

October 28, 2016

CD# 92896-CORR-00531-01031

**Mr. Marc Leblanc**  
Commission Secretary  
Canadian Nuclear Safety Commission  
280 Slater Street  
Ottawa, Ontario  
K1P 5S9

Dear Mr. Leblanc:

**Application for Renewal of Pickering Waste Management Facility  
Operating Licence**

Reference: 1. OPG letter, L. Swami to K. Glenn, "Letter of Intent to Renew the Pickering Waste Management Facility Waste Facility Operating Licence WFOL-W4-350.02/2018," October 7, 2016, CD# 92896-CORR-00531-01036.

The purpose of this letter is to request approval from the Canadian Nuclear Safety Commission (CNSC) to renew the Pickering Waste Management Facility (PWMF) Waste Facility Operating Licence, WFOL-W4-350.02/2018 for another term to August 31, 2028. The current ten-year operating licence expires on March 31, 2018.

Ontario Power Generation (OPG) Inc. is located at 700 University Avenue, Toronto, Ontario, M5G 1X6. The PWMF is located on the Pickering Nuclear site within the Regional Municipality of Durham, in the City of Pickering in southern Ontario. The PWMF is licensed by the CNSC under section 24(2) of the *Nuclear Safety and Control Act* to provide for the safe handling, management and interim storage of radioactive wastes.

As described in Reference 1, upon renewal, OPG requests authorization for the following buildings to be included in the PWMF operating licence Appendix C associated with Part IV d) for the site preparation, construction or construction modification of:

- Dry Storage Container (DSC) Storage Building #4 (carried over from current licence);
- DSC Storage Buildings #5 and #6 (new), and
- a new DSC Processing Building (new).

These facilities would not alter the basic purpose and activities associated with the PWMF. The additional DSC Storage Buildings will allow OPG to store all of the used fuel generated by Pickering Nuclear Generating Station (NGS) to the end of its commercial operational life. The new DSC Processing Building would increase processing capabilities from 50 DSCs to approximately 100 DSCs per year. PWMF will continue to provide safe, interim dry storage of used fuel generated by Pickering NGS under the current Power Reactor Operating Licence.

No significant changes are anticipated in the designs that have previously been accepted by the CNSC for the DSC Storage Buildings. The new DSC Processing Building design will be similar to those in operation at OPG's Western Waste Management Facility and the Darlington Waste Management Facility. Prior to construction, specific project design requirements will be submitted to the CNSC in accordance with the PWMF operating licence Licence Condition 3.2.

This licence renewal application demonstrates that OPG is qualified to operate the PWMF, and has made adequate provision for the protection of the environment, the health and safety of persons, and the maintenance of national security measures required to implement international obligations to which Canada has agreed.

The applicable Regulations under the *Nuclear Safety and Control Act* require specific information to be contained in an application for licence renewal. The following attachments are included with this application:

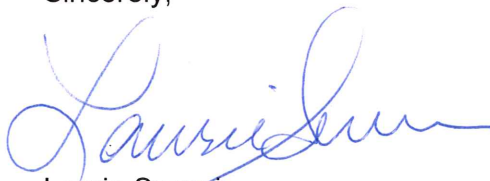
- Attachment 1 provides a copy of the Land Ownership Deed;
- Attachment 2 provides a matrix that identifies the specific location of the information to support the PWMF operating licence renewal application (Table 1) and identifies changes from the previous application (Table 2), and
- Attachment 3 provides the application and describes the objective of each Safety and Control Area and the programs in place to ensure compliance with the objectives. Also described is PWMF's performance since the last licence renewal in 2008 and our planned improvements.

Table 1 provides a list of commitments made in this application and their target completion dates.

Consistent with OPG's approach towards open and transparent public communications, OPG will post this application on its external website [www.opg.com](http://www.opg.com).

Should you have any questions, or requests for further information, please contact Ms. Leslie Mitchell, Manager, Regulatory Programs Strategy and Support, at [leslie.j.mitchell@opg.com](mailto:leslie.j.mitchell@opg.com), or (905) 839-6746 ext. 5198, or cell at 905-767-1530.

Sincerely,



Laurie Swami  
Senior Vice President  
Decommissioning & Nuclear Waste Management

Attach.

cc:	Haidy Tadros	CNSC (Ottawa)
	Karine Glenn	CNSC (Ottawa)
	Shirley Oue	CNSC (Ottawa)
	Shona Thompson	CNSC (Ottawa)

**Table 1****Summary of Regulatory Obligation Actions made in this Letter**

**Submission Title:** "Application for Renewal of Pickering Waste Management Facility Operating Licence"

**Regulatory Obligation Actions (REGO):**

No.	Description	Target Completion Date
1.	PWMF will meet the requirements of REGDOC-2.6.3, <i>Aging Management</i> .	July 15, 2017
2.	PWMF will meet the requirements of CSA Standards N292.0-14, <i>General Principles for the Management of Radioactive Waste and Irradiated Fuel</i> , N292.2-13, <i>Interim Dry Storage of Irradiate Fuel</i> , and N292.3-14, <i>Management of low-and-intermediate-Level Radioactive Waste</i> .	October 31, 2017
3.	PWMF will complete the implementation plan for meeting the requirements of CSA Standard N393-13, <i>Fire Protection for Facilities that Process, Handle, or Store Nuclear Substances</i> and provide a compliance date.	December 15, 2017
4.	PWMF will meet the requirements of REGDOC 2.10.1, <i>Nuclear Emergency Preparedness and Response (2014)</i> .	December 31, 2018

Attachment 1 to OPG Letter, L. Swami to Marc Leblanc,  
“Application for Renewal of Pickering Waste Management Facility Operating Licence,”  
CD# 92896-CORR-00531-01031

**ATTACHMENT 1**

**Land Ownership and Control Deed**

Note: OPG-Pickering Waste Inc. is a wholly-owned subsidiary of Ontario Power Generation Inc., and is controlled by Ontario Power Generation Inc.

