 There is potential for legacy code reconciliation and TSSA registration issues, however at this stage it is not possible to quantify the significance or number of issues. Therefore such legacy issues will be addressed with the successful proponent via the contract change manage process.

5.2.3.12 The Mimic Panel in the TRF/HWMB Control Room covers the TRF and Upgrader processes only. It will not be affected by the modification. Control Panel requirements for the process Instrumentation and Control (I&C) in the Control Room and in the field are covered in the Design Requirements sections 2.1.2.14 through 17, and Section 2.9.3. Alternatives evaluated, and recommended alternative to address these needs are covered in the Conceptual Design Report Section 6.2.7.

5.2.3.13 As per N-DAI-00150-10000 Item 3.32, the Contractor will address configuration management issues in their design. A list of known potential configuration management issues is included in Appendix H.

5.2.3.14 Prepare, verify, approve, and submit for OPG acceptance, a Construction Specification using the Construction Specification Institute (CSI) "MasterFormat®" system.

5.2.3.15 The Contractor shall comply with OPGN drafting procedure N-ST-01161-10000 (Drafting Presentation Standard and Practices) for drafting presentation, practices and symbols. The OPG Drawing Office shall review a representative sample of the new ADL documents created by the Contractor at 50% and 75% design complete to ensure that OPG drafting standards are being met.

5.2.3.16 The Contractor shall provide detailed design for a Category 6 Unified Cable Plant LAN system, integrated with the furniture systems and conference room equipment, including, but not limited to:

(a) telecommunications (voice and business LAN) specification

(b) location and number of voice and business LAN cables terminated at walls, ceilings, and in furniture systems

(c) consolidation points

(d) telecommunications system arrangement plans and riser diagrams

(e) DBOM for equipment associated with the vertical cable plant, such as racks, vertical cabling, panels, vertical managers, etc

(f) LAN server and telecommunications room(s), including appropriate HVAC and lighting requirements, if required

5.2.3.17 The Contractor shall provide detailed design and complete specification of materials necessary for the new office space, in accordance with OPG standards. See Appendix E for typical workstation layouts.

(a) Furniture system specification and layout

(b) Floor, wall, and ceiling finishes

(c) Washroom layout, equipment, fixtures, and millwork.

(d) Audiovisual equipment (speakers, projector, etc) for the conference room

(e) Bill of Materials (BOM), including but not limited to furniture, carpet and tile, paint and wall finishes, meeting room equipment (tables, A/V equipment, white boards, etc), cubicle partitions, shelving, desk lighting, window coverings, mailboxes, shelving/cabinets

5.2.3.18 In addition to the design requirements established in NK38-DR-38000-10001, the Contractor shall also be responsible for:

a) NK38-REP-38000-10002 Section 6.4.1 describes the recommended I&C scheme. The Contractor shall investigate the current System Six Computer Control System (SSCCS) configuration and identify the feasibility of using current HWMB/TRF control computers & panels to accommodate new control input and accordingly design the instrumentation and control systems. The Contractor shall design and specify I/O's up to tie-in with the Digital Control Units (DCUs) only. OPG, through the OEM, will be responsible for software design changes within the DCU itself.

b) To facilitate commissioning of the new storage tanks, the Contractor shall ensure a simplified connection is included in detailed design to allow for transfers between tanker trucks and storage tanks.

c) Connections between groups of tanks, such as Moderator and PHT storage tanks, and between reactor grade D2O tanks and downgraded D2O tanks require double isolation. All provisions for isolation must meet OPG work protection requirements.

The Contractor shall ensure that appropriate measures required to meet this are included in the detailed design.

d) Reliability requirements established in the Design Requirements are based on the existing D2O Supply System (SCI 38110), and are considered overly conservative for the functions included in this modification. It is the Contractor's responsibility to recommend an appropriate level of reliability in detailed design through collaboration with stakeholders and obtain OPG's acceptance.

e) The Contractor is responsible for the radiological safety analysis of the West Annex and updating of Appendix 11.8 of NK38-SR-03500, TRF/Heavy Water Management Building Failures.

f) Provide the ability to perform online transfers with Darlington Units 1-4 by including a means to send water to a given Unit moderator system from the D2O Storage Facility or the D2O Supply and Inventory System while simultaneously accepting moderator water from this Unit (via the outlet of 0-38410-IX3) to a different tank in the D2O Storage Facility or D2O Supply and Inventory System. The water being sent cannot mix with the water being received. This will allow online transfers to take place when the TRF and/or upgrader is unavailable. It is suggested that an additional tie in between 0-38410-V213 and 0-38410-V214 (NK38-F0H-38410-0001) would be required to accomplish this.

5.2.4 Site Preparation

5.2.4.1 The Contractor is responsible for scanning to identify underground services, and daylighting prior to excavation with machines.

5.2.4.2 "Daylighting" shall mean exposing of buried services by vacuum truck.

5.2.4.3 The Contractor shall prepare detailed engineering drawings for relocated services with terminal points.

5.2.4.4 The Contractor shall be responsible for design of temporary supplies or connections for the affected buried services, which would eliminate the impact on existing systems during construction or continued operations post-AFS.

5.2.4.5 Demolition of existing above ground infrastructure (truck dock, tanks, etc) and underground services removal and re-routing.

5.2.4.6 Excavation planning, and execution (including any design required). The contractor shall develop a soil/solid waste and de-watering (waste water) plan. This plan shall be submitted to OPG for acceptance at the completion of detailed design, prior to Site Preperation Activites starting.

5.2.5 Specification and Ordering of Long Lead Materials

5.2.5.1 The Contractor's responsibilities regarding specification and ordering of Long Lead Materials are outlined in N-DAI-00150-10000 (Contractor/Owner Interface Requirements), and D-DAI-38000-10001 (List of Deviations).

5.2.5.2 Prepare Long Lead Materials list, and sources for Long Lead Materials.

5.2.5.3 Order Long Lead Materials to support overall construction schedule, with advance notice to OPG, OPG's approval, and justification for long lead.

5.2.5.4 The Contractor shall be responsible for actions normally completed by OPG Procurement and Design Engineering in the Engineering Change Control process. The proponent will be accountable for the activities detailed in N-GUID-00700-10000 Appendix C, with exception of Appendix C, Activity #2 (new Cat ID screening, approval, and setting to "Ready" by the OPG Material Analyst).

5.2.5.5 The Contractor shall be responsible for warehousing of materials and equipment which is not delivered just-in-time and cannot be accommodated in the assigned laydown area(s). The OPG warehouse will not be available for storage of any materials with exception of spare parts.

5.3 Contract Phase 2: Procurement, Construction, Commissioning, and Closeout

5.3.1 Procurement of Balance of Material

5.3.1.1 The Contractor's responsibilities regarding procurement of the balance of materials are outlined in N-DAI-00150-10000 (Contractor/Owner Interface Requirements), and D-DAI-38000-10001 (List of Deviations).

5.3.1.2 Specify and procure all equipment and material for the construction of the facility.

5.3.1.3 Specify and procure all commissioning spares, disposable materials, and materials and equipment necessary for the commissioning of the facility.

5.3.1.4 Specify and procure all building finishes and appurtenances (office partition systems, furniture, washroom accessories, window treatments, floor & wall finishes, etc) with input from OPG Accommodations Planning. PC's, printers, and phones are excepted and will be provided by OPG.

5.3.1.5 Local Area Network (LAN) materials procurement shall be in accordance with a Network Infrastructure Specification, provided by New Horizons Systems Solutions (NHSS) on behalf of OPG. See Section 5.3.3 for division of procurement responsibilities between OPG and the Contractor.

5.3.1.6 The Contractor shall be responsible for actions normally completed by OPG Procurement and Design Engineering in the Engineering Change Control process. The proponent will be accountable for the activities detailed in N-GUID-00700-10000 Appendix C, with exception of Appendix C, Activity #2 (new Cat ID screening, approval, and setting to "Ready" by the OPG Material Analyst).

5.3.1.7 The Contractor shall be responsible for warehousing of materials and equipment which is not delivered just-in-time and cannot be accommodated in the assigned laydown area(s). The OPG warehouse will not be available for storage of any materials with exception of spare parts.

5.3.2 Construction

5.3.2.1 The Contractor shall be responsible for Construction of the HWMB West Annex including completion of all D2O system tie-ins and support systems tie-ins to station systems, following OPG Work Protection Procedures.

5.3.2.2 Some tie-in activities may be required to be undertaken during off hours (eg. limited night time hours or weekends). The Contractor will perform these off hours tie-ins at no additional costs to OPG.

5.3.2.3 The Contractor is to follow OPG work planning procedures N-PROC-MA-0022 for innage, and N-PROC-MA-0013 for outage.

5.3.2.4 Prepare a Construction Quality Assurance Plan, Project Site Specific Safety Plan (PSSSP), Site Specific Environment Management Plan (SSEMP), prior to commencing field work.

5.3.2.5 The field work portion of the contract will be managed by FIN-MAN-CM-001 "Contractor Management Process Manual". Control of cost changes will be administered according to this Manual. Section 9 lists the FIN-FORMs which the Contractor is either responsible to prepare, concur, or review as an input to their work planning.

5.3.2.6 OPG Field Engineering's role is defined in Section 6.2.3.

5.3.2.7 The Contractor shall be responsible for equipment labelling and tagging, as per N-PROC-OP-0034 "Equipment Labelling" and D-ED-01520-10001 "Darlington Equipment Identification".

5.3.2.8 Maintain housekeeping at all times to station standards (N-STD-MA-0008).

5.3.2.9 The Contractor shall be responsible for de-watering during construction. The Contractor shall verify that the water from de-watering operations is suitable for release to Lake Ontario. This will be done, by the Contractor, via representative sampling and through external laboratory, that Tritium is less than 0.108 uCi/kg, Gross Gamma is less than Minimum Detectable Activity (MDA), and no evidence of hydrocarbons (visible sheen) is evident. The contractor will ensure a Norm Scan is completed on the samples to identify the elemental source of any Gamma contamination, and provide copies of all labatoray results to OPG for review prior to disposal of waste water.

It will be assumed, for the purposes of submitting the Proposal, that the water is to be released to yard drainage, or to the forebay with OPG Environment section involvement and MOE approvals.

5.3.2.10 The Contractor shall be responsible for disposal of soil waste generated during construction. The Contractor shall verify through external laboratory, by taking 5 soil samples per pile, or once every 50 cubic metres, whichever is more rigorous:

a) Tritium is less than 0.108 uCi/kg

b) Gross Gamma is less than Minimum Detectable Activity (MDA)

c) No evidence of hydrocarbons (visible sheen) is evident

d) Toxicity Characteristic Leaching Procedure (TCLP) as per Method 1311 to determine concentrations of Contaminants which are then compared against leachate quality criteria in Schedule 4 of O.Reg. 347 (General – Waste Management) to determine the appropriate waste designation.

e) The Contaminants of interest on the Darlington site are as follows: metals, cyanide, fluoride, nitrate+nitrite, hydrocarbons F2 to F4, and hydrocarbons F1 where

gasoline spill is suspected, PCB (extractable + bulk) and VOC's. In addition, PAHs (Polycyclic Aromatic Hydrocarbons) shall be tested for bedrock waste.

f) The contractor will ensure a Norm Scan is completed on the samples to identify the elemental source of any Gamma contamination, and provide copies of all labatoray results to OPG for review prior to any disposal of solid waste off site.

It will be assumed, for the purposes of submitting the Proposal, that the soil may be disposed at a non-hazardous landfill site. The soil disposal planning shall be conducted with involvement of OPG Environment section.

5.3.2.11 With respect to welding, the Contractor shall comply with Nuclear's welding engineering standards such as N-STW-04800-10001 and N-STW-04800-10010, or their own procedures of equivalent standard acceptable to OPG Nuclear.

5.3.2.12 Other expectations/deliverables of the Construction phase include:

Work Planning			
1.	Prepare Work Order Assessments in Passport	2.	Project Site Specific Safety Plan
3.	Site Specific Environmental Management Plan	4.	Request and specify laydown area requirements. Erect laydown area barriers.
5.	Job Safety Analyses as per N-INS-08965-10014	6.	Coordinate schedule logic with Darlington Work Control and attend "T minus" reporting meetings
7.	Identify materials requiring Hazmat approval and provide MSDS sheets to OPG for approval	8	Prepare work packages including ITPs and other QA/QC related forms as per the Contractor's Quality Assurance program
Work Execution			
8.	Temporary lighting and grounding	9.	Submit PC1s
10.	Fire Watch	11.	Hoisting and Rigging
12.	Scaffolding	13.	Safe Work Areas
14.	Provide Holder of Record (HoR) and Maintenance Authority (MA) for all work	15.	Provide Safety Officer(s)

16.	Maintain clean work area and dispose of non-active waste	17.	Installation field technical support
18.	Removal of any temporary services installed	19.	Use of the 30/60/90 minute rule for prompt communication of issues
20.	Prepare/issue dig and drill/chipping cards as required	21.	Provide all tools and equipment necessary to complete the work scope, except as indicated in Section 6.0
22.	Construction and laydown area fencing	23.	Execution of soil/solid waste and de-watering activites in accordance with the contractor prepared, verified, and approved, and OPG accepted Soil/Solid and De-watering Plan.
24.	Provide welding consumables in accordance with the requirements of this Scope of Work.		
Administration			
23.	Field Initiated Changes (FIC) / Minor Field Initiated Changes (MINORFIC)	24.	Complete Work Reports in Passport at end of shift
25.	Compliance with Contract Administration in Oncore including timesheet entry, progress entry, recording of delays, etc, in accordance with N-INS-00150-10001 "Contract Administration in Oncore"	26.	Timely Station Condition Record (SCR) submissions for adverse conditions

5.3.3 LAN/Phone Procurement and Installation

The Contractor's Installer shall be manufacturer certified to install the Category 6 Cable Plant. The Contractor will purchase all equipment associated with the horizontal cable plant: floor or wall mounted racks, cables, trays, patch panels, etc. New Horizons Systems Solutions (NHSS), contracted directly to OPG, will purchase LAN switches, UPS, and end devices (phones, printers, and computers). NHSS will configure the new LAN switches and UPS before turning them over to the Contractor for installation. The Contractor will also install patch panels, LAN cables up to the concentration points, and the LAN and phone drops. The LAN/phone system shall be Unified Cable Plant type and shall be installed according to the manufacturer's specification.

The contractor will be responsible for testing and certification of the LAN/phone system and shall provide an overall testing plan to OPG. One hundred percent of the cables shall be tested. A Testing and Certification Report (hard and soft copies) will be provided to the CIO. NHSS will then perform a spot check on the cables. The contractor will be responsible for rectifying any cables which do not meet CIO Standards.

Upon installation, the LAN switches shall be left unjumpered. After NHSS performs a spot check of the contractor's work, Bell technicians will install the jumpers on the switches. Bell Canada will install and test the phones; NHSS Deskside Team will install/test the computers after they are placed in the final position by the Contractor.

OPG will contract New Horizons Systems Solutions (NHSS) for preparation of the rack layout (if required), and LAN materials specification. NHSS will specify the materials are associated with the horizontal cable plant, such as horizontal cables, trays, patch panels, switches, UPS's, etc., as well as end devices such as phones, printers, and computers.

5.3.4 Commissioning

5.3.4.1 General

Commissioning specifications shall be prepared, verified, approved by the Contractor and approved by OPG. OPG will conduct commissioning as per the Contractor's Commissioning Specification and Work Plans, in accordance with the OPG CNE Directive of May 20, 2011. The Contractor shall provide commissioning technical field support and direct commissioning. The Contractor is required to address any commissioning issues within the boundary of their design, and turn over the facility to OPG at the successful completion of commissioning and AFS.

The Contractor shall provide OPG with their pre-commissioning inspection program. OPG may determine to witness the Contractor's pre-commissioning inspection.

The Contractor shall perform testing, adjustment, and balancing of water and air systems.

The process systems shall be commissioned with light water to confirm no leaks, before introducing heavy water.

Commissioning may be completed on a per system basis, starting when all construction activities on a particular system are finalized, to the extent that commissioned system can be turned over to Operations without adverse impacts on the construction or operation of the other systems.

A Commissioning Report shall be prepared, verified, approved by the Contractor and will be accepted by OPG. Commissioning Specifications and Reports shall follow the requirements of N-INS-00960-10000.

5.3.4.2 Turnover to Commissioning

Commissioning pre-requisites shall include:

a) Review the Operations Turnover Plan and Issue Tracking File, to ensure deliverables required prior to commissioning have been completed.

b) All construction related Inspection and Test Procedures (ITPs) including Pressure Boundary testing are successfully executed, recorded and available.

c) Walkdowns and pre-tests including start-up verification is complete.

d) Designer of Record has approved all Field Initiated Changes (FICs) and integrated them on the marked-up as-built drawings required for the commissioning and the Constructor has assured himself that the systems are ready to be commissioned.

e) A documented declaration by the Designer of Record that the installation executed in the field matches the design drawings and that there are no configuration discrepancies that may prevent execution of the commissioning to prove that installation and performance can meet the Design Requirements.

f) Identification of all terminal points, open items and documentation that may impact on commissioning.