SoftDocs 4.1 Wordprocessor Interface  
P900468

### Transfer/Deed of Land

Form 1 — Land Registration Reform Act

**A**

**(1) Registry**  **Land Titles**  **(2) Page** of 3 pages

**(3) Property Identifier(s)** Block 26326 Property 0143(LT) - Part Additional: See Schedule

**(4) Consideration** NIL **P900468**  
00/100 Dollars \$NIL

**(5) Description** This is a: Property Division  Property Consolidation   
Parcel B.F. 2-19-1, Section Pickering being part of the Bed of Lake Ontario Opposite Lots 19 and 20 in Range 2 Broken Front Concession, designated as PART 1 on Plan 40R-18880, Town of Pickering, Regional Municipality of Durham - continued on Schedule annexed

**(6) This Document Contains** (a) Redescription  New Easement Plan/Sketch (b) Schedule for: Description  Additional Parties  Other  **(7) Interest/Estate Transferred** Fee Simple

**(8) Transferor(s)** The transferor hereby transfers the land to the transferee ~~and that the transferee shall have the land for a term of years and that~~ see attached Schedule A entitled "Electricity Act, 1998 Registration Statement".

Name(s) <b>OPG-PICKERING WASTE INC.</b>	Signature(s) By: <i>David W. Drinkwater</i> Name: David W. Drinkwater Title: Executive Vice President Law and Corporate Development	Date of Signature Y M D 2001 2 5
We have the authority to bind the corporation.	By: <i>Richard D. Cerni</i> Name: Richard D. Cerni Title: Executive Vice President and Corporate Secretary	Date of Signature Y M D 2001 2 5

**(9) Spouse(s) of Transferor(s)** I hereby consent to this transaction.  
Name(s) \_\_\_\_\_ Signature(s) \_\_\_\_\_ Date of Signature Y M D \_\_\_\_\_

**(10) Transferor(s) Address for Service** C/o 700 University Avenue, Toronto, Ontario M5G 1X6 (Attention: Legal Department)

**(11) Transferee(s)** **OPG-PICKERING WASTE INC.** Date of Birth Y M D \_\_\_\_\_

**(12) Transferee(s) Address for Service** C/o 700 University Avenue, Toronto, Ontario M5G 1X6 (Attention: Legal Department)

**(13) Transferor(s)** The transferor verifies that to the best of the transferor's knowledge and belief, this transfer does not contravene section 50 of the Planning Act. Date of Signature Y M D \_\_\_\_\_

Signature \_\_\_\_\_ Signature \_\_\_\_\_

Solicitor for Transferor(s) I have explained the effect of section 50 of the Planning Act to the transferor and I have made inquiries of the transferor to determine that this transfer does not contravene that section and based on the information supplied by the transferor, to the best of my knowledge and belief, this transfer does not contravene that section. I am an Ontario solicitor in good standing. Date of Signature Y M D \_\_\_\_\_

Name and Address of Solicitor \_\_\_\_\_ Signature \_\_\_\_\_

**(14) Solicitor for Transferee(s)** I have investigated the title to this land and to abutting land where relevant and I am satisfied that the title records reveal no contravention as set out in subclause 50(22)(c)(ii) of the Planning Act and that to the best of my knowledge and belief this transfer does not contravene section 50 of the Planning Act. I act independently of the solicitor for the transferor(s) and I am an Ontario solicitor in good standing.

Name and Address of Solicitor \_\_\_\_\_ Date of Signature Y M D \_\_\_\_\_

Signature \_\_\_\_\_

**(15) Assessment Roll Number of Property** \_\_\_\_\_ City: \_\_\_\_\_ Mun: \_\_\_\_\_ Map: \_\_\_\_\_ Sub: \_\_\_\_\_ Par: \_\_\_\_\_

**(16) Municipal Address of Property** Pickering Nuclear G.S. (Part)  
Pickering, Ontario  
11158189.1

**(17) Document Prepared by:** **BLAKE, CASSELS & GRAYDON LLP**  
Barristers and Solicitors  
Box 25, Commerce Court West  
Toronto, Ontario M5L 1A9  
(416) 863-2400  
ATTENTION: Edward M. Perlmutter

**FOR OFFICE USE ONLY**

<b>Fees and Tax</b>	
Registration Fee	60
Land Transfer Tax	NILA
<b>Total</b>	

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SCHEDULE A  
TO TRANSFER/DEED OF LAND