5.3.5 Available for Service

5.3.5.1 The Contractor shall coordinate partial and/or final AFS Meeting(s) and ensure that the following design related deliverables are presented at the meeting.

(a) AFS Declaration N-FORM-10091 and any other requirements of the Operations Turnover Plan

(b) Design Plan updated

(c) Regulatory pre-requisites fulfilled

(d) Commissioning report or equivalent accepted by OPG

(e) ADL updated / change papers available in PassPort

(f) Field Initiated Changes (FIC) documented and changes papers available in hard copy or PassPort

(g) On-line wiring updated and statused as “currently built”

(h) PassPort Master Equipment List minor revision ready for launch, including Environmental Qualification (EQ) flags, Q-List information (safety class and Q-level)

(i) Equipment Bill of Materials complete and on the Approved Models panel. Any needed UTC installed on the Install History panel

5.3.6 Close Out

5.3.6.1 The OPG Drawing Office shall be responsible to complete the drafting work for the existing OPG drawings change papers and operational flowsheets.

5.3.6.2 The Contractor shall be responsible to complete the drafting work for the new ADL documents created as a result of the modification, as well as for existing operational flowsheets.

5.3.6.3 The Contractor shall provide as-built drawings and specifications.

5.3.6.4 The Contractor shall provide product data, materials and finishes, and related information.

5.3.6.5 The new ADL documents shall be submitted to OPG in paper and electronic form as per N-PROC-AS-0003 (Controlled Document Management).

5.3.6.6 The Contractor shall initiate incorporation of the Project and Design EC(s) change papers into Controlled Documents in accordance with the Contractor/Owner Interface Requirement, and N-PROC-AS-0003 (Controlled Document Management).

5.3.6.7 The Contractor shall leave the site in acceptable condition to OPG including:

a) Removal of waste material and debris from site.

b) Sweep and wash any exterior walks, steps and surfaces.

c) Remove dust, dirt and other foreign disfigurations from exposed surfaces.

d) Vacuum clean and dust building interiors, behind grilles, louvers and screens.

e) Remove stains, spots, marks, dirt, excess paint and caulking from decorative work, electrical and mechanical fixtures, floors and walls.

f) Change out HVAC filters in the HWMB Annex.

5.3.6.8 The Contractor shall close the Master EC, Project EC(s), and Design EC(s) within 6 months of AFS declaration and shall inform Business Services/Records to set the related bookmarked EC Modification records to “archived”

6.0 OPG ACCOUNTABILITIES

N-DAI-00150-10000, Contractor/Owner Interface Requirements (IR), outlines the roles and responsibilities of the OPG project team members for the lifecycle of the project.

6.1 General

OPG accountabilities include:

1.	Attend meetings as outlined in this Scope of Work	2.	Process Contractor Station Condition Records (SCR) and perform FLM duties on contractor submitted SCRs
3.	Review schedule and forecasts	4.	Joint responsibility of OPG and the Contractor to ensure full compliance with administrative and procedural requirements with respect to Radiation Protection
5.	OPG to provide all Radiation Personal Protective Equipment	6.	Support the contractor to resolve issues or obstacles when identified by the contractor
7.	Measure compliance with the pre-defined quality assurance program and evaluate work quality	8.	Conduct challenge meetings
9.	Monitor how effectively the contractor manages Human Performance and Behaviour Expectations	10.	Monitor the contract
11.	Provide OPG-specific training (time for such training, identified at time of contract award, at Contractor's cost)	12.	Process Contract Change Requests in a timely manner
12.	Provide parking and lunch area for Contractor personnel	13.	Lay down areas for construction materials and equipment
14.	Process site security clearances	15.	Site access for receipt of materials
16.	Warehousing for delivered spare parts	17.	Support during medical emergencies and fire response
18	OPG will be the chief contact with the CNSC during all licensing activities including contacts with the		

	Ministry of Environment (MOE)		

6.2 OPG Resource Support

6.2.1 Design Projects

OPG Design Projects shall be responsible to provide contract administrating services for the engineering contract as per FIN-MAN-CM-002 (Technical Contractor Management Process Manual).

The OPG Project Manager is responsible for review of changes to scope and schedule, coordination of OPG resources, contractor oversight and corrective action as required, coordination of review of deliverables, approval of milestone completion and invoices. The OPG Project Manager is accountable to the OPG Sponsor for the overall adherence to project scope, schedule, cost, and quality.

The OPG Project Manager, or delegate, is responsible for the role of OPG Project Representative as outlined in N-DAI-00150-10000 and N-STD-MP-0009.

6.2.2 Refurbishment Design Engineering

OPG Refurbishment Design Engineering may be delegated the role of OPG Project Representative as outlined in N-DAI-00150-10000.

OPG Refurbishment Design Engineering shall be responsible to fulfill the role of Engineering SPOC(s) in N-STD-MP-0009-R003 and OPG DTL as per N-GUID-01920-10000-R002.

The OPG Design Authority ensures that design modifications are conducted in accordance with the specified Nuclear Quality Assurance program, as per N-INS-01100-10000, Engineering and Design Authority.

6.2.3 Field Engineering

The design, construction, and commissioning of the facility shall be executed under the Contractor's QA program as specified in the ES-MSA, except in the following specific cases, where OPG Field Engineering will provide the following quality assurance and/or surveillance in accordance with Field Engineering Procedures:

a. Prepare ITPs, and quality assurance and surveillance for Station Tie-Ins;

b. Prepare ITPs, and quality surveillance up to the terminal points for process piping, and building electrical, mechanical, and civil services or structures.

In addition to the Contractor's QA program, OPG Field Engineering will provide overall quality surveillance of the Contractor's activities as per a project-specific Quality Surveillance Plan, in accordance with N-PROC-AS-0074 "Contractor Quality Surveillance".

6.2.4 Drawing Office

OPG Drawing Office shall be responsible to revise existing OPG drawings and operational flowsheets, reserve new equipment codes and update OLW as requested by the Contractor as per N-PROC-MP-0076 (Preparation, Review, and Approval of Engineering Drawings, Design Flow Diagrams and Operational Flow Sheets). The Contractor shall be responsible for drafting services and close out activities for any new drawings and operational flowsheets, that are created as a result of the modification. The new drawings shall be prepared in accordance with N-PROC-MP-0076 (Preparation, Review, and Approval of Engineering Drawings, Design Flow Diagrams and Operational Flow Sheets) and submitted to Business Services as per N-PROC-AS-003 (Controlled Document Management). The OPG Drawing Office shall review a representative sample of the new drawings created by the Contractor at 50% and 75% design complete to ensure that OPG drafting standards are being met.

6.2.5 Computers & Control Design (CCD) and Engineering Mechanics (EM)

These groups' responsibilities with respect to software and software-containing components are outlined in N-PROC-MP-0049.

6.2.6 Supply Chain

OPG Supply Chain's roles are outlined in N-DAI-00150-10000 (Contractor/Owner Interface Requirements), and D-DAI-38000-10001 (List of Deviations).

In addition, OPG Supply Chain will be responsible to receive and store all spare parts procured by the Contractor.

6.2.7 Project Stakeholders

The scope of this modification is very large and it is critical that the Contractor involve the appropriate project stakeholders during the modification process.

OPG will coordinate stakeholder reviews of engineering products. The Contractor is accountable to seek comments from and should expect involvement by the following groups as a minimum:

- Operations & Maintenance
- Tritium Removal Facility
- Station Engineering
- Projects & Modifications

- Contract Management Office
- Conventional Safety
- Radiological Safety / Health Physics
- Field Engineering
- OPG Design Engineering
- Chief Information Officer (CIO)
- Environment & Chemistry
- Computers & Control Design
- Human Factors Engineering
- OPG contract owner and representatives

OPG Design Projects shall provide the Contractor with a list of project stakeholders once the engineering contract is awarded to the successful proponent.

6.3 Access to OPG Programs and Databases

OPG shall provide Contractor qualified staff access to OPG programs and databases to support the project.

6.4 Contractor Score Cards

The OPG Project Manager may prepare on a monthly basis a Contractor Score Card. The Contractor is expected to participate in the process and review the results with the OPG Project Manager. The Contractor Score Card process is outlined in the Extended Services Master Service Agreement (ES-MSA).

7.0 DOCUMENTATION

Typical Design Documentation requirements, in addition to this section, are listed in Appendix A.

7.1 Flow Diagrams, Drawings, and Nuclear Subject Classification Index

a) The flow diagrams shall contain the information listed in N285.0-08/N285.6 SERIES-08.

b) Pressure boundaries shall be clearly defined on the flow diagrams

c) Refer to the OPG Design and Construction Requirements Manuals N-STM-01110-10001 (Nuclear Construction Requirements Manual) and N-STM-01110-10002 (Design and Construction Requirements Manual) for the pipe material codes

d) The Canadian Registration Number shall be shown on the flow diagrams (when available)

e) Tolerance on test pressure and temperature shall be indicated on the flow diagrams

f) All Design and Configuration Management documentation shall be prepared as outlined in N-DAI-00150-10000, using OPG's forms and templates.

g) Documentation (drawings, flow diagrams, manuals, reports, etc) resulting from the modifications to existing station systems shall maintain the same System Classification Index (SCI) and identification methodology used in the existing HWMB. The same system characteristics (design basis, registration, etc) shall also be applied to these modifications.

h) 3D modelling shall be utilized as a best practice for both the new facility and system tie-ins, for error reduction, facilitation of design reviews by OPG stakeholders, and improvement of Constructability, Operability, Maintainability, and Safety of the design.

7.2 Manufacturer's Manuals and Drawings

The Contractor shall assemble the manufacturer Installation, Operating, and Maintenance manuals into a set of binders for final submission to OPG as per N-PROC-MP-0078, Specification Review Acceptance and Use of Vendor Technical Documents. The binders shall be divided into five categories: the Contractor's, Civil/Architectural, Mechanical and Process, Instrumentation and Control, and Electrical.

The manuals shall be tabbed and indexed with tables of contents. Each manual shall be marked with a Title, Manufacturer and OPG document numbers with revision,

Equipment Codes to which it applies, and all pages including appendices numbered chronologically. One (1) electronic, and five (5) paper copy sets shall be provided.

Note that the necessity of Partial AFS's may mean that some manufacturer manuals may need to be submitted to OPG in advance of the final consolidated submission.

The Contractor, as the designer of the complete detailed design, shall include in their 'Contractor' manuals all relevant documentation such as:

(a) Design description
(b) Control description / sequence of operations
(c) Installation procedures
(d) Operating and Maintenance procedures
(e) Bills of Material
(f) Recommended Spare Parts
(g) Equipment specification sheets
(h) Design calculations
(i) Shop and site test reports
(j) Design calculations
(k) Recommended maintenance schedules
(l) Any other information required for operation and maintenance of the Facility

The Contractor shall edit the individual manufacturer's drawings and manuals to ensure that the reader will use only applicable and correct information. For common or general manuals, this can be achieved by crossing out non-applicable information, mark arrows to the row or column where the information applies and provide additional parts identification sheet(s). The use of 'highlighters' to identify applicable information in the document is not acceptable.

For pressure vessels and tanks, fabrication drawings (including tank lining, if any) shall be submitted in addition to specification drawings. Canadian Registration Number shall be added on the pressure vessel drawings after they are registered. For tanks or vessels with internal parts, the internal arrangement of these internal parts and piping shall also be submitted as part of the tank drawings.

For pumps and compressors, general arrangement drawing for pump-motor and base plate, pump cross section, mechanical seal and pump performance curve shall be submitted. Pump curve shall be a certified curve based on the actual impeller diameter. Marking an indicator between curves of various impeller diameters is not acceptable. NPSH, efficiency and power requirement shall also be included in the pump curve drawing.

7.3 Other Documentation

The Contractor will:

a) Collect reviewed submittals and assemble documents executed by Subcontractors, suppliers, and manufacturers.

b) Submit material in a neatly indexed package, prior to final payment.

c) Be responsible for obtaining and enforcing all required vendor warranties within the terms of the Agreement.

7.4 Equipment and Spare Parts Lists

The Contractor shall provide a recommended spare parts list for all supplied equipment or systems. The list shall include a detailed description of each recommended spare part, the equipment or system associated with the spare, the supplier, supplier contact information, and recommended initial quantity. Based on the recommended list, operational experience, and OPG's spare parts program, OPG will develop its list of spare parts and will procure the parts or provide a change order to the Contractor to provide the parts. Spare parts are to be on site prior to final or partial Available for Service, as applicable.

The Contractor shall identify any special tools required for ongoing maintenance of the Facility, including identification of equipment or system for which the tools are applicable, and instruction on intended use of tool.

7.5 Samples

a) Submit samples for review in duplicate to the OPG Representative.

b) Notify OPG's Representative in writing, at the time of submission of deviations in samples from requirements of Specifications.

c) OPG's Representative may provide comments on samples for certain Goods to the Contractor. Such comments are not intended to change the Contract Price nor the Contract Schedule. The Contractor shall not delay processing of samples for OPG's Representative's review.

d) Make change in samples that OPG's Representative may require, consistent with the Specifications.

e) Samples will be retained by OPG's Representative.

7.6 Other Submittals

a) All other Submittals shall be submitted as one (1) electronic copy and five (5) paper copies. OPG's Representative may amend this requirement upon considering a written request from the Contractor.

8.0 APPLICABLE LAWS, STANDARDS AND CODES

Refer to NK38-DR-38000-10001 "Preliminary Design Requirements for the Darlington Heavy Water Management Building West Annex".

9.0 OPG GOVERANCE, POLICIES, STANDARDS AND PROCEDURES

The Contractor shall be responsible to complete the design, installation, and commissioning while adhering to to the following OPG governance, policies, standards and procedures, in addition to procedures listed in N-DAI-00150-10000.

9.1 OPG Procedures

Controlled Document Number	Controlled Document Title
N-GUID-00700-10000	GUIDE TO MODIFICATIONS PROCEDURE
N-GUID-01900-10000	HUMAN PERFORMANCE EVENT-FREE TOOLS FOR KNOWLEDGE WORKERS
N-GUID-01920-10000	GUIDELINE FOR MANAGING THE DESIGN AGENCY INTERFACE AS PER N-STD-MP-0009
N-GUID-08135-10000	GUIDE FOR VALIDATION OF ASSUMPTIONS
N-LIST-08400.00-10002	WORK PROTECTION MANUAL INDEX
N-PROC-AS-0003	CONTROLLED DOCUMENT MANAGEMENT
N-PROC-AS-0028	DEVELOPMENT REVIEW AND APPROVAL OF TECHNICAL PROCEDURES
N-PROC-AS-0069	FIELD ENGINEERING INSTALLATION QUALITY PROCESS *(Station tie-ins only)*
N-PROC-MA-0008	WORK INITIATION, APPROVAL, AND PRIORITIZATION
N-PROC-MA-0031	CONTROL OF UNSECURED EQUIPMENT IN A SEISMICALLY QUALIFIED AREA AND CONTROL OF SEISMIC ROUTE INTEGRITY
N-PROC-MA-0068	ENGINEERING REQUIREMENTS SUPPORTING THE CALIBRATION PROCESS
N-PROC-MA-0070	CALIBRATION OF FIELD EQUIPMENT
N-PROC-MM-0008	CREATE AND MAINTAIN CATALOG INFORMATION
N-PROC-MP-0040	SYSTEM AND ITEM CLASSIFICATION

Controlled Document Number	Controlled Document Title
N-PROC-MP-0047	DESIGN VERIFICATION
N-PROC-MP-0058	EQUIPMENT BILL OF MATERIAL
N-PROC-MP-0059	PREPARATION REVIEW AND APPROVAL OF ENGINEERING SPECIFICATIONS
N-PROC-MP-0065	PREPARATION AND REVISION OF SYSTEM DESIGN MANUALS
N-PROC-MP-0074	DESIGN PLAN
N-PROC-MP-0076	PREPARATION REVIEW AND APPROVAL OF ENGINEERING DRAWINGS DESIGN FLOW DIAGRAMS AND OPERATIONAL FLOW SHEETS
N-PROC-MP-0077	EQUIPMENT DATA MAINTENANCE
N-PROC-MP-0078	SPECIFICATION REVIEW ACCEPTANCE AND USE OF VENDOR TECHNICAL DOCUMENTS
N-PROC-MP-0082	DESIGN REGISTRATION
N-PROC-MP-0083	CONSTRUCTABILITY, OPERABILITY, MAINTAINABILITY AND SAFETY (COMS)
N-PROC-MP-0084	PREPARATION REVIEW AND APPROVAL OF ENGINEERING STANDARDS
N-PROC-MP-0087	PRESSURE BOUNDARY REPAIR AND REPLACEMENT
N-PROC-MP-0088	PRESSURE BOUNDARY MODIFICATIONS
N-PROC-MP-0089	DESIGN SPECIFICATIONS DESIGN REPORTS AND OVERPRESSURE PROTECTION REPORTS
N-PROC-MP-0090	MODIFICATION PROCESS
N-PROC-MP-0103	SECURITY FOR REAL-TIME SOFTWARE SYSTEMS

Controlled Document Number	Controlled Document Title
N-PROC-OP-0002	IDENTIFICATION AND MANAGEMENT OF ENVIRONMENTAL ASPECTS
N-PROC-OP-0013	CONTROL OF SYSTEM CHEMISTRY
N-PROC-OP-0034	EQUIPMENT LABELLING
N-PROC-RA-0013	RADIATION PROTECTION
N-PROC-RA-0022	PROCESSING STATION CONDITION RECORDS
N-PROC-RA-0027	RADIOACTIVE WORK PLANNING EXECUTION AND CLOSE OUT
N-PROC-RA-0047	COMMUNICATIONS WITH THE CANADIAN NUCLEAR SAFETY COMMISSION
N-PROG-MA-0015	WORK PROTECTION
N-PROG-MP-0006	SOFTWARE

9.2 OPG Instructions

Controlled Document Number	Controlled Document Title
N-INS-00150-10001	CONTRACT ADMINISTRATION IN ONCORE
N-INS-00700-10002	UPDATING LEGACY DESIGN MANUALS AND PRODUCTION OF MODIFICATION DESIGN REQUIREMENTS
N-INS-00960-10000	DETAILED COMMISSIONING SPECIFICATIONS AND COMMISSIONING REPORTS
N-INS-01130-10000	GUIDE TO CLASS EXEMPT ASSESSMENT
N-INS-01370-10000	QUALITY ASSURANCE OF CLASSIFICATION AND REGISTRATION SUBMISSION PACKAGES
N-INS-01913.11-10005	PRESSURE BOUNDARY PRESSURE TESTING
N-INS-01913.11-10006	PRESSURE BOUNDARY INSPECTION AND TEST PLAN PREPARATION
N-INS-01983.1-10001	FIELD ENGINEERING INSPECTION AND TEST PLANS *(Station tie-ins only)*
N-INS-01983.1-10002	FIELD ENGINEERING FABRICATION/INSTALLATION PACKAGE RELEASE *(Station tie-ins only)*
N-INS-01983.1-10004	FIELD ENGINEERING NONCONFORMANCE AND CORRECTIVE ACTION *(Station tie-ins only)*
N-INS-01983.1-10000	FIELD ENGINEERING OVERALL QUALITY PLAN *(Station tie-ins only)*
N-INS-01983.1-10011	FIELD ENGINEERING CONTROL OF WELDING PROCEDURE SELECTION AND USE *(Station tie-ins only)*
N-INS-07080-10000	HAZARDOUS MATERIAL CONTROL
N-INS-07080-10002	LABELLING STORAGE USE AND DISPOSAL OF HAZARDOUS MATERIAL IN THE FIELD
N-INS-08121.3-10000	IMPLEMENTATION OF PRE-START HEALTH AND SAFETY REVIEW (PSR)

Controlled Document Number	Controlled Document Title
N-INS-08135-10116	DETERMINING RISK CRITICAL AND SAFETY SIGNIFICANT EQUIPMENT AND COMPONENTS FOR THE Q-LIST
N-INS-08965-10014	JOB SAFETY ANALYSIS PROCESS
N-INS-60110-10000	ON-LINE WIRING UPDATING AND DESIGN

9.3 OPG Standards

Controlled Document Number	Controlled Document Title
D-ED-01520-10001	DARLINGTON EQUIPMENT IDENTIFICATION
N-LIST-01300-10000	BOUNDED DOCUMENT SET
N-LIST-01300-10006	LIST OF ACTIVE ENGINEERING STANDARDS AND GENERIC ENGINEERING SPECIFICATIONS
N-LIST-01300-10007	ONTARIO HYDRO DESIGN STANDARDS AND SPECIFICATION
N-ST-01161-10000	DRAFTING PRESENTATION STANDARDS AND PRACTICES
N-ST-08131.02-10000	PREPARATION OF OPERATIONAL SAFETY REQUIREMENTS
N-STD-MP-0009	CONTRACTOR\OWNER DELIVERABLES AND ACTIVITIES INTERFACE CONTROL
N-STD-01161-10000	DRAFTING PRESENTATION STANDARD AND PRACTICES
N-STI-69000-10000	SOFTWARE CATEGORIZATION
N-STM-01110-10001	NUCLEAR CONSTRUCTION REQUIREMENTS
N-STM-01110-10002	DESIGN AND CONSTRUCTION REQUIREMENTS
N-STM-01110-10003	PIPING STANDARDS MANUAL
N-STM-01110-10005	TUBING DESIGN GUIDE
N-STM-04940-10006	STEEL VALVES NOMINAL PIPE SIZE 3 AND LARGER FOR CRITICAL SERVICE
N-STW-04800-10000	WELDING PROCEDURES INDEX

Controlled Document Number	Controlled Document Title
N-STW-04800-10001	CONTROL AND HANDLING OF WELDING CONSUMABLES
N-STW-04800-10010	AUTOMATIC INSTRUMENT TUBE WELDING
N-TSI-60431-10000	PRESSURE TRANSMITTERS FOR NUCLEAR SERVICE
N-STD-MP-0008	DEVELOPMENT QUALIFICATIONS AND USE OF SCIENTIFIC ENGINEERING AND SAFETY ANALYSIS SOFTWARE
N-STD-OP-0031	MONITORING OF RADIOACTIVITY IN EFFLUENTS

9.4 OPG Miscellaneous Documents

Controlled Document Number	Controlled Document Title
D-ED-01520-10001	DARLINGTON EQUIPMENT IDENTIFICATION
D-STE-60110-10001	COMPUTER WIRING APPLICATIONS AND WIRING PRACTICES
FIN-MAN-CM-001	CONTRACTOR MANAGEMENT PROCESS MANUAL
FIN-MAN-CM-002	TECHNICAL CONTRACTOR MANAGEMENT PROCESS MANUAL
N-CORR-01930-0387907	CSA N286-05 APPLICABLE ELEMENTS FOR DESIGN PROCUREMENT AND CONSTRUCTION SERVICE SUPPLIERS FOR NUCLEAR REFURBISHMENT
N-LIST-01300-10000	BOUNDED DOCUMENT SET
N-MAN-06700-10002	HUMAN FACTORS ENGINEERING GUIDE FOR VENDORS
N-MAN-08135-10000	OPG NUCLEAR DATA DICTIONARY FOR PASSPORT MASTER EQUIPMENT LIST CONFIGURATION DATA
N-RPP-03415.1-10000	RADIATION PROTECTION POLICIES AND PRINCIPLES
N-RPP-03415.1-10001	RADIATION PROTECTION REQUIREMENTS
N-TQD-510-00001	SUPPLEMENTAL BTU DIRECT HIRE AND CONTRACT MANAGEMENT TRAINING AND QUALIFICATION DESCRIPTION
NK38-MAN-60310-10001	ANNUNCIATION DESIGN GUIDE
NK38-OPP-03600	OPERATING POLICIES AND PRINCIPLES

Controlled Document Number	Controlled Document Title
NK38-SR-35000-10002	DN 1-4 SAFETY REPORT: PART 3 – ACCIDENT ANALYSIS

9.5 OPG Forms

Controlled Document Number	Controlled Document Title
FIN-FORM-CM-003	CONTRACT WORK RELEASE
FIN-FORM-CM-006	JOB SAFETY ANALYSIS PLAN
FIN-FORM-CM-008	CONTRACT SAFETY HAZARDS EVALUATION
FIN-FORM-CM-009	CONTRACT ENVIRONMENTAL ASPECTS EVALUATION
FIN-FORM-CM-011	CONTRACT WORK RELEASE WORKSHEET E
FIN-FORM-CM-012	CONTRACT INSPECTION CHECKLIST
FIN-FORM-CM-013	CONTRACT MANAGEMENT PLAN
FIN-FORM-CM-015	SAFETY CERTIFICATION/CONTROL FOR RENTED OR CONTRACTOR'S EQUIPMENT
FIN-FORM-CM-016	CONTRACT CHANGE AUTHORIZATION
FIN-FORM-CM-017	CONTRACT MONTHLY SAFETY INCIDENTS
FIN-FORM-CM-018	NOTICE OF CONSTRUCTION CONTRACT COMPLETION
FIN-FORM-CM-019	ROLES AND RESPONSIBILITIES MATRIX FOR CONTRACTOR MANAGEMENT
N-FORM-10005	TEMPORARY MODIFICATION REMOVAL EXTENSION FORM

Controlled Document Number	Controlled Document Title
N-FORM-10007	COMS SCREEN FORM
N-FORM-10014	TECHNICAL PROCEDURE ACTION REQUEST
N-FORM-10024	PRE-JOB BRIEFING AND POST-JOB DEBRIEFING
N-FORM-10091	AVAILABLE FOR SERVICE DECLARATION OR OPERATIONS ACCEPTANCE DECLARATION
N-FORM-10287	FIRE PROTECTION IMPACT EVALUATION
N-FORM-10369	CANADIAN NUCLEAR SAFETY COMMISSION APPROVALS AND NOTIFICATIONS SCREENING
N-FORM-10408	SOFTWARE PROCUREMENT PLANNING
N-FORM-10409	SOFTWARE QUALITY ASSURANCE REQUIREMENTS
N-FORM-10521	DOCUMENT SCOPING CHECKLIST (WORKING FILES DOCUMENT)
N-FORM-10528	PRESSURE BOUNDARY DESIGNER'S CHECKLIST
N-FORM-10560	CHEMISTRY DESIGN CHANGE CHECKLIST
N-FORM-10580	IDENTIFYING HUMAN FACTORS LEVEL OF ACTIVITY
N-FORM-10853	PSR DETERMINATION CHECKSHEET FOR OPG, NUCLEAR
N-FORM-10958	MODIFICATION OUTLINE
N-FORM-10959	DESIGN SCOPING CHECKLIST (WORKING FILES DOCUMENT)
N-FORM-11239	NICR JUSTIFICATION

Controlled Document Number	Controlled Document Title
N-FORM-11443	DESIGNER'S ECC JOB AID

9.6 OPG Templates

Controlled Document Number	Controlled Document Title
N-TMP-10020	ENGINEERING CALCULATION\REPORT
N-TMP-10019	ENGINEERING SPECIFICATION
N-TMP-10090	DESIGN PLAN
N-TMP-10143	PREPARATION AND REVISION OF SYSTEM DESIGN MANUAL
N-TMP-10179	GENERIC COVER SHEET
N-TMP-10183	QUALITY ASSURANCE PLAN
N-TMP-10189	DARLINGTON DESIGN MANUAL
N-TMP-10190	DESIGN SPECIFICATION
N-TMP-10275	SOFTWARE MAINTENANCE PLAN
N-TMP-10278	SOFTWARE DESIGN DESCRIPTION
N-TMP-10010	CONTROLLED DOCUMENT OR RECORD

10.0 REFERENCE DOCUMENTS

The Contractor shall make use of the following OPG Design Manuals and Drawings while designing the new HWMB West Annex.

The primary list of OPG Design Manuals and Drawings is provided in NK38-DR-38000-10001. The below list is a secondary list which augments NK38-DR-38000-10001. The Contractor shall ensure that the appropriate OPG documents are modified as per N-PROC-MP-0090 (Modification Process).

10.1 OPG Design Manuals/Requirements

Controlled Document Number	Controlled Document Title
NK38-DM-38210	D2O LIQUID RECOVERY
NK38-DM-50320	CLASS II POWER
NK38-DM-50330	CLASS III POWER
NK38-DM-50340	CLASS IV POWER
NK38-DM-60280	PUBLIC ADDRESS/MTCE COMM
NK38-DM-62330/62341	I&C FAAGM/I&C FAATM
NK38-DM-63861	D2O LEAK DETECTION BEETLES
NK38-DM-73210-10001	POWERHOUSE HEATING AND CONDENSATE
NK38-DM-73680/36150	TRF/D2O MANAGEMENT BUILDING PROCESS STEAM, HEATING STEAM
NK38-DM-78100	FIRE PROTECTION WATER SUPPLY AND DISTRIBUTION SYSTEM
NK38-DR-38000-10001	PRELIMINARY DESIGN REQUIREMENTS FOR THE DARLINGTON HEAVY WATER MANAGEMENT BUILDING WEST ANNEX

10.2 OPG Drawings

10.2.1 Flow Sheets

Controlled Document Number	Controlled Document Title
NK38-FEX-38000-0501	HEAVY WATER MANAGEMENT SYSTEM OVERVIEW SCHEMATIC
NK38-FXX-38110-0501	D2O MANAGEMENT BUILDING D2O SUPPLY SYSTEM
NK38-FEX-38110-0502	D2O MANAGEMENT BUILDING TRF OUTGOING AND INCOMING D20 FACILITY
NK38-FEX-38110-0503	D2O MANAGEMENT BUILDING DRUM AND BULK LOADING/UNLOADING ARRANGEMENT FOR D2O
NK38-FXX-38410-0501	D2O MANAGEMENT BUILDING D2O CLEANUP SYSTEM
NK38-FEX-38410-0502	D2O MANAGEMENT BUILDING D2O CLEANUP SYSTEM
NK38-FEX-38410-0503	D2O MANAGEMENT BUILDING D2O CLEANUP SYSTEM ULTRAVIOLET DISINFECTION UNIT UV1
NK38-FXX-38500-0501	DOWNGRADED D2O TRANSFER SYSTEM C.S.A & F.F.A.A. BUILDING
NK38-FEX-38500-0502	DOWNGRADED D2O TRANSFER SYSTEM D2O MANAGEMENT BUILDING

10.2.2 Flow Diagrams

Controlled Document Number	Controlled Document Title
NK38-F0H-38110-0002	REACTOR AUX BAY D2O SUPPLY SYSTEM FLOW DIAGRAM

Controlled Document Number	Controlled Document Title
NK38-F0H-38210-0002	D2O MANAGEMENT BUILDING D2O LIQUID RECOVERY SYSTEM FLOW DIAGRAM
NK38-F0H-38500-0001	REACTOR AUX BAY DOWNGRADED D2O TRANS. SYS. FLOW DIAGRAM
NK38-F0H-38410-0001	D2O MANAGEMENT BLDG. D2O CLEANUP SYSTEM FLOW DIAGRAM

10.2.3 Mechanical Drawings

Controlled Document Number	Controlled Document Title
NK38-D1H-10249-1343	YARD SERVICES AREA NO. 1343
NK38-D1H-10249-2414	YARD SERVICES AREA NO. 2414
NK38-D1H-10249-2424	YARD SERVICES AREA NO. 2424
NK38-G5H-23802-0002	D2O MANAGEMENT BUILDING FL. EL. 94.000 PLAN P2 EQUIPMENT LOCATION
NK38-D0H-38009-0008	D2O MGMT. BLDG. FL. El. 87,000 COL. ROW DA1-DC LINE D3-D4 D2O SUPPLY CLEAN UP AND TRANSFER SYSTEM PIPING
NK38-D0H-38009-0017	D2O MANAGEMENT BLDG. D2O SUPPLY CLEAN UP & TRANSFER PIPING SECTIONS & DETAILS.
NK38-D0H-38009-0018	D2O MGMT. BLDG. FL. EL. 100,000 COL. ROW DA1-DC LINE D1-D2 D2O SUPPLY CLEAN UP AND TRANSFER SYSTEM PIPING
NK38-D0H-38009-0019	D2O MGMT. BLDG. FL. EL. 100,000 COL. ROW DC-DD LINE D3-D4 D2O SUPPLY CLEAN UP AND TRANSFER SYSTEM PIPING

Controlled Document Number	Controlled Document Title
NK38-D0H-38009-0020	D2O MGMT. BLDG. FL. EL. 100,000 COL. ELEVATION SECTIONS & DETAILS D2O SUPPLY CLEAN UP AND TRANSFER SYSTEM PIPING
NK38-D0H-38009-0021	D2O MGMT. BLDG. FL. EL. 107,800 COL. ROW DA1-D2 LINE D3-D4 D2O SUPPLY CLEAN UP AND TRANSFER SYSTEM PIPING
NK38-D1H-72709-0038	D2O MANAGEMENT BUILDING SUPPLT TO T.R.F. BLDG. DOMESTIC WATER PIPING
NK38-D1H-74259-0020	D2O MGMT. BLDG. FL. EL. 94,000 H.P. DEMINERALIZED WATER
NK38-D1H-78119-0048	D2O MANAGEMENT BUILDING SUPPLY TO HYDRANT HY DB-D1 FIRE PROTECTION PIPING
NK38-D1H-78119-0050	D2O MANAGEMENT BUILDING SUPPLY TO FHC'S 106 & 107 FIRE PROTECTION PIPING
NK38-D1H-78119-0068	D2O MANAGEMENT BUILDING SUPPLY TO FHC'S 114, 131 & 133 FIRE PROTECTION PIPING