P900468

ELECTRICITY ACT, 1998 REGISTRATION STATEMENT

1. The Transferor is the transferor referred to in Box (8) in the Form 1 (Transfer/Deed of Land) under the *Land Registration Reform Act* to which this schedule is attached, is a person referred to in section 124 of the *Electricity Act, 1998* and is a person from which no consent was required in respect of the transfer in the transfer order, as amended, pursuant to subsection 116(5) of the *Electricity Act, 1998*.
2. The interests described in Box (7) in the lands (the "Lands") described in Box (5) in the Form 1 under the *Land Registration Reform Act* to which this schedule is attached were transferred unconditionally to the Transferor from Ontario Hydro by or pursuant to a Transfer Order, as amended, made under the *Electricity Act, 1998*, which transfer has taken effect.
3. There were no conditions or other provisions in the Transfer Order, as amended, that restrict the power or right of the Transferor to transfer to the Transferee the interest described in Box (7) in the Lands.
4. The foregoing statements are statements made pursuant to section 124 of the *Electricity Act, 1998*.
5. This transfer/deed of land is being registered to record the name of Transferee on title to the Lands.
6. Pursuant to Section 135 of the *Electricity Act, 1998* the *Land Transfer Tax Act* does not apply to any transfer of assets by or pursuant to a transfer order.
7. Where applicable, by the *Power Commission Amendment Act, 1973* proclaimed March 4, 1974, the name of The Hydro-Electric Power Commission of Ontario was changed to Ontario Hydro.

SCHEDULE

PICKERING NUCLEAR GENERATING STATION

**P900468**

Legal Description

OPG – PICKERING WASTE INC.

**PIN: 26326-0143 (LT) - Part**

Parcel B.F. 2-19-1, Section Pickering being part of the Bed of Lake Ontario Opposite Lots 19 and 20 in Range 2 Broken Front Concession, designated as PART 1 on Plan 40R-18880, Town of Pickering, Regional Municipality of Durham

TOGETHER WITH an easement for access over part of Lot 19, Range 2, Broken Front Concession and part of the road allowance between Lots 18 and 19, Range 2, Broken Front Concession, closed by By-law 110-74 registered as Instrument No. D190 and now described as PART 13 on Reference Plan 40R-18858.

TOGETHER WITH an easement for access over that part of the bed of Lake Ontario opposite Lots 19 and 20, Range 2, Broken Front Concession, designated as PART 2 on Reference Plan 40R-18880.

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PLANNING	PLANNING	PLANNING	PLANNING
APPROVED	APPROVED	APPROVED	APPROVED
DATE	DATE	DATE	DATE
BY	BY	BY	BY

PLANNING  
APPROVED  
DATE  
BY

P900488

PLAN OF SURVEY OF  
PART OF THE BED OF LAKE  
ONTARIO, BEING  
RANGE 2, B.F.C. AND OPPOSITE  
BLOCKS A AND B  
REGISTERED PLAN 518 (LOCATION MY76)  
ON THE WEST SIDE OF  
MONTGOMERY PARK ROAD IN FRONT  
OF LOTS 21 AND 22,  
RANGE 2, B.F.C. (LOCATION MY45)  
TOWN OF PICKERING  
REGIONAL MUNICIPALITY OF DURHAM