10.2.4 Electrical Drawings

Controlled Document Number	Controlled Document Title
NK38-D0S-56184-0004	D2O MANAGEMENT BUILDING COL ROW DA1-DF COL LINE D1-D7 FL. EL. 107.800 LOCATION LIGHTING ARRANGEMENT
NK38-D0S-56184-0052	D2O MANAGEMENT BUILDING COL ROW DA1-DF COL LINE D1-D7 FL. EL. 94.000 WIRING LIGHTING ARRANGEMENT

Controlled Document Number	Controlled Document Title
NK38-D0S-56184-0053	D2O MANAGEMENT BUILDING COL ROW DA1-DF COL LINE D1-D7 FL. EL. 100.000 WIRING LIGHTING ARRANGEMENT
NK38-D0S-57484-0004	D2O BUILDING FL. EL. 107.800 COL. DA-DF/D1-D7 CABLE TRAY LAYOUT
NK38-D0S-57684-0003	D2O MANAGEMENT BUILDING COL. ROW DA-DF COL. LINE D1-D7 FL. EL. 94.000 GROUNDING ARRANGEMENT

10.2.5 I&C Drawings

Controlled Document Number	Controlled Document Title
NK38-D1H-60712-0805	D2O MANAGEMENT BUILDING INTERMEDIATE CONTROL PANEL PL 1815A (EVEN) MODULE 1000 EQUIPMENT LAYOUT
NK38-D1H-60712-0806	D2O MANAGEMENT BUILDING INTERMEDIATE CONTROL PANEL PL 1815A (EVEN) MODULE 2000 EQUIP LAYOUT
NK38-D1H-60712-0807	D2O MANAGEMENT BUILDING INTERMEDIATE CONTROL PANEL PL 1815A-21(EVEN) MODULE 3000 EQUIP LAYOUT
NK38-D1H-60712-0811	D2O MANAGEMENT BUILDING INTERMEDIATE CONTROL PANEL PL 1815B (EVEN) MODULE 2000 DETAIL
NK38-D1H-60712-0814	D2O MANAGEMENT BUILDING INTERMEDIATE CONTROL PANEL PL 1815B (EVEN) MODULE 1000 EQUIPMENT LAYOUT

Controlled Document Number	Controlled Document Title
NK38-D1H-60712-0815	D2O MANAGEMENT BUILDING INTERMEDIATE CONTROL PANEL PL 18158(EVEN) MODULE 2000 EQUIP LAYOUT
NK38-D0S-63800-0001	D2O MANAGEMENT BUILDING ADDITIONAL ELECT. EQUIPMENT MOUNTED ON INST. PNL. PL1815-21 ELECTRICAL ARRANGEMENT
NK38-D0S-63841-0001	D2O MANAGEMENT BUILDING D2O CLEANUP SYSTEM CABLE BLOCK DIAGRAM
NK38-D0S-63841-5007	D2O CLEANUP SYSTEM PRODUCT TANK OUTLET VALVES 3841-PV1, PV2, PV91 & PV92 ELEMENTARY WIRING DIAGRAM
NK38-D0S-63841-5008	D2O CLEANUP SYSTEM PRODUCT TANK INLET VALVES 3841-PV89, PV90 ELEMENTARY WIRING DIAGRAM
NK38-D1H-63841-0002	D2O MANAGEMENT BLDG D2O CLEANUP SYSTEM PANEL 0-63841 PL 1844-21 INST. TUBING INSTL. DETAILS
NK38-D1H-63841-0003	D2O MANAGEMENT BLDG D2O CLEANUP SYSTEM PANEL 0-63841 PL 1845-21 INST. TUBING INSTL. DETAILS
NK38-D1S-63841-5005	D2O CLEANUP SYSTEM PRODUCT TANKS 0-3841 TK1, TK2, & CONDUCTIVITY CELLS CS19, CS21 ANNUNCIATION EWD
NK38-D2S-63841-5001	D2O CLEANUP SYSTEM D2O CLEANUP PRODUCT TANK 0-3841TK1 LEVEL MEASUREMENT ELEMENTARY WIRING DIAGRAM
NK38-D2S-63841-5002	D2O CLEANUP SYSTEM D2O CLEANUP PRODUCT TANK 0-3841TK2 LEVEL MEASUREMENT ELEMENTARY WIRING DIAGRAM

Controlled Document Number	Controlled Document Title
NK38-D1S-63850-0005	D2O MANAGEMENT BLDG. DOWNGRADED D2O TRANSFER SYS. 0-3850-TK5, TK6 & TK7 CABLE BLOCK DIAGRAM
NK38-D1S-63850-5005	DOWNGRADED D2O TRANSFER SYS. 0-3850-TK5, TK6 & TK7 TANK LEVEL ELEMENTARY WIRING DIAGRAM
NK38-D2S-63850-5010	DOWNGRADED D2O TRANSFER SYS. 0-3850-TK5 TRANSFER TANK LEVEL ELEMENTARY WIRING DIAGRAM
NK38-D2S-63850-5011	DOWNGRADED D2O TRANSFER SYS. 0-3850-TK6 TRANSFER TANK LEVEL ELEMENTARY WIRING DIAGRAM

10.2.6 Civil Drawings

Controlled Document Number	Controlled Document Title
NK38-D1H-20000-9002	STANDARD LADDERS
NK38-D1H-20000-9008	STANDARD STAIR DETAILS
NK38-D1H-20000-9007	STANDARD STAIR DETAILS
NK38-D1H-20000-9009	STANDARD LADDER DETAILS
NK38-D5A-23860-0008	D2O MANAGEMENT BLDG., NORTH ELEVATION
NK38-D5A-23860-0009	D2O MANAGEMENT BLDG., SOUTH ELEVATION & MISCELLANEOUS DETAILS
NK38-D5A-23860-0011	D2O MANAGEMENT BLDG., WEST ELEVATION

Appendix A: Typical Documentation Requirements

A.1.0 GENERAL

The Contractor shall commit to all deliverables required to complete the project as detailed in the Interface Requirements (IR) document.

A.2.0 DESIGN PLANS: TYPICAL DESIGN PRODUCTS

A.2.1 Mechanical Design Products

Typical design deliverables to be considered by the Contractor include:

(a) Design Flow Diagrams

(b) Detailed Design Plan

(c) Design Descriptions

(d) Design Manual Revisions / New Design Manual(s)

(e) Equipment Layout Drawings

(f) Piping Arrangement, Isometric and Hanger / Support Drawings

(g) Embedded and Buried Piping, Embedded Parts Drawings

(h) Bill of Materials (DBOM and EBOM)

(i) Equipment List (MEL) with Canadian Registration Numbers for registered equipment

(j) Valve List and Line List

(k) Engineering Calculations

(l) Copies of Permits and Registration

(m) Site Test Plans and Reports

(n) Technical Specification Data Sheets (TSDS)

A.2.2 Typical Instrumentation and Control Design Products

Typical design deliverables to be considered by the Contractor include:

(a) Flow diagrams showing all equipment, piping, instrumentation, and process data

(b) Design Descriptions

(c) Control logic, interlocking, ladder and / or sequencing diagrams (except existing TRF/HWMB DCU's)

(d) Bill of Materials (DBOM and EBOM)

(e) Instrument data sheets (Calibration sheets) for control valves, flow elements, and analyzers, and calculations for flow elements and control valves with three data points.

(f) PLC documents including hardware & software specifications; bill of material; system power distribution, grounding, and shielding design; UPS calculation; panel arrangement; I/O assignment; set point and alarm list; wiring & connection; testing procedures & reports; software quality assurance (SQA) program, system & application software programs including source code; operating and maintenance manuals (except DCU's)

(g) Instrument loop or functional diagrams

(h) Instrument index including instrument tag number, service description, Flow Diagram number, calibration range, set point, PLC I/O addresses, wiring diagram, location drawing, junction box number. Instrument index shall be in both paper copy and compact optical disc or USB media by using Microsoft Excel spreadsheet

(i) Instrument installation details and material take-off for installation

(j) Control room / area arrangement drawing

(k) Instrument / junction box location diagrams

(l) Technical Specification Data Sheets (TSDS)

(m) Control room annunciations and alarms

A.2.3 Typical Electrical Design Products

Typical design deliverables to be considered by the Contractor include:

(a) Design Descriptions

(b) Cable Block Diagrams

(c) Electrical Wiring Diagrams

(d) Electrical Single Line Diagrams

(e) Electrical Panel Schematic Wiring Diagrams

(f) Electrical Arrangement Drawings

(g) Electrical Equipment Layout Drawings

(h) Short Circuit Calculations

(i) Loading Calculations

(j) Electrical Protection and Coordination Study

(k) Grounding Detail Drawings

(l) Motor List

(m) Power Supply List

(n) Junction box schedule and layout diagrams

A.2.4 Typical Civil Design Products

Typical Design deliverables to be considered by the Contractor include:

(a) Topographical Survey of Area, if OPG does not have capability

(b) Concrete Drawings

(c) Structural Steel Drawings

(d) Tender Packaging for contractor work

(e) Technical Specification Data Sheets (TSDS)

(f) Bills of Materials (DBOM and EBOM)

A.3.0 OVERPRESSURE PROTECTION REPORT

The Overpressure Protection Report (OPPR) documents not only compliance with the applicable codes, but also documents the potential for more minor over pressurizations that may result in outage delays. The OPPR shall address, as a minimum, the following items:

(a) Compliance with all applicable code requirements

(b) All isolatable volumes over 1.5 cu. ft.

(c) All isolatable volumes that contain energy sources

(d) All vessels over 1.5 cu. ft.

(e) Isolatable pumpsLine blockage from freezing

(f) All vessels over 1.5 cu. ft. during a fire

(g) All open tanks

(h) Clearly identify where an operational procedure is the only source of OPP

(i) Description of normal and transient system operation and the main OPP during those operations

(j) Summarize the purpose of each RV, locked valve, or vent with respect to providing OPP

(k) Summarize the calculation relieving capacity of each OPP device

A.4.0 ENGINEERING CALCULATIONS

The Contractor shall provide design calculations required to demonstrate compliance with codes, regulations and standards.

(a) The Contractor shall consider the following items when determining whether a Design Calculation is required:

(1) Mass balance (quantity and flow rate) and energy balance

(2) Pressure, flow and temperature of each stream under various operating (clean and fouled) conditions and operating modes

(3) Safety analysis for the chemicals and other gases (free and dissolved) or reactions with water under normal mode and failure mode conditions

(4) Pressure relief valve pressure (set pressure, opening pressure, closing pressure) and relieving capacity

(5) Chemical consumption

(6) Waste Generation (quantity, rate and composition)

(7) Pressure vessel calculations submitted for TSSA / CRN registration

(8) Pump design including pump performance curves and system curves (clean and fouled conditions)

(9) SSC stress

(10) Hydraulic and transient analyses

(11) Electrical load analysis and calculations

(c) ETAP studies (protection coordination, load flow and arc flash). OPG will provide access to the existing ETAP model. The following analyses will be required:

(1) Short circuit analysis

(2) Arc flash analysis and recommended personal protective equipment (PPE) consistent with OPG's arc flash report, NK38-REP-50000-002

(3) Load flow analysis to ensure minimum voltage drop acceptable to OPG

(4) Protective relay coordination study

A.5.0 TECHNICAL REVIEWS

(a) When required by the Design Plan the Contractor shall perform a technical review as per OPGN procedure N-PROC-MP-0047 (Design Verification). The purpose of the technical review is to independently verify the proposed design prior to field installation.

(b) During the technical review, the Contractor shall be required to respond, in writing, to questions and comments raised by the review team. The Contractor shall prepare a technical review report identifying issues posed by the technical review team, why the issue was brought out, the action taken to resolve/ disposition the issue, and other comments. The design changes, additional calculations, analyses and documentation may be required to resolve some of the issues. The review team will determine if the responses made by the Contractor are satisfactory and have resolved the issues.

(c) OPG may undertake a detailed technical review on selected Engineering Change packages. Such reviews will be identified in advance and be incorporated into the project schedule.

A.6.0 REFERENCES TO OPGN CONTROL DOCUMENTATION

The Contractor shall ensure that proper reference to OPGN document numbers is made in any of the Contractor's own drawings / documents or the documentation received from the Contractor's sub-vendor / manufacturer.

A.7.0 STANDARD NOTES / TOLERANCES IN THE DRAWINGS

The Contractor shall ensure that all required engineering notes are included in the design documentation particularly in the piping / fabrication drawings. This includes but is not limited to:

(a) Details of welding procedure

(b) Allowable tolerances on the following

(1) Test Pressures / temperature

(2) Torque values

(3) Fabrication dimensions / angles

Appendix B: Human Factors Engineering

B.1.0 HUMAN FACTORS ENGINEERING

At OPG, Human Factors Engineering (HFE) is considered in every modification having a Human System Interface (HSI). OPG uses a tailored approach with the appropriate level of HFE effort and rigor. For this project, the Contractor will be responsible for execution of the HFE design, as per the Contractor Interface Agreement. N-MAN-06700-10002 (Human Factors Engineering Guide for Vendors) outlines the approach expected by OPG, including the processes, procedures and deliverables.

Modifications are classified according to one of three different levels of HFE activities: Minimum, Basic, and Full. Each level has unique requirements for documentation and deliverables, Contractor HFE Specialist involvement and OPG HFE oversight. See N-MAN-06700-10002 (Human Factors Engineering Guide for Vendors) for details. Because this project impacts multiple HSI's, it has been determined that the level of HFE activity on this project will be "Full". One of the main consequences of this determination is that the Contractor will be responsible to prepare a Human Factors Engineering Program Plan.

All HFE activities conducted by the Contractor will be carried out by qualified HFE Specialist(s). The Proponent is required to demonstrate in their Proposal, how they will meet the qualification requirements specified in N-MAN-06700-10002 (Human Factors Engineering Guide for Vendors), for either the case of a "Basic" or "Full" designation.

The required international programmatic HFE standards, and standards required by the CNSC are identified in N-MAN-06700-10002 (Human Factors Engineering Guide for Vendors). Additional Darlington-specific HFE requirements are identified in N-FORM-10580 (Human Factors Level of HF Activity Form). Several of the documents referenced in N-FORM-10580 (Human Factors Level of HF Activity Form) refer to the Darlington Main Control Room. Any modifications to the TRF/HWMB Control Room shall follow the same HFE conventions as for the Darlington Main Control Room.

Appendix C: Contractor Software Responsibilities

C.1.0 CONTRACTOR SOFTWARE PROCUREMENT SUPPORT

The Contractor shall have the responsibility of the "Requisitioner" as described in N-PROC-MP-0049 (Procurement of Software and Products Containing Software), and the roles previously attributed to OPG, as per the Contractor's QA program: Supply Chain Quality Services (SCQS), Procurement Engineering (PE), and Supply Planning & Strategic Sourcing (SPSS). OPG Computers & Control Design (CCD) and Engineering Mechanics (EM) groups will retain their roles under this procedure.

The following sections provide a summary of the key Software Classification, Categorization, Procurement and Qualification activities. It is not a comprehensive summary of all Contractor responsibilities; therefore the referenced procedures should be consulted for clarity.

In addition, for Category II/III RTPC software, the successful Proponent is required to prepare a Software Requirements Specification as per N-STI-69000-10004 "Category II/III Software Requirements Specification". For Category IV, a Software Requirements Specification is also required, using N-STI-69000-10004 for guidance. Category I and "Low Impact" category are also possible, however for the purposes of the Software Requirements Specification, assume the RTPC software will be either Category II/III/IV. The change papers, list of I/O's, and Software Requirements Specification will be used by the OPG DCC Design group, through the Original Equipment Manufacturer, to modify the Digital Control Unit (DCU) software as necessary.

C.1.1 Software Procurement Planning

The Contractor will identify, classify and categorize each distinct software component to be procured to identify the Software Quality Assurance requirements and complete N-FORM-10408 (Software Procurement Planning) as per the DAIA. The steps to be followed are:

(a) Classify each software item into one of the Real-Time Process Computing (RTPC); Scientific, Engineering, and Safety Analysis (SESA); or Software Engineering Tool classifications in accordance with N-PROG-MP-0006 (Software).

(b) Categorize RTPC software into one of 4 categories in accordance with N-STI-69000-10000 (Software Categorization). OPG Section Manager, Process Control, and Human Factors Engineering, will support the Contractor with the categorization and provide concurrence of the categorization. A qualification is required to perform software categorization.

(c) Identify and classify any RTPC cyber asset that is part of the system in accordance with N-PROC-MP-0103 (Security for Real-Time Process Computing Systems) and N-STI-69000-10015 (Cyber Asset Identification for Real-Time Process Computing Systems) with the assistance of the OPG RTPC Cyber Security Single Point of Contact (SPOC).

(d) Depending on the outcome of the Cyber Security Requirements identification, the Contractor will be responsible for identifying the design considerations required to reduce the cyber security risk of

the RTPC software, with assistance from the OPG RTPC Cyber Security SPOC, as per N-STI-69000-10016 (Cyber Security for Real-Time Process Computing Systems).

(e) Categorize software tools in accordance with N-STI-69000-10002 (Qualification of Software Tools). The Contractor shall follow N-STI-69000-10002 (Qualification of Software Tools) and qualify any such tools required for the execution of the Design or for long term support/maintenance of the D2O Storage Facility.

(f) Grade SESA software in accordance with N-STD-MP-0008 (Development, Qualification and Use of Scientific, Engineering and Safety Analysis Software). The Contractor will ensure SESA software is qualified in accordance with N-STD-MP-0008 (Development, Qualification and Use of Scientific, Engineering and Safety Analysis Software).

(g) Identify the procurement approach to purchase Commercial off-the Shelf Software (COTS), Modifiable off-the Shelf Software (MOTS), or Custom Developed software.

(h) Determine the software quality assurance requirements and select the appropriate procurement clauses in Appendix B accordance with Section 1.2.4 of N-PROC-MP-0049 (Procurement of Software and Products Containing Software)

C.1.2 Software Procurement

The Contractor shall procure the software items in accordance with the following steps:

(a) Prepare an engineering specification in accordance with N-PROC-MP-0059 (Preparation, Review and Approval; of Engineering Specifications) including the relevant SQA requirements and cyber security requirements.

(b) Pre-select suppliers and products to ensure potential suppliers are able to meet the SQA requirements.

(c) Initiate the procurement process for the items or services to obtain and evaluate proposals.

(d) Document the supplier's compliance to SQA requirements which may include software qualification, imposing SQA requirements on the supplier or require supplementary testing.

(e) If the supplier has an insufficiently mature SQA process or inadequate related capability, prepare a risk assessment to identify mitigating actions.

(f) Complete N-FORM-10409 (Software Quality Assurance Requirements) as per the DAIA.

(g) Perform supplier monitoring, deliverable reviews and review and witness any supplier factory acceptance testing and installation and site testing.

C.1.3 Software Maintenance Planning

The Contractor shall be responsible for developing the Software Maintenance Plan (SMP) for RPTC software as per N-STI-69000-10001 (Software Maintenance) with support from the OPG Section Manager, CCD Department, or for SESA software in accordance with N-STD-MP-0008 (Development, Qualification and use of Scientific, Engineering and Safety Analysis Software).

The Contractor will also be responsible for developing a Software Release Notice in accordance with N-STI-69000-10014 (Software Release Notice) for RTPC software classified as custom developed or configurable software.

Appendix D: Contractor Safety, Leadership and Work Conduct Behaviours

D.1.0 EXCEPTION

None.

D.2.0 REQUIREMENT

OPG recognizes the importance of human performance and behaviours as integral to completing required work safely, with high quality, and no re-work as normal working conditions. The "how work gets completed" is as important as "what work was completed". Expectations around human performance and behaviours have been developed and refined over the years for OPG staff and it is expected that Design Agencies are held to the same standards when they are working for OPG.

Below is a high-level summary of key human performance and behaviour expectations to be adhered to for work on OPG projects, with a focus on typical engineering / Contractor activities (engineering work, field walk downs, MTL support etc.)

References to specific governance are provided. This list is not all inclusive; therefore it is important that the Contractor review the associated governance documents of each section to ensure full understanding and compliance.

D.3.0 SAFETY BEHAVIOURS

D.3.1 Safety Expectations

Controlled Document Number	Controlled Document Title
N/A	Occupational Health & Safety Act (OH&SA)
N-INS-08965.12-10000	Conventional Safety Incident Management
N/A	Corporate Safety Rules – Common Safety Rules

- Ensure that all staff members will not endanger the safety or unlawfully interfere with other persons on or off the site. This includes, but is not limited to:

  (1) All applicable laws including the Occupational Health and Safety Act (Ontario)

(2) OPG's safety requirement, "Contractor Health and Safety Management Standard"

(3) The Contractor's safety program

(4) Best practices of respecting health and safety in a manner that recognizes and minimizes the risks to workers, other individuals, and property.

D.3.2 Body Mechanics

Controlled Document Number	Controlled Document Title
N/A	Corporate Safety Rules – Common Safety Rules

- Exercise body mechanic behaviour to minimize potential injuries. This includes, but is not limited to:

  (1) Assuming the appropriate postures when working in cramped locations

  (2) Using mechanical aids and proper techniques during manual handling tasks

  (3) Exercising proper behaviour in stairwells, including holding the handrails, watching your steps, and taking one step at a time.

D.3.3 Confined Spaces

Controlled Document Number	Controlled Document Title
N-INS-08965-10020	Confined Spaces – Establishing and Executing Entry

- Ensure that entries into confined spaces are safe, planned, and controlled by:

  (1) Ensuring unqualified individuals do not enter confined spaces

  (2) Ensuring that air samples are taken when confined space is open

  (3) Barriers are in place when confined space is open

  (4) Confined space entry monitor is present while confined space is open.

D.3.4 Electrical Hazards

Controlled Document Number	Controlled Document Title
N-INS-08965-10021	Electrical Safety
N-INS-09106-10011	Control of Lifted Electrical Leads

- Ensure that, all potential sources of electrical energy that could pose harm are isolated and de energized using work protection. Where it is not practical to isolate and de-energize electrical energy, the contractor agrees to follow the guidelines for safe work practices. This includes:

  (1) Ensure everyone's awareness of the electrical hazards in the workplace

  (2) Ensuring staff are aware that they are not to touch or open electrical equipment for inspections without OPG approval

  (3) Ensuring staff are aware not to cross marked electrical exclusion boundaries unless approved by the responsible Maintenance Authority /Holder of Record

  (4) Personnel performing electrical work are not wearing conductive jewellery

D.3.5 Falling Object Hazards

Controlled Document Number	Controlled Document Title
N-INS-08965-10035	Falling Objective Prevention

- Identify and eliminate falling object hazards which relate to materials, tools, and equipment. This includes, but is not limited to:

  (1) Ensure materials/tools (including personal items such as pens, cameras, binders etc) are properly secured during transportation, especially when on floor gratings or by railings

D.3.6 Hand Safety Hazards

Controlled Document Number	Controlled Document Title
N-MAN-08965-10000 Sht: SEC A14.1	Personal Protective Equipment

- Ensure all staff members possess a pair of gloves in the required areas and identify, control, and eliminate pinch hazards and other hand injuries. This includes, but is not limited to:

  (1) Personnel have a pair of gloves in required areas

D.3.7 Hearing Protection and Noise Hazards

Controlled Document Number	Controlled Document Title
N-MAN-08965-10000 Sht: SEC A14.1	Personal Protective Equipment

- Ensure all staff members wear the required hearing protection correctly in the identified areas at all times.

D.3.8 Heat Stress

Controlled Document Number	Controlled Document Title
N-INS-08965-10028	Heat and Cold Stress in the Workplace

- Contractor supervision and workers will ensure that the following practices are adhered to:

  (1) Beware of the hazards associated with exposure to excessive Heat Stress and follow the precautions prescribed in the N-INS-08965-10028 (Heat and Cold Stress in the Workplace)

  (2) Stop work / walk down if feeling unwell due to excessive heat exposure, report to supervisor, and seek medical assistance as required.

D.3.9 Operation of Vehicles

Controlled Document Number	Controlled Document Title
N-INS-08965-10001	Operation of In-Plant / Off-Road Vehicles
N-INS-08100-10002	Pickering and Darlington Traffic Management

- Follow the safe driving process for the operation and effective use of all vehicles on OPG property including in-plant, off-road, commercial, and personal vehicles. This includes, but is not limited to:

  (1) Obeying site speed limits

  (2) Parking only in designated areas

  (3) Displaying site parking passes and affixing them to windshield in designated location

  (4) Driving vehicles safely, and obeying all signage or otherwise defined procedures.

  (5) Removing parking pass and returning it to site sponsor upon termination of contract employment

D.3.10 Work Protection

Controlled Document Number	Controlled Document Title
N-PROC-MA-0012	Work Protection
N-STD-MA-0001	Work Protection

- Establish conditions which provide staff with a safe working environment. This includes, but is not limited to:

  (1) Know and understand qualifications and responsibilities from the Work Protection perspective

  (2) Know that staff under no circumstances are to touch or operate a tagged work protection device

  (3) Know that staff are to not enter identified safe work areas unless approved by the Maintenance Authority / Holder of Record

D.3.11 Working at Heights

Controlled Document Number	Controlled Document Title
N/A	Corporate Safety Rules Part One Risk Based Rules
N-INS-08960-10001	Working at Heights
N-STD-MA-0006	Scaffolds and Temporary Work Structures

Ensure worker safety and reduce potential injuries by:

- Know that OPG qualification is required for working at heights or using fall arrest equipment on OPG property
- Using only approved and properly secured ladders
- Personnel maintains 3 point contact when climbing ladders
- Before putting a ladder in front of the door, lock, bolt and guard the door including posting a sign
- Scaffolding has in-date inspection tags attached
- Identifying hazards, posting with signs, and containing guardrails/swing gates
- Incorporating facilities for fall arrest tie off points in issued designs

D.4.0 LEADERSHIP BEHAVIOURS

D.4.1 Contractor Supervisor/Leadership Expectations

Controlled Document Number	Controlled Document Title
N-MAN-09071-10001	Training Basis for Radiation Protection
N-PROC-MA-0006	Work Performance
N-PROC-MA-0018	Foreign Material Exclusion
N-PROC-MA-0021	Troubleshooting Plant Equipment
N-PROC-MA-0031	Control of Unsecured Equipment in a Seismically Qualified Area and Control of

Controlled Document Number	Controlled Document Title
	Seismic Route Integrity
N-PROC-OP-0005	Pre-Job Briefing and Post-Job Debriefing
N-PROC-RA-0022	Processing Station Condition Records
N-PROG-MA-0004	Conduct of Maintenance
N-STD-MA-0001	Work Protection
N-STD-MA-0004	Post-Maintenance Test
N-STD-OP-0012	Conservative Decision-Making
N-STD-OP-0015	Observation and Coaching
N-STD-OP-0009	Reactivity Management
N-STD-TR-0001	Conduct of Training

- OPG requires the provision of supervision and leadership that continuously demonstrates professionalism through honesty, respect, integrity, leadership, communications, and teamwork with an overriding focus on safety, including conventional, nuclear, radiological, and environmental safety in accordance with the OPG Nuclear Values by:

  (1) Ensuring full compliance with regulatory requirements, procedures, and plant policies

  (2) Demonstrating and communicating genuine concern for personal safety

  (3) Leading by example

  (4) Routinely evaluating work locations to ensure event free tools are used

  (5) Ensuring supervisors possess confidence from their knowledge, skills, and experience

  (6) Continually working to improve and encourage the safety, efficiency, and productivity of workers.

D.5.0 CONDUCT OF WORK BEHAVIOURS

- Contractor supervision and leadership is vital to ensuring work is completed safely, to high quality standards and without errors. Supervisors must be competent, capable, and qualified to supervise the workers and the scope of work.

D.5.2 Fitness for Duty

Controlled Document Number	Controlled Document Title
N/A	Corporate Safety Rules – Common Safety Rules

- Contractors need to ensure that all staff members are both mentally and physically able to perform the job assigned at all times in a safe, reliable and efficient manner on OPG property. This includes, but is not limited to:

  (1) Compliance with all corporate Safety Rules and all OPG and legislative safety requirements

  (2) Not being under the influence of or bring intoxicants, illegal drugs, firearms or illegal devices into an OPG work place

  (3) Not engaging in any prank or horseplay

  (4) Reporting of any physical or other limitations that may reduce the ability to work safely or to the required performance level

  (5) Checking in and out with a designated contact person if not working at normal work location.

D.5.3 Human Performance (includes Pre-Job, Post-Job Debriefs)

Controlled Document Number	Controlled Document Title
N/A	Corporate Safety Rules Part One Risk Based Safety Rules
N-PROG-AS-0002	Human Performance
N-GUID-01900-10000	Human Performance Event Free Tools for Knowledge Work
N-PROC-OP-0005	Pre-Job Briefing and Post-Job Debriefing

Controlled Document Number	Controlled Document Title
N-FORM-11056	Engineering Pre-job Briefing and Post-Job Debriefing Checklist
N-STD-OP-0004	Self-Check Program
N-POL-0001	Nuclear Safety Policy of the OPG Board of Directors
N-STD-OP-0012	Conservative Decision-Making
N-STD-OP-0002	Communications

- Identify and address individual behaviours, reduce organizational vulnerability and workplace errors by applying event free tools to reduce human error, such as:

  (1) 3-way communication

  (2) Pre-job briefs and post-job debriefings

  (3) Procedural use and adherence

  (4) Self-checks and peer checks

  (5) Use of Phonetic alphabet

  (6) Questioning attitude and conservative decision making

- Promoting team work

- Performing regular self-assessments

- Contractor leadership defines and exhibits model behaviours, and holds themselves accountable.

D.5.4 Foreign Materials Exclusion (FME)

Controlled Document Number	Controlled Document Title
N-INS-09106-10001	Foreign Material Exclusion Planning
N-PROC-MA-0018	Foreign Material Exclusion

- Prevent foreign materials from entering systems and equipment. This includes, but is not limited to:

(1) Ensuring staff performing walk downs or otherwise working on OPG sites are aware of FME requirements and accountabilities

(2) Ensuring designs produced by staff anticipate and address potential FME concerns

D.5.5 Hoisting, Rigging and Scaffolding

Controlled Document Number	Controlled Document Title
N-MAN-08965-10000 Sht: SEC A14.1	Personal Protective Equipment
N-INS-09180-10015	Lift Planning
N-STD-MA-0018	Hoisting and Riggins
N-INS-09180-1000	Scaffold Builders Handbook
N-STD-MA-0006	Scaffolds and Temporary Work Structures

- Ensure that the following practices are adhered to:

  (1) Staff are aware of OPG training requirements to access or climb a scaffold, and do not access scaffolds unless qualified.

D.5.6 Housekeeping

Controlled Document Number	Controlled Document Title
N-STD-MA-0008	Station Materiel Condition Housekeeping and Inspection
N-PROC-RA-0054	Control of Transient Material and Space Allocation within the Site
N-PROC-MA-0031	Control of Unsecured Equipment in a Seismically Qualified Area and Control of Seismic Route Integrity

- Ensure that the following practices are adhered to:

  (1) Properly store all equipment and materials

  (2) Ensure space allocation or housekeeping tags are in place

(3) Transient material has a housekeeping tag dated within last 15 days

(4) Tripping hazards are identified/controlled

(5) Waste material are placed in appropriate bins

(6) Work areas have appropriate lighting

(7) Minimize active waste by removing packaging prior to entering radiation area

(8) Identify degraded equipment.

D.5.7 Main Control Room Access

Controlled Document Number	Controlled Document Title
N-STD-OP-0013	Main Control Room Access

- Adhere to the requirements for the Main Control Room and HWMB Control Room entry.

D.5.8 Signs and Barriers

Controlled Document Number	Controlled Document Title
N-INS-08965-10013	Use of Warning Signs and Barricades for Conventional Safety Hazards

- Ensure that the following practices are adhered to:

  (1) Obey signs and barriers

D.5.9 Station Condition Record (SCR)

Controlled Document Number	Controlled Document Title
N-PROC-RA-0022	Processing Station Condition Records

- Identify adverse conditions to OPG contact. This includes, but is not limited to:

  (1) Requesting OPG to initiate an SCR in the event that the Contractor observes an adverse condition

(2) Taking steps to secure the situation and preserve evidence.

(3) Cooperating with OPG incident investigations, self-assessments, and corrective actions.

NOTE

An adverse condition is an unwanted situation, inappropriate actions, or situation that does not meet expectations or does not have the desired outcome or response. An adverse condition has consequences of a personnel, programmatic or equipment deficiency impacting radiological, nuclear, or industrial safety, the environment, production or cost.

D.6.0 NUCLEAR SAFETY BEHAVIOURS

D.6.10 Nuclear Safety

Controlled Document Number	Controlled Document Title
N-STD-AS-0023	Nuclear Safety Oversight
N-POL-0001	Nuclear Safety Policy

- Nuclear safety may be impacted when performing maintenance or modification activities. Contractor supervision and staff must be aware of how they may impact nuclear safety and what behaviours are expected.
- These must be reviewed at pre-job briefing and standards enforced by Contractor supervisors. Key elements that impact nuclear safety include:

  (1) Seismic Qualification of equipment is appropriately maintained

  (2) Steam doors are closed and latched on their own and verified latched

  (3) Aware of nuclear safety significant equipment in the work area.