SCALE: 1:2000  
MONTGOMERY PARK ROAD  
CONFESSION

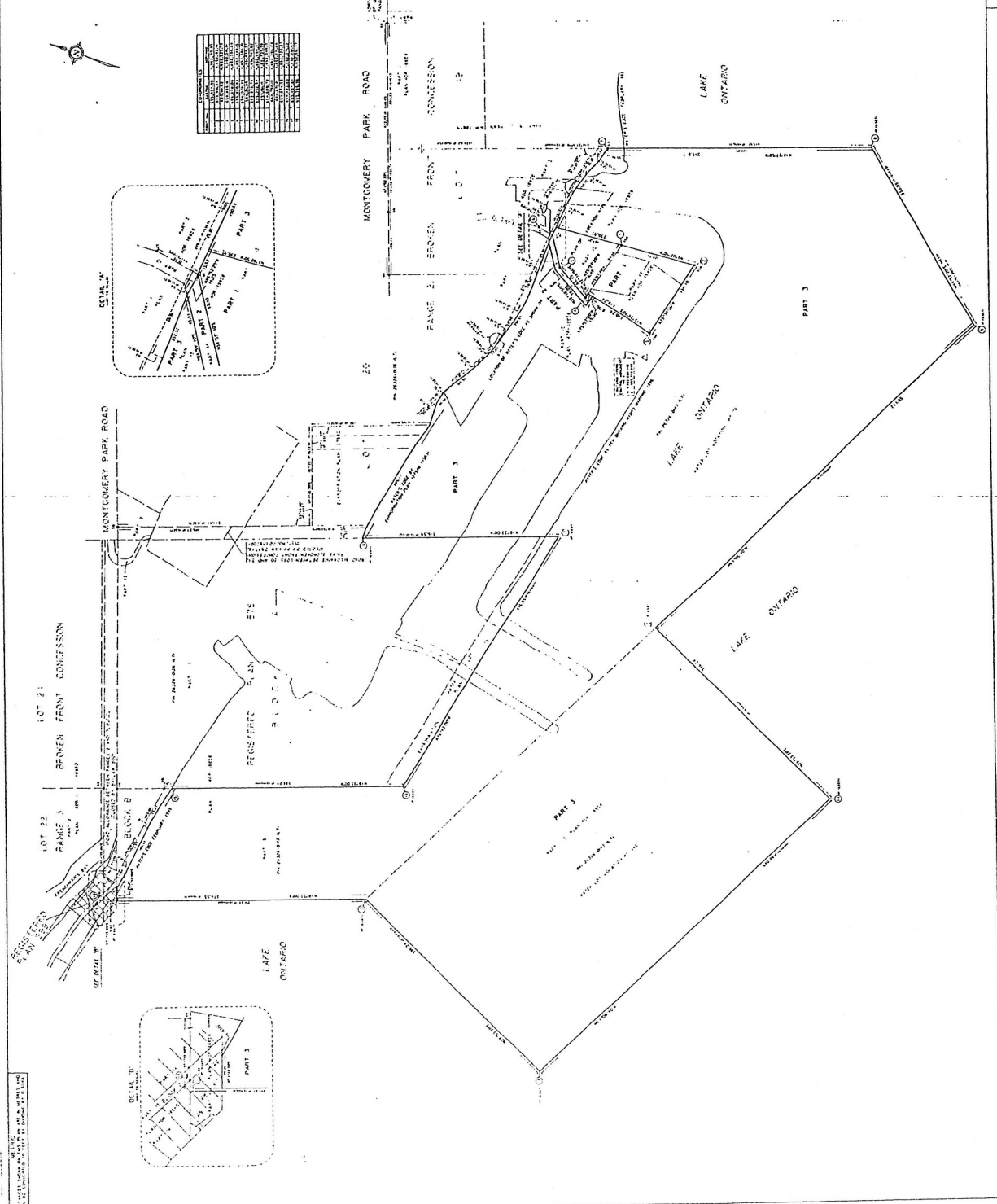
NOTES:  
1. THE SURVEY IS BASED ON THE REGISTERED PLAN 518 (LOCATION MY76) AND THE REGISTERED PLAN 519 (LOCATION MY77) AS SHOWN ON THE ATTACHED MAPS.  
2. THE SURVEY IS BASED ON THE REGISTERED PLAN 518 (LOCATION MY76) AND THE REGISTERED PLAN 519 (LOCATION MY77) AS SHOWN ON THE ATTACHED MAPS.  
3. THE SURVEY IS BASED ON THE REGISTERED PLAN 518 (LOCATION MY76) AND THE REGISTERED PLAN 519 (LOCATION MY77) AS SHOWN ON THE ATTACHED MAPS.  
4. THE SURVEY IS BASED ON THE REGISTERED PLAN 518 (LOCATION MY76) AND THE REGISTERED PLAN 519 (LOCATION MY77) AS SHOWN ON THE ATTACHED MAPS.

LEGEND  
1. ...  
2. ...  
3. ...  
4. ...

SURVEYOR'S CERTIFICATE

I, the undersigned, being a duly qualified and licensed Surveyor, do hereby certify that the foregoing is a true and correct copy of the original plan as shown to me by the applicant, and that the same has been approved by me in accordance with the provisions of the Survey Act, R.S.O. 1990, Chapter S.5, and the Regulations thereunder.

**BENNETT-YOUNG LIMITED**  
SURVEYORS  
1000 SHEPPARD AVENUE EAST, SUITE 100  
SCARBOROUGH, ONTARIO M1S 1T7  
TEL: (416) 291-1111  
FAX: (416) 291-1112  
WWW.BENNETT-YOUNG.COM





Attachment 2 to OPG Letter, L. Swami to Marc Leblanc,  
“Application for Renewal of Pickering Waste Management Facility Operating Licence,”  
CD# 92896-CORR-00531-01031

**ATTACHMENT 2**

**PWMF Licence Renewal Application Matrix (Table 1)**

**and**

**Changes Between Previous Application and Current Application (Table 2)**

## PWMF Licence Renewal Application Matrix

Table 1			
Regulatory Requirement	Description of Regulatory Requirement	Related Safety Control Area	Location in Submission
<b>General Nuclear Safety and Control Regulations</b>			
<b>General Application Requirements</b>			
3. (1) An application for a licence shall contain the following information;			
(a)	The applicant's name and business address;	Not Applicable	Ontario Power Generation Inc. 700 University Avenue Toronto, Ontario M5G 1X6  <u>Mailing Address c/o:</u> Ms. Laurie Swami Senior Vice President Decommissioning and Nuclear Waste Management 1340 Pickering Parkway, 4 <sup>th</sup> Floor Pickering, Ontario L1V 0C4
(b)	The activity to be licensed and its purpose;	Not Applicable	Cover Letter – OPG letter, Laurie Swami to Marc Leblanc, “Application for Renewal of Pickering Waste Management Facility Operating Licence”, October 28, 2016, CD# 92896-CORR-00531-01031.
(c)	The name, maximum quantity and form of any nuclear substance to be encompassed by the licence;	Not Applicable	Attachment 3, Section 1.1
(d)	A description of any nuclear facility, prescribed equipment or prescribed information to be encompassed by the licence;	Security	Attachment 3, Section 2.12

PWMF Licence Renewal Application Matrix (cont'd)