D.6.11 Control of Unsecured Equipment in Seismically Qualified Areas

Controlled Document Number	Controlled Document Title
N-PROC-MA-0031	Control of Unsecured Equipment in a Seismically Qualified Area and Control

Controlled Document Number	Controlled Document Title
	of Seismic Route Integrity

- When work in and around seismically qualified areas, Contractor supervisors must ensure all staff are aware of the additional requirements and restrictions. Control of unsecured equipment in the Seismically Qualified Areas is listed but not limited to:

  (1) Maintain a minimum horizontal offset distance from seismic equipment and areas

  (2) Ensure items on wheels or other portable/semi-permanent equipment/work materials are continuously tended, secured or removed from seismically qualified areas

  (3) Do not store unrestrained equipment above seismically qualified systems, structures or components

  (4) Treat Seismic Route/Safe Personnel pathways as a seismically qualified system.

  (5) Ensure entry to and exit from doors on the seismic route is not compromised.

D.6.12 Design Management and Engineering Change Control

Controlled Document Number	Controlled Document Title
N-PROG-MP-0001	Engineering Change Control

- Design Agencies must ensure:

  (1) Staff qualifications to complete modifications is maintained

  (2) Staff are familiar with the systems, structures, and components being modified and nuclear safety implications

  (3) Plant configuration (Bounded document set including MEL, EBOM, CALCs, and drawings) is only approved modifications are made to station structures, systems, and components (SSCs). Modifications must be installed in accordance with the approved design and installation requirements.

D.6.13 Security

Controlled Document Number	Controlled Document Title
N/A	Nuclear Operations and Maintenance Hand Book (Safe and Secure at OPG's Nuclear Facilities)
N-INS-08100-10002	Pickering and Darlington Traffic Management
OPG-HR-SEC-STD-004	Facility Security and Access Control Standard
N-INS-61400-10001	Use of Photographic Equipment
N-INS-61400-10009	Access Authorization for Nuclear Stations and Facilities

- Ensure the security of OPG facilities is maintained. This includes, but is not limited to:

  (1) Ensuring security clearance forms are filled in completely and accurately

  (2) Wearing photo identification visible on the front of body between neck and waist at all times while working on OPG property and offsite buildings (e.g. 777 and 889 Brock Rd. offices)

  (3) Report to Security anyone who appears suspicious or is observed not wearing photo identification

  (4) Display parking passes in vehicles

  (5) Ensure powerhouse and security doors are closed and locked after use

  (6) Ensure everyone's awareness of the security issues, requirements, and constraints when working around protected area, security equipment, doors and fences

  (7) Ensure everyone's awareness of the items NOT to wear/carry prior to access the protected areas to obtain alarm free entry.

  (8) Ensure only photographic equipment approved by the Site Security Director is used.

D.6.14 Use of Doors

Controlled Document Number	Controlled Document Title

Controlled Document Number	Controlled Document Title
N/A	Nuclear Operations and Maintenance Hand Book (Steam Doors / Fire Doors)

- Ensure the following practices are adhered to:

  (1) Keep all steam doors/fire doors/security doors in the closed and latched state when not being accessed

  (2) Report via an SCR if a door is found open or unlatched

  (3) Before leaving a door, ensure the door has closed and is latched

  (4) Do not use overhead doors for personnel transfer unless no alternative

  (5) Ensure overhead door is fully open and stationary before the overhead door is used to transfer equipment from one location to another

  (6) Remain a safe distance back (approximately 3 meters) while the overhead door is in motion

  (7) Immediately report any overhead door anomalies and post hazard signs.

D.7.0 RADIOLOGICAL SAFETY BEHAVIOURS

D.7.15 Radiation Hazards

Controlled Document Number	Controlled Document Title
N-PROC-RA-0024	Hazard Surveys Posting Labelling and Radiological Log

- Follow the requirements for radiation hazards by:

  (1) Ensuring that staff follow directions from Radiation Protection Assistant, Radiation Exposure Permit, and all signs, barriers, and warning devices (e.g., location area radiation alarms, dose control devices, station announcements, etc.).

D.7.16 Radiation Worker Practices

Controlled Document Number	Controlled Document Title

Controlled Document Number	Controlled Document Title
N-PROG-RA-0013	Radiation Protection
N-PROC-RA-0014	Radiological Zoning, Personnel/Material Monitoring and Transfer Permits

- Ensure the Radiation Protection (RP) program is adhered to; this includes, but is not limited to:

  (1) Workers maintain radiation protection qualifications and complete requalification, bioassay, and whole body count requirements prior to expiry/due dates

  (2) Workers know and follow instructions of assigned yellow or green personnel

  (3) Workers aware of requirements and limitations for transferring personal / no permit items from the radiation area

D.7.17 Radioactive Waste Minimization

Controlled Document Number	Controlled Document Title
N-PROC-RA-0017	Segregation and Handling of Radioactive Waste

- Consider waste reduction, segregation, and handling into all work planning and execution. Work should include considerations such as:

  (1) Restricting materials entering Radiological Zones and only those materials absolutely necessary for job are used

  (2) Maximizing reusable materials and equipment (e.g., re-washable coveralls and booties)

  (3) Dividing material into likely clean programs

  (4) Ensuring active waste segregation (proper bagging and identification of waste).

D.8.0 ENVIRONMENTAL ASPECT BEHAVIOURS

D.8.18 Environment

Controlled Document Number	Controlled Document Title
N-PROG-RA-0013	Environmental Policy
N-PROG-OP-0006	Environmental Management

- Follow Site Specific Environmental Management Plan (SSEMP). Provide recommendations for improved environmental performance. Include aspects such as:

  (1) Checking if permits are required

  (2) Complying with air, liquid, and solid waste system requirements

  (3) Notifying and reporting events

  (4) Restoring the site to its original condition.

D.8.19 Spill Management

Controlled Document Number	Controlled Document Title
N-STD-OP-0026	Spill Management

- The Contractor agrees to ensure (when directing / coordinating field activities):

  (1) Dyke integrity is maintained

  (2) Spill materials are readily available, drain covers are in place, and there is no risk of chemicals/oils being exposed to the environment

  (3) Spill socks are used for proper application

  (4) Spill contamination is installed and is correct size to contain liquids.

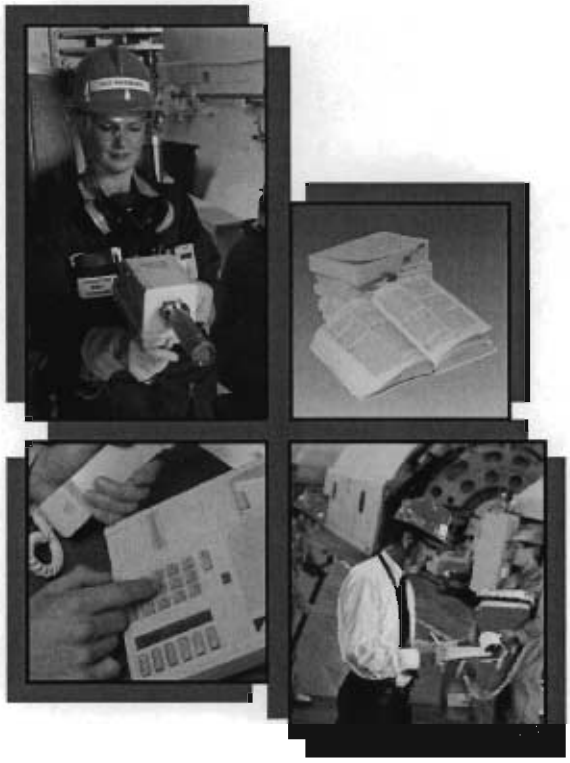
D.9.0 NUCLEAR SAFETY AND CONTROL ACT AND REGULATIONS

Contractor staff must be aware of and familiar with the unique expectations when working in the Nuclear Industry. Below is a brochure that briefly outlines the obligations of OPG employees and contractors under the Nuclear Safety and Control Act (NSCA) and Regulations. The NSCA is the primary legislation governing the regulation of nuclear energy in Canada. Although portions of this are reinforced during

initial training of all staff, contractors are expected to be aware of these obligations when submitting their proposals.

OBLIGATIONS OF OPG EMPLOYEES AND CONTRACTORS

Under the Nuclear Safety And Control Act And Regulations



ONTARIOPOWER GENERATION

Overview

The purpose of this pamphlet is to ensure that anyone who works in one of OPG's nuclear sites is aware of his / her responsibilities under the Nuclear Safety and Control Act (NSCA) and Regulations.
The NSCA is the primary legislation governing the regulation of nuclear energy in Canada.

The NSCA and Regulations places an obligation on all workers including but not limited to:*

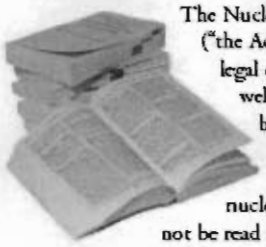
- *Assisting inspectors;*
- *Using equipment meant to protect people, the environment or to monitor radiation in a reasonable manner;*
- *Observing prohibitions on the removal of nuclear material, the use of prescribed equipment, and the use of prescribed information;*
- *Reporting certain types of events such as security events, radiological hazards and acts of sabotage and thefts;*
- *Obeying all radiological signs and notices;*
- *Informing OPG of your pregnancy; and*
- *Maintaining minimum shift complement under a strike or lockout condition.*

In addition, the brochure also outlines the penalties for offences under the NSCA and the defenses that are available.

Employees who have specific concerns on any aspects of this brochure are encouraged to bring such concerns to their managers. If you require additional clarification or interpretation of these regulatory requirements please contact your manager or your Regulatory Affairs Department.

*Worker means a person who performs work that is referred to in a licence (General Nuclear Safety and Control Regulations - Definitions).

Introduction



The Nuclear Safety and Control Act ("the Act") and Regulations imposes legal obligations on individuals as well as on the company. This brochure spells out those basic individual obligations for workers in OPG's nuclear power plants. It should not be read as dispensing with other legal obligations workers may owe under other statutes, such as the Occupational Health and Safety Act and Regulations, the Environmental Protection Act and Regulations and the Technical Standards and Safety Act and Regulations.

Your legal obligations can be met by following procedures, obeying the safety rules and always considering nuclear safety as part of your work and behavior. In most cases, showing due diligence is a defense, even if an incident or a violation occurs.

Assistance To Inspectors

Some staff of the Canadian Nuclear Safety Commission (CNSC) stationed at our facilities have been formally designated as "inspectors" under the Act. In carrying out his / her duties an inspector shall, if requested produce his / her certificate (s. 37(3) NSCA). The Act gives inspectors extensive powers, including the power to enter and inspect facilities, to seize property, and to issue orders. The Act requires anyone in the facility to provide "all reasonable assistance" to inspectors (s. 36 NSCA). This means that you should treat CNSC staff with courtesy and respect, cooperate with them, answer their questions honestly and comply with all reasonable requests.

In the unlikely event that a CNSC inspector asks you to stop work, ensure that it is safe to do so, ensure that the workplace is left in a safe state and inform your supervisor or FLM as soon as possible. The Act makes it clear that you cannot be disciplined by your employer for assisting a CNSC inspector (s. 48(g) NSCA).

Failing to comply with an inspector's order is an offence under the Act as is making misleading oral or written statements (s. 48(d) and 48(e) NSCA). Failing to assist or give information to an inspector when requested to do so, or interfering with the performance of an inspector's duties, is also an offence (s. 48(f) NSCA).

Use of Equipment Intended to Protect People To Protect The Environment Or To Monitor Radiation

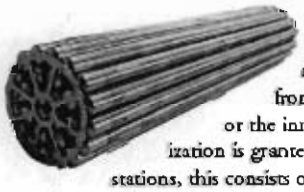
Workers must use, in a reasonable and responsible manner, equipment, devices, facilities and clothing that is intended to:

- Protect the environment, or
- Protect the health and safety of persons, or
- Determine doses of radiation, dose rates or concentrations of radioactive substances (s. 17 General NSC Regulations).

From time to time, intentional damage has been done to things such as Whole Body Monitors and portable contamination meters. These events are a violation of the Regulations and are reported to the CNSC.

Furthermore, it is an offence under the Act for anyone (without authority) to alter equipment or items meant to protect the environment, or the health and safety of persons, from the risk associated with the production of nuclear energy. (s. 48 NSCA).

Removal Of Nuclear Material



Category I, II, or III nuclear material must not be removed from the protected area or the inner area unless authorization is granted to do so. At the stations, this consists of used fuel (s. 28 Nuclear Security Regulations).

Prescribed Equipment and Information

Workers are prohibited from possessing nuclear substances, prescribed equipment or prescribed information that is capable of being used to produce a nuclear weapon or a nuclear explosive device (s. 50 NSCA).

Prescribed information includes, for example:

- Information on nuclear facility security arrangements, security equipment, security systems or security procedures; or
- Information on routes or schedules for transporting nuclear material; or
- Information or equipment required to produce a nuclear weapon or explosive.

This prohibition does not apply if workers are required to use such information in the course of their duties and are legally entitled to do so (s.22(2)(a) General NSC Regulations).

Workers in possession of, or who have knowledge of, prescribed information shall take all necessary precautions to prevent any unauthorized transfer or disclosure of any information. Disclosure is prohibited unless the employee is legally required to do so, or discloses it to a worker for the purposes of enabling the worker to perform duties assigned by OPG, or discloses it to a person who is legally required or legally authorized to obtain or receive the information. (s. 21, 22 & 23 General NSC Regulations).

Duty To Report

You are required to promptly inform your supervisor of any situation where you believe that there may be:

- An increased risk to the environment, or the health and safety of other employees, or the public, or a release into the

environment of an unauthorized quantity of a radioactive nuclear substance or hazardous substance (s. 17 General NSC Regulations);

- A threat to the maintenance of security or a security incident (s. 17 General NSC Regulations). Furthermore, workers must report the presence of any persons they have reason to believe are not authorized to be in the protected area to the nearest security guard (s. 24(2) Nuclear Security Regulations).
- A failure to comply with the Act, regulations or license (s. 17 General NSC Regulations); and
- An act of sabotage, theft, loss or illegal use or possession of a nuclear substance, prescribed equipment or prescribed information at the station (s. 17 General NSC Regulations).

Radiological Hazards

The Act places an obligation on workers (upon reasonable belief) to report immediately any contamination or radiation hazards which could lead to an exposure of persons or the environment to a dose of radiation in excess of the regulatory limits (s. 45 NSCA). This obligation can be discharged by adhering to OPG's Radiation Protection Requirements and Procedures.

Signs And Notices

You must observe and obey all notices and warning signs posted in accordance with the Radiation Protection Regulations (s. 17 General NSC Regulations).

You must not post or maintain a posting that indicates the presence of radiation, a nuclear substance or prescribed equipment when this information is misleading (s. 23 Radiation Protection Regulations).

Pregnancy

When a worker has reasonable belief that she is pregnant she must inform her employer in writing of her condition immediately (s. 11 Radiation Protection Regulations).

Strike Or Lockout

Notwithstanding the occurrence of a legal strike or lockout, sufficient workers are required to report for duty and remain on duty to maintain the nuclear facility in a safe operating condition (s. 49 NSCA). To maintain the facility in a safe operating condition, the minimum shift complement must be met. Workers may further be required by management to continue on duty beyond their normal shift to maintain shift complement. This is a term of the license through the incorporation of minimum shift complement documents D-PROC-OP-0009 and P-ODP-2. Failure to comply with these conditions would be an offence under the Act (s. 48(c) and 48(k)).

Other Prohibited Activities

It is a contravention of the Regulations to take into the protected area or inner area any weapons or explosives unless they are under the control of a nuclear security guard or members of a response force (s. 28 Nuclear Security Regulations). OPG's procedures extend the prohibition to all OPG property and premises. Some practical examples of weapons are firearms, slingshots, barons, clubs, mace, pepper spray and blades (over 15 centimeters long although the CNSC are considering smaller blades as well).

Penalties And General Punishment For Offences under the Act

Depending on the seriousness of the offence, workers who commit a violation of the NSCA, Regulations or license may face fines and/or imprisonment.

All of the above listed offences carry penalties with maximum fines of between $500,000 to $1,000,000 and maximum jail terms of between 18 months to 5 years depending on how the prosecutor elects to proceed (s.51(3) NSCA).

Defense

The Act provides that, if you exercise all due diligence to prevent the commission of an offence, you will have a defense to the charges (s. 51.1 NSCA). Without being exhaustive, exercising all due diligence would include the fact that you have followed station procedures, safety rules and have considered nuclear safety as part of your work and behavior. Additional factors which may be considered are foreseeability of harm, promptness of response and efforts made to address the problem.