<b>Table 1</b>			
<b>Regulatory Requirement</b>	<b>Description of Regulatory Requirement</b>	<b>Related Safety Control Area</b>	<b>Location in Submission</b>
(e)	The proposed measures to ensure compliance with the <i>Radiation Protection Regulations</i> , the <i>Nuclear Security Regulations</i> and the <i>Packaging and Transport of Nuclear Substances Regulations</i> , 2015;	Radiation Protection  Security  Packaging & Transport	Attachment 3, Section 2.7  Attachment 3, Section 2.12  Attachment 3, Section 2.14
(f)	Any proposed action level for the purpose of section 6 of the <i>Radiation Protection Regulations</i> ;	Radiation Protection  Environmental Protection	Attachment 3, Section 2.7  Attachment 3, Section 2.9
(g)	The proposed measures to control access to the site of the activity to be licensed and the nuclear substance, prescribed equipment or prescribed information;	Security  Radiation Protection	Attachment 3, Section 2.12  Attachment 3, Section 2.7
(h)	The proposed measures to prevent loss or illegal use, possession or removal of the nuclear substance, prescribed equipment or prescribed information;	Security	Attachment 3, Section 2.12
(i)	A description and the results of any test, analysis or calculation performed to substantiate the information included in the application;	Not Applicable	Attachment 3, Section 1.1
(j)	The name, quantity, form, origin and volume of any radioactive waste or hazardous waste that may result from the activity to be licensed, including waste that may be stored, managed, processed or disposed of at the site of the activity to be licensed, and the proposed method for managing and disposing of that waste;	Waste Management	Attachment 3, Section 2.11

PWMF Licence Renewal Application Matrix (cont'd)

<b>Table 1</b>			
<b>Regulatory Requirement</b>	<b>Description of Regulatory Requirement</b>	<b>Related Safety Control Area</b>	<b>Location in Submission</b>
(k)	The applicant's organizational management structure insofar as it may bear on the applicant's compliance with the Act and the regulations made under the Act, including the internal allocation of functions, responsibilities and authority;	Management System	Attachment 3, Section 2.1
(l)	A description of any proposed financial guarantee relating to the activity to be licensed;	Other Matters of Regulatory Interest - Financial Guarantee	Attachment 3, Section 3.5
(m)	Any other information required by the Act or the regulations made under the Act for the activity to be licensed and the nuclear substance, nuclear facility, prescribed equipment or prescribed information to be encompassed by the licence.	Not Applicable	Not Applicable
(1.1)	<p>The Commission or a designated officer authorized under paragraph 37(2)(c) of the Act, may require any other information that is necessary to enable the Commission or the designated officer to determine whether the applicant:</p> <p>(a) is qualified to carry on the activity to be licensed, or</p> <p>(b) will, in carrying on that activity, make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.</p>	Not Applicable	Refer to "Other Information" below.

PWMF Licence Renewal Application Matrix (cont'd)

<b>Table 1</b>			
<b>Regulatory Requirement</b>	<b>Description of Regulatory Requirement</b>	<b>Related Safety Control Area</b>	<b>Location in Submission</b>
(2)	Subsection (1) does not apply in respect of an application for a licence to import or export for which the information requirements are prescribed by the <i>Nuclear Non-Proliferation Import and Export Control Regulations</i> , or in respect of an application for a licence to transport while in transit for which the information requirements are prescribed by the <i>Packaging and Transport of Nuclear Substances Regulations, 2015</i> .	Not Applicable	Not Applicable
<b>Other Information</b>			
(1)	Summary of programs and supporting documentation needed to support the licence application organized under each SCA, including other matters of regulatory interest. The programs and supporting documentation should be sufficiently detailed to describe the safety and control measures that will be implemented at PWMF for each SCA.	All Safety and Control Areas (SCAs)	Attachment 3, Sections 2.1 to 2.14
(2)	Description of PWMF's approach to safety, including reference to corporate and facility specific documents which enunciate the safety policies and standards to which PWMF must adhere.	Management System  Radiation Protection  Conventional Health & Safety	Attachment 3, Sections 2.1.1 & 2.1.6  Attachment 3, Section 2.7  Attachment 3, Section 2.8
(3)	Documents describing the organizational structure, roles and responsibilities of organizational units and management; including documents governing the day to day operation and conduct of the organization.	Management System	Attachment 3, Section 2.1
(4)	Information on PWMF's performance for each SCA during the current licence period, relative to OPG's expectations, including any trends.	All SCAs	Attachment 3, Sections 2.1 to 2.14

PWMF Licence Renewal Application Matrix (cont'd)