Final Note

This brochure is intended for information purposes only and is not to be used as authoritative or comprehensive text on the subject. The information contained herein represents a best attempt to interpret worker obligations under the NSCA and relevant Regulations and is not to be depended on or construed as legal advice. For any situation where a worker's legal obligations come into question please refer the matter to your supervisor who will contact the Law Division of OPG for clarification.

ONTARIOPOWER GENERATION

D.10.0 TRAINING BEHAVIOURS

Controlled Document Number	Controlled Document Title
N-STD-TR-0001	Conduct of Training
N-TQD-403-00001	Nuclear Engineering Support Personnel Training and Qualification Description

- The Contractor is required to ensure that supervisors and workers are appropriately trained in accordance with the work requirements. The Contractor is required to have the records of qualifications. If the Contractor will be performing work particular to the OPG Nuclear QA program, then such staff shall be qualified with the external company's QA program, plus be qualified in TIMS for each incremental assigned role not covered by the external company's QA program. When qualified to an internal OPG qualification that has a requalification requirement, the Contractor is required to ensure any requalification training or CBTs are complete prior to the qualification's expiry date.

- When attending OPG training, or completing OPG computer based training, the Trainee should:

  (1) Ensure all prerequisite training is met

  (2) Attend training on time

  (3) Behave in a businesslike, professional manner that is respectful of other Trainees and Trainers

  (4) Be physically and mentally alert, attentive, and receptive to learning

  (5) Complete assignments, exercises, quizzes, and examinations in a manner that promotes learning

  (6) Do own work on all examinations and evaluations, neither receiving nor providing assistance to other Trainees unless directed to do so by examination administrators

  (7) Actively participate in training by developing and exhibiting a questioning attitude that stimulates discussions and promotes understanding of material

  (8) Set a positive example of a life-long learner by seeking out answers from knowledgeable sources and be willing to learn from other Trainees

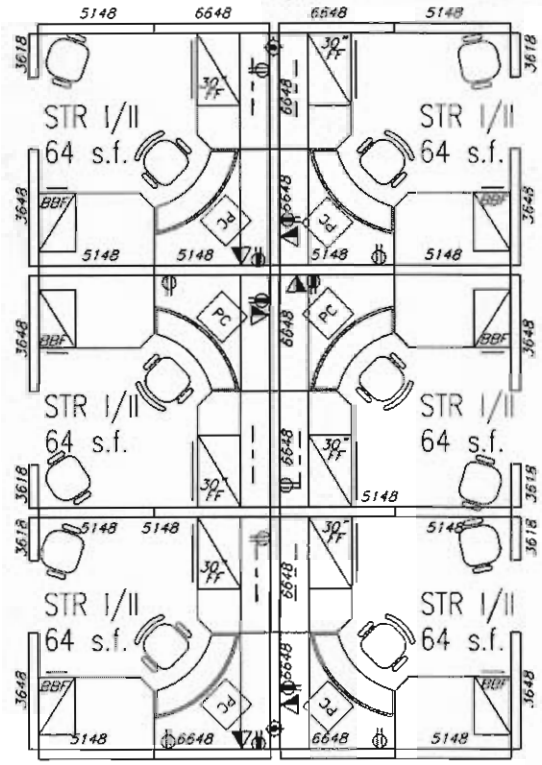
(9) Provide constructive feedback on training program strengths and weaknesses during and following training

(10) Leave distractions such as non-training related reading materials, outside classroom. Silence pagers, telephones, alarms, and other distracting devices during training sessions

(11) Not draw observers into training delivery that is in progress.

Appendix E: Typical Workstation Layouts

Ontario Power Generation: Typical Stratum I/II Workstation



SIZE:

- *64 square feet – int. dim. 8'–0" x 8'–0"*

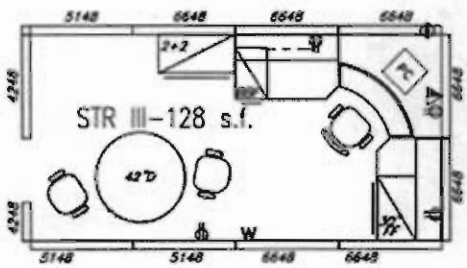
ELECTRICAL, VOICE & LAN:

- *Triplex electrical outlet supplied with systems furniture – mounted in desk height raceway*
- *Indicates end location of one voice and one lan drop – running in desk height raceway*
- *Indicates location of power pole supplied with systems furniture. Electrical harness runs in one half of the pole – voice and lan cabling in the other half*

FURNITURE:

- *Stratum I/II workstations are built from systems furniture panels. Panels are a combination of 66", 51" and 36" high (heights to be determined at a later date). Worksurfaces and shelves are mounted on the systems furniture panels. The remainder of the furniture is freestanding.*
- *Workstation includes:*
  - *–panel mounted corner unit with curved keyboard*
  - *–two panel mounted 30" x 48" worksurfaces*
  - *–30"w. file, file pedestal*
  - *–box, box, file pedestal*
  - *–two 48" panel mounted shelves*
  - *–one task light*
  - *–desk chair*
  - *–guest chair*

Ontario Power Generation:
Typical Strat. III Band H Manager with Supervision Workstation



SIZE:

- 128 square feet – int. dim. 8'–0" x 16'–0"

ELECTRICAL, VOICE & LAN:

- Triplex electrical outlet supplied with systems furniture – mounted in desk height raceway
- Indicates end location of one voice and one lan drop – running in desk height raceway
- Indicates location of power pole supplied with systems furniture. Electrical harness runs in one half of the pole – voice and lan cabling in the other half

FURNITURE:

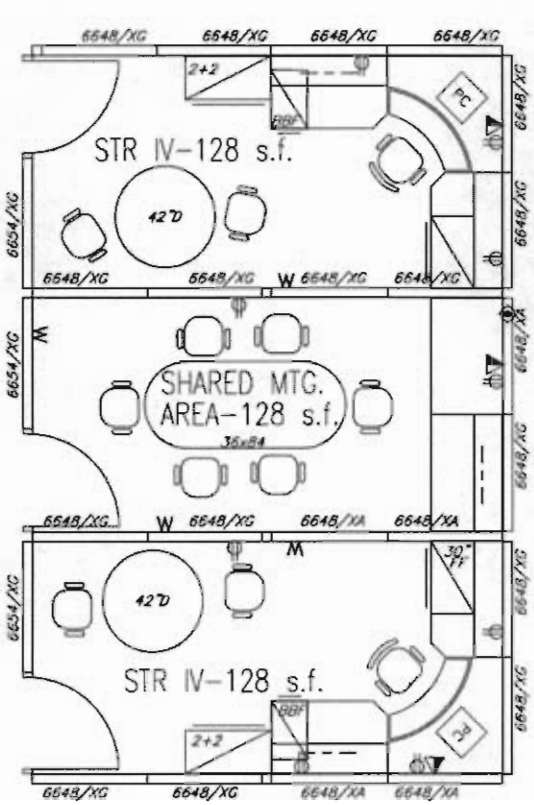
- Stratum III workstations are built from systems furniture panels. Panels are a combination of 66", 51" and 36" high (heights to be determined at a later date). Worksurfaces, shelves and whiteboards are mounted on the systems furniture panels. The remainder of the furniture is freestanding.
- Workstation includes:
  - –panel mounted corner unit with curved keyboard
  - –two panel mounted 30" x 48" worksurfaces
  - –30"w. file, file pedestal
  - –box, box, file pedestal
  - –two 48" panel mounted shelves
  - –one task light
  - –desk chair
  - –two guest chairs
  - –42"d. conference table
  - –four drawer storage cabinet (two file drawers, two binder shelves)
  - –whiteboard

Plan

Internal Use Only		
Document Number: NK38-SOW-38000-10004		Usage Classification: N/A
Sheet Number: N/A	Revision Number: R000	Page: 95 of 108

Title: **SCOPE OF WORK FOR EPC CONTRACT FOR THE DARLINGTON HEAVY WATER**

Ontario Power Generation: Typical Stratum IV Workstation



SIZE:

- 128 square feet – int. dim. 8'–0" x 16'–0"
- 2 Stratum IV offices to share one Meeting area

ELECTRICAL, VOICE & LAN:

- Triplex electrical outlet supplied with systems furniture – mounted in desk height raceway
- Indicates end location of one voice and one lan drop – running in desk height raceway
- Indicates location of power pole supplied with systems furniture. Electrical harness runs in one half of the pole – voice and lan cabling in the other half

FURNITURE:

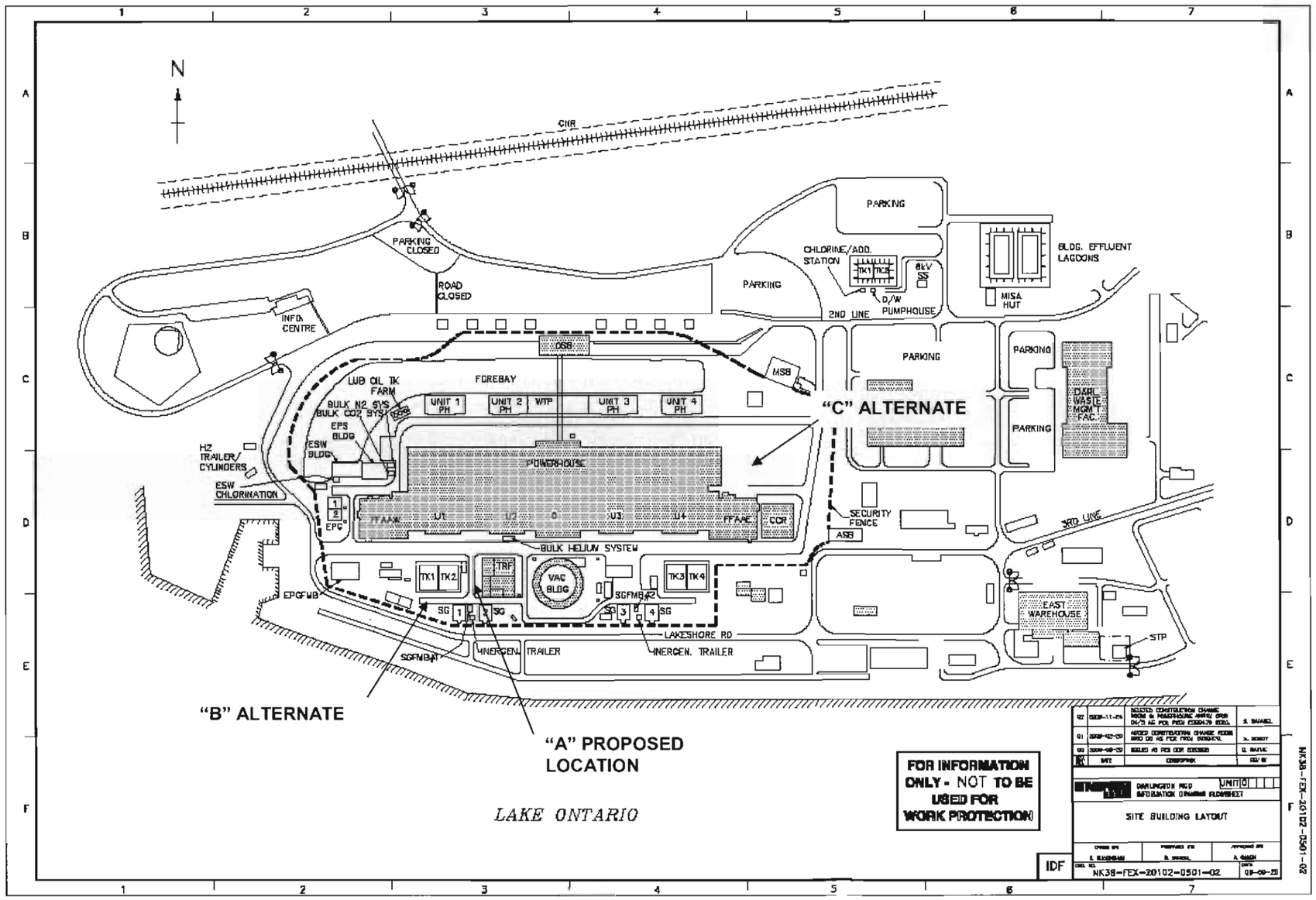
- Stratum IV offices are built from systems furniture panels. Panels are 66"h with 15"h glass or fabric overpanels for a total height of 81". Worksurfaces, shelves and whiteboards are mounted on the system furniture panels. The remainder of the furniture is freestanding.
- Workstation includes:
  - –panel mounted corner unit with curved keyboard
  - –two panel mounted 30" x 48" worksurfaces
  - –30"w. file, file pedestal
  - –box, box, file pedestal
  - –two 48" panel mounted shelves
  - –one task light
  - –desk chair
  - –two guest chairs
  - –42"d. conference table
  - –four drawer storage cabinet (two file drawers, two binder shelves)
  - –whiteboard
- Shared Meeting Area includes:
  - –meeting table 36" x 84"
  - –6 chairs
  - –whiteboard

Plan

Internal Use Only		
Document Number: NK38-SOW-38000-10004		Usage Classification: N/A
Sheet Number: N/A	Revision Number: R000	Page: 96 of 108

Title: SCOPE OF WORK FOR EPC CONTRACT FOR THE DARLINGTON HEAVY WATER

Appendix F: Proposed Building Location



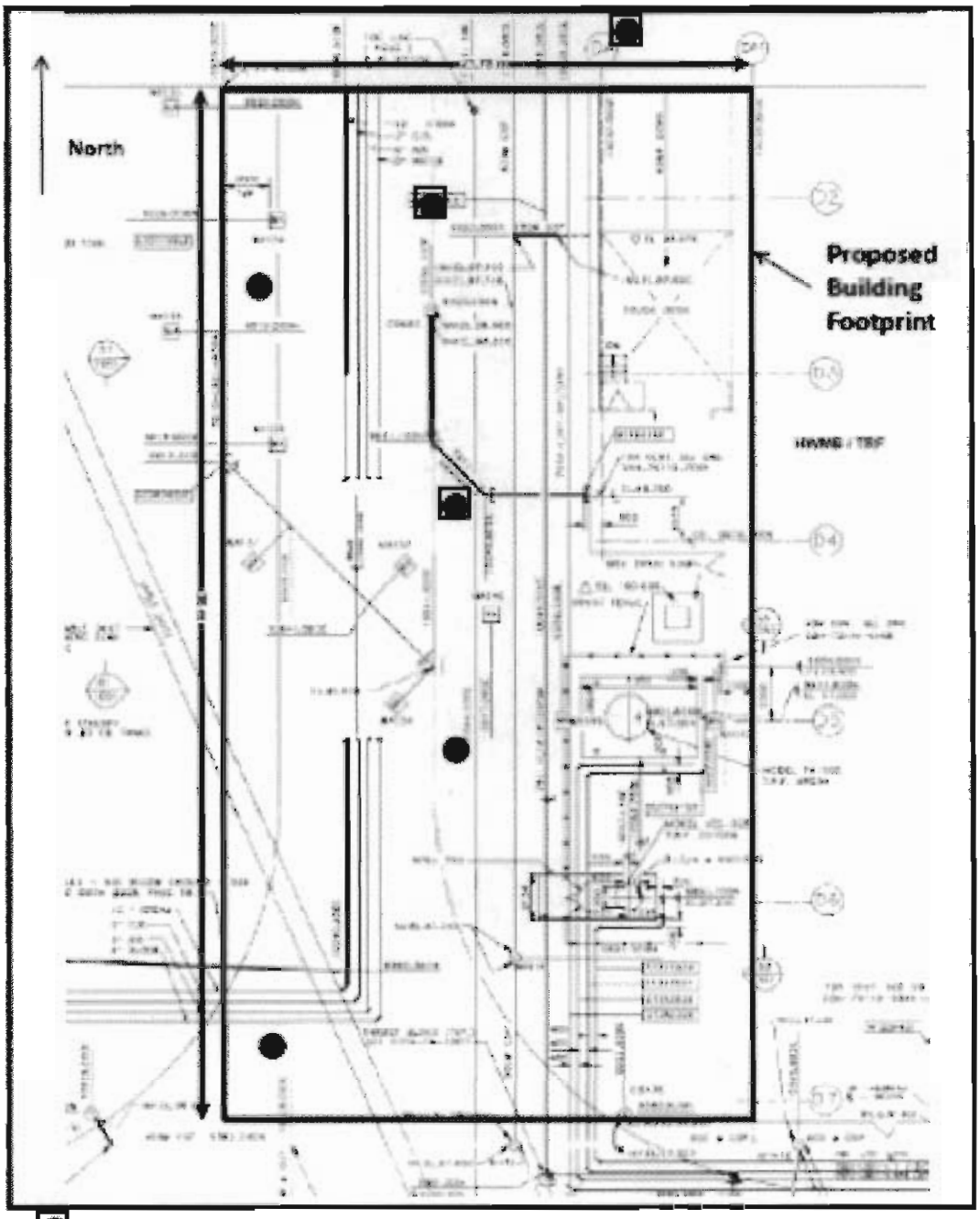
Potential Building Locations:

(a) Area immediately west of the TRF/HWMB

(b) Area behind the SG oil tanks (TK1 and TK2)

(c) Area east of the power

Appendix G: Location of Geotechnical Boreholes



Existing Geotechnical Borehole

Proposed Geotechnical Borehole

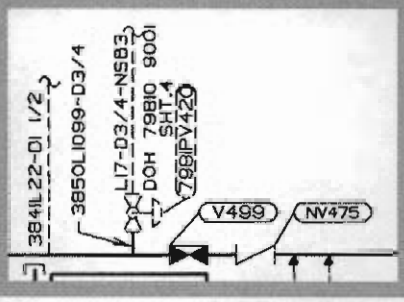
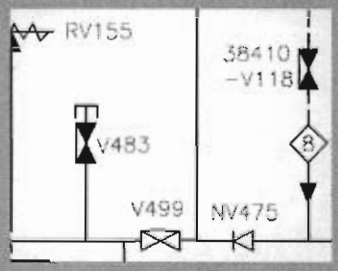
(Reference: NK38-D1H-10249-1343)

FIGURE 4.3-2
Proposed Borehole Locations for the New Heavy Water Storage Facility
OPG DARLINGTON WST SPILL PHASE II ESA
ONTARIO POWER GENERATION INC.
DARLINGTON, ONTARIO

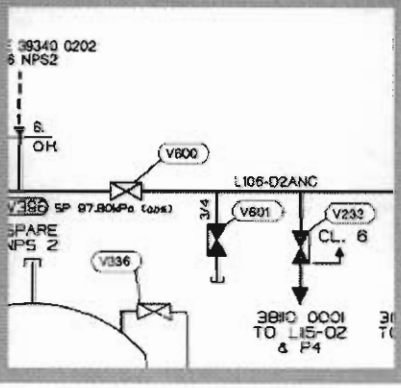
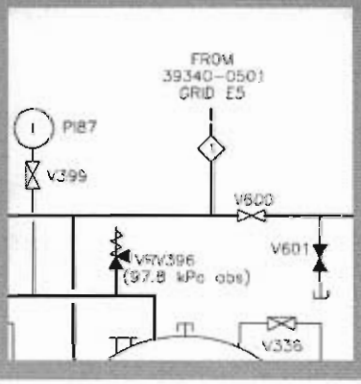
ONTARIO POWER GENERATION

Appendix H: Description of Known Potential Configuration Management Errors

CLOSED/OPEN – ERROR WHERE THE NORMAL OPERATING STATE OF A VALVE IS SHOWN AS CLOSED IN ONE REFERENCE AND OPEN IN THE CORRESPONDING REFERENCE

CLOSED/OPEN ERROR	FLOW DIAGRAM	FLOW SHEET
V499	NK38-F0H-38500-0002 R12 (SHOWN N. C.) 	NK38-FEX-38500-0502 R09 (SHOWN N.O.) 

TYPE – ERROR WHERE THE TYPE OF EQUIPMENT DIFFERS ON THE REFERENCE SHEETS OR WHERE INSTRUMENTATION IS NOT SHOWN ON BOTH REFERENCES

CLOSED/OPEN ERROR	FLOW DIAGRAM	FLOW SHEET
V600	NK38-F0H-38110-0003 R09 N.O. DIAPHRAGM VALVE SHOWN 	NK38-FEX-38110-0502 R04 N. O. GATE VALVE SHOWN 

# OF ERRORS	FLOW DIAGRAM	REV #	FLOW SHEET	REV #	CHG TYPE	EC#	CLOSED/OPEN ERROR	TYPE ERROR
6	NK38-F0H-38110-0001	14	NK38-FXX-38110-0501	9	DCR DCR	111188 67387	RV496, V229, RV129, RV130, V224	PT21/PI21
4	NK38-F0H-38110-0002-U1	9	NK38-FEX-38110-1501	5	DCR	86346	34520-PV29, PV38, 34330-PV29	PG25 / PI25
4	NK38-F0H-38110-0002-U2	9	NK38-FEX-38110-2501	7	DCR DCR	86346 87230	34520-PV29, PV38, 34330 PV29	PG25 / PI25
4	NK38-F0H-38110-0002-U3	9	NK38-FEX-38110-3501	4	DCR DCR	86346 87230	34520-PV29, PV38, 34330 PV29	PG25 / PI25
4	NK38-F0H-38110-0002-U4	9	NK38-FEX-38110-4501	3	DCR	86346	34520-PV29, PV38, 34330 PV29	PG25 / PI25
13	NK38-F0H-38110-0003	9	NK38-FEX-38110-0502	4	-	-	RV502, V313, V317, RV503, VRV395, V331, RV498, RV499, V302, V306, V330	V601, V600
4	NK38-F1H-38110-0004	8	NK38-FEX-38110-0503	8	-	-	PRV63, RV504	PG23/PI23, PG24/PI24
11	NK38-DRAW-38410-10002	1	NK38-FEX-38410-0502	9	-	-		FG311/FI311, FG301/FI301, FG302/FI302, FG303/FI303, FG304/FI304, FG305/FI305, FG306/FI306, FG308/FI308, FG309/FI309, FG310/FI310, V348
3	NK38-F0H-38410-0001	13	NK38-FEX-38410-	9	-	-	V117	FG6/FI6, PG24/PI24

			0502					
11	NK38-DRAW-38410-10002	1	NK38-FEX-38410-0503	1	-	-		FG311/FI311, FG301/FI301, FG302/FI302, FG303/FI303, FG304/FI304, FG305/FI305, FG306/FI306, FG308/FI308, FG309/FI309, FG310/FI310, V348
21	NK38-F0H-38410-0001	13	NK38-FXX-38410-0501	10	-	-	V12, V154, V219, V143, V137, V136, V144, V315, V314 V211 (MISSING)	PG20/PI20, PG22/PI22, PG28/PI28, PG27/PI27, PG21/PI21, PG25/PI25, PG34/PI34, FG9/FI9, FG8/FI8, FG39/FI39, LG36/LI36
6	NK38-F0H-38500-0001	16	NK38-FXX-38500-0501	9	DCR	90707	V364, RV497, RV496	PG4/PI4, V493, V492
8	NK38-F0H-38500-0002	12	NK38-FXX-38500-0501	9	-	-	V499, V364, RV497, RV496	V484, PG4/PI4, V493, V492
12	NK38-F0H-38500-0001	16	NK38-FEX-38500-2501	12	DCR	90707	RV199, V494, RV205, RV495, V69, RV490	V202, V46, V45, V47, V55, V56
2	NK38-F0H-38500-0002	12	NK38-FEX-38500-0502	9	-	-	V499, V484	
16	NK38-F0H-38500-0001	16	NK38-FEX-38500-1501	13	DCR	90707	V8, V7, RV199, V45, V47, V494, V46, RV205, V56, V55, RV495, V69, RV490, V477, V479	V57
13	NK38-F0H-38500-0001	16	NK38-FEX-38500-3501	9	DCR	90707	V8, V7, RV199, V45, V47, V494, V46, RV205, V56, V55, RV495, V69, RV490,	

16	NK38-F0H-38500-0001	16	NK38-FEX-38500-4501	8	DCR	90707	V8, V7, RV199, V47, V45, RV494, V46, RV205, V477, V479, RV495, V55, V56, RV490, V69	V202
20	NK38-F1H-33850-0001-U2	8	NK38-FXX-33300-2501	18	-	-	RV9	ALL VALVES SHOWN AS GLOBE ON FD, GATE ON FS
5	NK38-F0H-72700-0007	24	NK38-FEX-72700-1501	8	DCR DCR DCR	86261 10421 5 10941 5	RV726, RV717	V7579, V703/794 (MISSING)
7	NK38-F0H-72700-0007	24	NK38-FEX-72700-0506	7	DCR DCR DCR	86261 10421 5 10941 5	V7551, V7550, V7555, V7554	V7510, V7540, V9258 (NO FD REF)
2	NK38-F0H-73690-0002	11	NK38-FEX-73690-0502	7	-	-	NONE	DP24, DP180 MISSING
0	NK38-F0H-73690-0003	15	NK38-FXX-73690-0503	10	DCR	10634 5	NONE	NONE
5	NK38-F0H-74250-0002	35	NK38-FEX-74250-3501	10	DCN NIC R MO D DCR DCR	11267 7 10150 9 98815 20764 10851 6	V9066	V9018, V46, V1504, V1505

3	NK38-F0H-79710-0003	21	NK38-FEX-79710-0503	10	MOD	99572	NONE	V902, V906, V908
0	NK38-F1H-75110-0006	7	NK38-FEX-75110-0506	5	-	-	NONE	NONE
0	NK38-F1H-75130-0006	12	NK38-FEX-75130-0505	6	-	-	NONE	NONE
7	NK38-F1H-75160-0004	15	NK38-FEX-75160-0504	8	DCR DCR DCR	106454 106455 106456	RV 640, RV646	V559, V560, V681, V2012, V2010
2	NK38-F1H-79110-0011	3	NK38-FEX-79110-0508	3	-	-	NONE	PG144/PI144, PG145/PI145
1	NK38-F1H-79110-0012	4	NK38-FEX-79110-0508	3	-	-	NONE	DB-D4 MISSING
1	NK38-F5H-78110-0009	9	NK38-FEX-78110-0503	9	MOD	114782	NONE	V127
TOTAL 211 ITEMS								

Appendix I: Schedule Definitions

Level 1 Schedule - Executive Summary, also called a Project Master Schedule (PMS).

This is a major milestone type of schedule; usually only one page, it highlights major project activities, milestones, and key deliverables for the whole project. It is used to summarise the project schedule in reports and other documents when a more detailed schedule is not required. Audiences for this schedule Level include, but are not limited to client, senior executives and general managers. If included with a bid and/or the Contract, demonstrates conformance to contractual and other milestones.

Level 2 Schedule - Management Summary, also called a Summary Master Schedule (SMS).

Maintained as a summarisation of the Level 3 Project Coordination Schedule(s). It depicts the overall project broken down into its major components by area and is used for higher-level management reporting. It will include the Level 1 information expanded to show activities by area or major item of capital equipment. Should demonstrate the driving path for structures and major process systems at the CSI Division Level (e.g., Earthwork, Foundations, Framing, Enclosure, MEP Services and Process Equipment), based on the project method statement. Audiences for this type of schedule include, but are not limited to general managers, sponsors, and program or project managers.

Level 3 Schedule - Project Coordination Schedule (PCS) also called a Publication Schedule.

Initially developed as an integrated Critical Path Methodology (CPM) overview of the project, the Level 3 schedule is then maintained as an integrated rollup or summary of the Level 4 schedule activities for reporting status to senior management and to report monthly status. The schedule consists of a set of integrated Level 4 schedules based on CPM and is developed with detailed input from the project management team. Usually developed by the 'main contractor' as part of its tendering process for the project or by the project team during the initial phases of planning. The Level 3 schedule spans the whole of the project and is used to support the monthly report. It includes all major milestones, major elements of design (design engineering change package level), engineering, procurement, construction, testing, commissioning and/or start-up. During the execution phase of the project this schedule defines the overall critical path and is the primary coordination tool for the overall project. Audiences for this type of schedule include, but are not limited to program or project managers, CMs or owner's representatives, super-intendents, and general foremen.

Level 4 Schedule - Execution Schedule, also called a Project Working Level Schedule.

Will not be required for formal status report submittals on this project.

Level 4 is the detailed working level schedule, where each schedule is an expansion of part of a Level 3 schedule, and is established within the integrated project schedule. This is the key working level CPM schedule displaying the activities to be accomplished by the project workforce and is required for every project. The dates generated by the schedule activities represent the anticipated start and completion of work required to complete the project.
If there is no 'Level 3' schedule, activities in future months/years may be summary in nature but still provide approximate start and completion dates for major pieces of work (this is called

'rolling wave scheduling'). Developed by the 'contractor', 'subcontractor' (trade contractor), or the project team prior to commencing work on the project execution, or work in a phase or area of the project. The Level 4 schedule may be for the whole of the project or a part of the project depending on the size of the project and complexity of the work. A critical factor is keeping each 'Level 4' schedule to a sensible size that can be easily managed, updated, validated, etc. 'Level 4' schedules may be for major sections of the work or for discrete processes such as a 'Design Schedule', 'Procurement schedule' and/or a 'Commissioning Schedule'. Generally, the 'Level 4' schedule represents the area of authority of a section manager or engineer, so one manager is responsible for all of the work in the schedule. Activities are generally over a week in duration (depending on the nature of the project) and should be resource loaded at least in the near term and include detailed crew movements and other means and methods to ensure viability. Where used, short term 'look ahead' are produced from this level; typically 'Three Week Look-ahead' schedules are updated every two weeks. Audiences for this type of schedule include but are not limited to project managers, superintendents, and general foremen.

Level 5 Schedule - Detail Schedule.

Will not be required for formal status report submittals on this project.

The further breakdown of the activities of a Level 4 Schedule. A short term schedule used to map out the detailed tasks needed to coordinate day to day work in a specific areas. Level 5 schedules are developed by workforce supervisors to plan and coordinate their work at the detail level; Workarounds and critical areas can be exploded here. Typically Bar Charts (Gantt Charts), the schedules are replaced every 1, 2 or 4 weeks depending on the complexity of the work, typically schedules extend for 1 or 2 weeks beyond the date when the replacement is due (eg a 'weekly schedule' will extend for 2 weeks and be updated/replaced each week), this encourages continuity of working. Audiences for this type of schedule include but are not limited to superintendents, team leaders, crew leaders, general foremen, foremen and sub-foremen.

Acronym List

AACE:	Association for the Advancement of Cost Engineering
ACB:	Affected Catalogue Bill of Materials List
ADL:	Affected Document List
AEL:	Affected Equipment List
AFS:	Available for Service
ANSI:	American National Standards Institute
ASL:	Approved Suppliers List
ASME:	American Society of Mechanical Engineers
ASTM:	American Society of Testing and Materials
AVL:	Approved Vendor List
BOM:	Bill of Materials
CAL:	Computer Assisted Learning
CAT ID:	Catalogue Identification Number
CBT:	Computer Based Training
CNSC:	Canadian Nuclear Safety Commission
CPM:	Critical Path Methodology
CRN:	Canadian Registration Number
CSA:	Canadian Safety Association
CSI:	Construction Specification Institute
DA:	Design Authority
DAIA:	Contractor Interface Agreement
DBOM:	Drawing Bill of Materials
DCU:	Distributed Control Unit (for TRF/HWMB)
DOM:	Director of Operations and Maintenance

DTL:	Design Team Leader
DE:	Design Engineer
DEC:	Design Engineering Change (package)
DNGS:	Darlington Nuclear Generating Station
EBOM:	Equipment Bill of Materials
ECC:	Engineering Change Control
ES-MSA:	Extended Services Master Service Agreement
EQ:	Environmental Qualification
FAAGM:	Fixed Area Alarming Gamma Monitors
FAATM:	Fixed Area Alarming Tritium Monitors
FIC:	Field Initiated Change
HFE:	Human Factors Engineering
HSI:	Human System Interface
HWMB:	Heavy Water Management Building
IEEE:	Institute of Electronic and Electronics Engineers
IR:	Interface Requirements (equivalent to a DAIA)
ISO:	International Organization for Standardization
MCR:	Main Control Room
MOTS:	Modifiable off-the Shelf Software
MTL:	Modification Team Leader
NBCC:	National Building Code of CANADA
NEMA:	National Electrical Manufactures Association
NFCC:	National Fire Code of Canada
NFPA:	National Fire Protection Act
NGET:	Nuclear General Employee Training

OHSA:	Occupational Health and Safety Act (Ontario)
OLW:	On-line Wiring
OPEX:	Operating Experience
OPG:	Ontario Power Generation
OPGN:	Ontario Power Generation Nuclear
OPS:	Operations
OPP:	Operating Policies and Principles
PCS:	Project Coordination Schedule
PDRI:	Project Definition Rating Index
P. Eng:	Professional Engineer
PJB:	Pre-job Brief
PNGS:	Pickering Nuclear Generating Station
PO:	Purchase Order
PSR:	Pre-Start Health and Safety Reviews
QA:	Quality Assurance
RFP:	Request for Proposals
RPTC:	Real-Time Process Computing
RV:	Relief Valve
SCO:	Station Containment Outage
SESA:	Scientific, Engineering and Safety Analysis
SCR:	Station Condition Record
SG:	Standby Generators
SM:	Section Manager
SME:	Subject Matter Expert
SMP:	Software Maintenance Plan

SMS:	Summary Master Schedule
SPOC:	Single Point of Contact
SRE:	System Responsible Engineer
SSC:	Systems, Structures and Components
SQA:	Software Quality Assurance
TOC:	Total Organic Carbon
TRF:	Tritium Removal Facility
TSDS:	Technical Specification Data Sheets
VBO:	Vacuum Building Outage