<b>Table 1</b>			
<b>Regulatory Requirement</b>	<b>Description of Regulatory Requirement</b>	<b>Related Safety Control Area</b>	<b>Location in Submission</b>
(5)	Assessment of existing and future safety challenges, along with a safety improvement plan to address these challenges during the next licence period.	All SCAs	Attachment 3, Sections 2.1 to 2.14
(6)	Describe opportunities for improvements and any safety improvement plans to address identified safety challenges.	All SCAs	Attachment 3, Sections 2.1 to 2.14
(7)	A description of the proposed operating plan for the next licensing period.	Not Applicable  Operating Performance	Attachment 3, Section 1.0  Attachment 3, Section 2.3
(8)	Information on significant activities envisaged beyond the end of the next licensing period, if any.	All SCAs	Attachment 3, Sections 2.1 to 2.14
(9)	Provide a list of federal, provincial, municipal or other regulations, other than the regulations pursuant to the <i>Nuclear Safety and Control Act</i> (NSCA), which PWMF must abide by.	Other Matters of Regulatory Interest – Other Relevant Regulations, Obligations and Permits	Attachment 3, Section 3.10.1
(10)	Provide a description of any obligations for municipal, provincial or other federal authorities and any obligations for public and/or private organizations.	Other Matters of Regulatory Interest – Other Relevant Regulations, Obligations and Permits	Attachment 3, Section 3.10.1
(11)	Provide a list of any permits, certificates and licences issued by authorities other than the CNSC.	Other Matters of Regulatory Interest - Other Relevant Regulations, Obligations and Permits	Attachment 3, Section 3.10.1
(12)	Provide updated Derived Release Limits and Operating Release Limit reports for the facility.	Environmental Protection	Attachment 3, Section 2.9
(13)	Provide OPG's plans and schedule, including dates, with respect to complying with the standards, codes and CNSC regulatory documents, including transition measures as appropriate.	All SCAs	Attachment 3, Sections 2.1 to 2.14

PWMF Licence Renewal Application Matrix (cont'd)

<b>Table 1</b>			
<b>Regulatory Requirement</b>	<b>Description of Regulatory Requirement</b>	<b>Related Safety Control Area</b>	<b>Location in Submission</b>
(14)	Summary of the current status of all open actions items, as well as issues and requests that were discussed during the last PWMF Commission hearings or meetings, including a plan and date for resolution.	Other Matters of Regulatory Interest – Open Action Items Discussed in CNSC Hearings and Meetings	Attachment 3, Section 3.10.2
(15)	Provide justification to ensure that any proposed action level for the purpose of section 6 of the <i>Radiation Protection Regulations</i> will provide timely warning of any potential or actual loss of control of part of the radiation protection program.	Radiation Protection  Environmental Protection	Attachment 3, Section 2.7  Attachment 3, Section 2.9
<b>Application for Renewal of Licence</b>			
5. An application for the renewal of a licence shall contain:			
(a)	The information required to be contained in an application for that licence by the applicable regulations made under the Act; and	Not Applicable	Attachments 1, 2 and 3
(b)	A statement identifying the changes in the information that was previously submitted.	Not Applicable	Attachment 2, Table 2: "Changes Between Previous Application and Current Application"
<b>Obligations – Representatives of Applicants and Licensees</b>			
15. Every applicant for a licence and every licensee shall notify the Commission of			
(a)	the persons who have authority to act for them in their dealings with the Commission;	Management System	Attachment 3, Section 2.1.10
(b)	the names and position titles of the persons who are responsible for the management and control of the licensed activity and the nuclear substance, nuclear facility, prescribed equipment or prescribed information encompassed by the licence; and		
(c)	any change in the information referred to in paragraphs (a) and (b), within 15 days after the change occurs.		

PWMF Licence Renewal Application Matrix (cont'd)

<b>Table 1</b>			
<b>Regulatory Requirement</b>	<b>Description of Regulatory Requirement</b>	<b>Related Safety Control Area</b>	<b>Location in Submission</b>
<b><i>Class I Nuclear Facilities Regulations</i></b>			
<b><i>Licence Applications, General Requirements</i></b>			
3. An application for a licence in respect of a Class I nuclear facility, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the <i>General Nuclear Safety and Control Regulations</i> :			
(a)	A description of the site of the activity to be licensed, including the location of any exclusion zone and any structures within that zone;	Not Applicable	Attachment 3, Section 1
(b)	Plans showing the location, perimeter, areas, structures and systems of the nuclear facility;	Not Applicable	Attachment 3, Section 1
(c)	Evidence that the applicant is the owner of the site or has authority from the owner of the site to carry out the activity to be licensed;	Not Applicable	Attachment 1
(d)	The proposed quality assurance program for the activity to be licensed;	Management System	Attachment 3, Section 2.1
(e)	The name, form, characteristics and quantity of any hazardous substances that may be on the site while the activity to be licensed is carried on;	Not Applicable	Attachment 3, Section 1.2
(f)	The proposed worker health and safety policies and procedures;	Conventional Health & Safety	Attachment 3, Section 2.8
(g)	The proposed environmental protection policies and procedures;	Environmental Protection	Attachment 3, Section 2.9
(h)	The proposed effluent and environmental monitoring programs;	Environmental Protection	Attachment 3, Section 2.9
(i)	If the application is in respect of a nuclear facility referred to in paragraph 2(b) of the <i>Nuclear Security Regulations</i> , the information required by section 3 of those Regulations;	Security	Attachment 3, Section 2.12,
(j)	The proposed program to inform persons living in the vicinity of the site of the general nature and characteristics of the anticipated effects on the environment and the health and safety of persons that may result from the activity to be licensed, and	Other Matters of Regulatory Interest - Indigenous Community Engagement  Community Relations	Attachment 3, Section 3.2  Attachment 3, Section 3.3



PWMF Licence Renewal Application Matrix (cont'd)

<b>Table 1</b>			
<b>Regulatory Requirement</b>	<b>Description of Regulatory Requirement</b>	<b>Related Safety Control Area</b>	<b>Location in Submission</b>
(k)	The proposed plan for the decommissioning of the nuclear facility or of the site.	Waste Management	Attachment 3, Section 2.11.4
<b>Licence to Operate</b>			
6. An application for a licence to operate a Class I nuclear facility shall contain the following information in addition to the information required by section 3:			
(a)	A description of the structures at the nuclear facility, including their design and their design operating conditions;	Not Applicable  Physical Design	Attachment 3, Section 1  Attachment 3 Section 2.5
(b)	A description of the systems and equipment at the nuclear facility, including their design and their design operating conditions;	Not Applicable  Physical Design	Attachment 3, Section 1  Attachment 3 Section 2.5
(c)	A final safety analysis report demonstrating the adequacy of the design of the nuclear facility;	Safety Analysis	Attachment 3, Section 2.4
(d)	The proposed measures, policies, methods and procedures for operating and maintaining the nuclear facility;	Operating Performance	Attachment 3, Section 2.3
(e)	The proposed procedures for handling, storing, loading and transporting nuclear substances and hazardous substances;	Packaging & Transport	Attachment 3, Section 2.14
(f)	The proposed measures to facilitate Canada's compliance with any applicable safeguards agreement;	Safeguards	Attachment 3, Section 2.13
(g)	The proposed commissioning program for the systems and equipment that will be used at the nuclear facility;	Not Applicable	Project specific.
(h)	The effects on the environment and the health and safety of persons that may result from the operation and decommissioning of the nuclear facility, and the measures that will be taken to prevent or mitigate those effects;	Other Matters of Regulatory Interest - Environmental Assessments  Environmental Protection	Attachment 3, Section 3.1  Attachment 3, Section 2.9

PWMF Licence Renewal Application Matrix (cont'd)

<b>Table 1</b>			
<b>Regulatory Requirement</b>	<b>Description of Regulatory Requirement</b>	<b>Related Safety Control Area</b>	<b>Location in Submission</b>
(i)	The proposed location of points of release, the proposed maximum quantities and concentrations, and the anticipated volume and flow rate of releases of nuclear substances and hazardous substances into the environment, the health and safety and hazardous substances into the environment, including their physical, chemical and radiological characteristics;	Other Matter of Regulatory Interest - Environmental Assessments  Environmental Protection	Attachment 3, Section 3.1  Attachment 3, Section 2.9
(j)	The proposed measures to control releases of nuclear substances and hazardous substances into the environment;	Radiation Protection  Environmental Protection	Attachment 3, Section 2.7  Attachment 3, Section 2.9
(k)	The proposed measures to prevent or mitigate the effects of accidental releases of nuclear substances and hazardous substances on the environment, the health and safety of persons and the maintenance of security, including measures to (i) assist off-site authorities in planning and preparing to limit the effects on an accidental release, (ii) notify off-site authorities of an accidental release or the imminence of an accidental release, (iii) report information to off-site authorities during and after an accidental release, (iv) assist off-site authorities in dealing with the effects of an accidental release, and (v) test the implementation of the measures to prevent or mitigate the effects of an accidental release;	Emergency Management	Attachment 3, Section 2.10
(l)	The proposed measures to prevent acts of sabotage or attempted sabotage at the nuclear facility, including measures to alert the licensee to such acts;	Security	Attachment 3, Section 2.12
(m)	The proposed responsibilities of and qualification requirements and training program for workers, including the procedures for the requalification of workers; and	Human Performance	Attachment 3, Section 2.2.2.4

PWMF Licence Renewal Application Matrix (cont'd)

<b>Table 1</b>			
<b>Regulatory Requirement</b>	<b>Description of Regulatory Requirement</b>	<b>Related Safety Control Area</b>	<b>Location in Submission</b>
(n)	The results that have been achieved in implementing the program for recruiting, training and qualifying workers in respect of the operation and maintenance of the nuclear facility.	Human Performance	Attachment 3, Section 2.2.2.4
<b><i>Nuclear Security Regulations</i></b>			
<b><i>Part 2 Security Of Nuclear Facilities Listed in Schedule 2 – Licence Applications</i></b>			
41	An application for a licence in respect of a nuclear facility shall contain, in addition to the information required by sections 3 to 8 of the <i>Class 1 Nuclear Facilities Regulations</i> , a description of the physical protection measures to be taken to ensure compliance with sections 42 to 48.	Security	Attachment 3, Section 2.12
<b><i>Nuclear Substances and Radiation Devices Regulations</i></b>			
<b><i>Licence Applications, General Requirements</i></b>			
3. (1) An application for a licence in respect of a nuclear substance or a radiation device, other than a licence to service a radiation device, shall contain the following information in addition to the information required by section 3 of the <i>General Nuclear Safety and Control Regulations</i> :			
(a) to (o)		Radiation Protection  Security	OPG holds several licences under the <i>Nuclear Substances and Radiation Devices Regulations</i> , as listed in Attachment 3, Sections 2.7 and 2.12. However, OPG is not applying for these activities under this licence application.

## Changes Between Previous Application and Current Application

<b>Table 2</b>			
<b>Parts of Previous Application</b>	<b>Contents of Previous Application (June 2007)</b>	<b>Parts of Current Application</b>	<b>Contents of Current Application (October 2016)</b>
Letter of Application	Letter and the Pickering Waste Management Facility Safety Report	Letter of Application	Letter, including attachments
		Attachment 1	Land Ownership and Control Deed and Shareholder Certificate
		Attachment 2	PWMF Licence Renewal Application Matrix and Changes Between Previous Application and Current Application
		Attachment 3	PWMF Licence Renewal Application

Attachment 3 to OPG Letter, L. Swami to Marc Leblanc,  
“Application for Renewal of Pickering Waste Management Facility Operating Licence,”  
CD# 92896-CORR-00531-01031

**ATTACHMENT 3**

**PWMF Licence Renewal Application**

Attachment 3 to OPG Letter, L. Swami to Marc Leblanc,  
"Application for Renewal of Pickering Waste Management Facility Operating Licence,"  
CD# 92896-CORR-00531-01031

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# ONTARIO **POWER** GENERATION



## Pickering Waste Management Facility

### Application for Licence Renewal

October 2016

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## EXECUTIVE SUMMARY

The purpose of this application is to request approval from the Canadian Nuclear Safety Commission (CNSC) to renew the Pickering Waste Management Facility (PWMF) Waste Facility Operating Licence until August 31, 2028. The current ten year operating licence, WFOL-W4-350.02/2018, for the PWMF expires on March 31, 2018.

Upon renewal, OPG requests authorization for the following buildings to be included in the PWMF operating licence Appendix C associated with Part IV d) for the site preparation, construction or construction modification of:

- Dry Storage Container (DSC) Storage Building #4 (carried over from current licence);
- DSC Storage Buildings #5 and #6 (new), and
- a new DSC Processing Building (new).

These new buildings would not alter the basic purpose and activities associated with the PWMF. The additional DSC Storage Buildings will allow OPG to store all of the used fuel generated by Pickering Nuclear Generating Station (NGS) to the end of its commercial operational life. The new DSC Processing Building would increase processing capabilities from 50 DSCs to approximately 100 DSCs per year. The on-site transfer of used fuel in a clamped DSC from Pickering NGS to PWMF will continue, and may extend into the PWMF Phase II site.

PWMF demonstrated its commitment to safety by operating for the past 22 years without a lost time accident.

OPG is committed to innovative and responsible solutions for managing radioactive materials safely, efficiently and cost effectively, and making investments for the continued safe operation of PWMF.

OPG has built a healthy safety culture that permeates the organization, and demonstrates a focus to improve organizational effectiveness through the use of best practices, enhanced behaviours and learning.

This application presents information on the performance of PWMF in areas related to the 14 Safety and Control Areas. During the current licensing period, PWMF has operated safely and reliably to protect the public, the workers and the environment. This application lays out the planned improvements and upgrades currently envisaged for the next licence period. OPG is proud of its excellent record in conventional and radiological worker safety, and is well positioned for the continued operation of PWMF.

## 1.0 OVERVIEW

Ontario Power Generation (OPG) is an Ontario-based electricity generation company whose principal business is the generation and sale of electricity in Ontario. Electricity generated by nuclear power comes with the by-product of radioactive waste. OPG is committed to the responsible and comprehensive management of all its radioactive waste, and has been safely storing this waste at its waste management facilities located at the Bruce, Pickering and Darlington Nuclear sites.

This licence renewal application for the Pickering Waste Management Facility (PWMF), located on the Pickering Nuclear site within the Regional Municipality of Durham, in the City of Pickering in southern Ontario, demonstrates that:

- (1) OPG is qualified to operate the PWMF, and
- (2) OPG has and will continue to make adequate provision for the protection of the environment, the health and safety of persons, and the maintenance of national security and measures required to implement international obligations to which Canada has agreed to in operating this facility.

The PWMF is licensed by the CNSC under section 24(2) of the *Nuclear Safety and Control Act*. It is a Class IB nuclear facility as defined in the *Class I Nuclear Facilities Regulations* to provide for the safe handling, management, and the interim storage of radioactive wastes, including intermediate level radioactive waste and used fuel produced by Pickering NGS. The PWMF has been developed to accommodate used fuel produced by Pickering NGS reactor operation, and the intermediate level waste from the refurbishment of Pickering NGS units 1 to 4.

The current ten-year operating licence for PWMF (WFOL-W4-350.02/2018) expires on March 31, 2018. OPG is requesting a renewal of the operating licence with an expiry date of August 31, 2028. The renewal would allow OPG to continue with the safe interim storage of used fuel and intermediate-level radioactive waste.

OPG is planning to extend the operation of the Pickering NGS before permanent shutdown and safe storage. This will result in an increase in the number of used fuel bundles produced that require interim storage in Dry Storage Containers (DSC) at PWMF.

Upon renewal, OPG requests authorization for the following buildings to be included in the PWMF operating licence Appendix C associated with Part IV d) for the site preparation, construction or construction modification of:

- Dry Storage Container (DSC) Storage Building #4 (carried over from current licence);
- DSC Storage Buildings #5 and #6 (new), and
- a new DSC Processing Building (new).

These buildings are described in more detail in Sections 1.5.5 and 1.5.6. No significant changes are anticipated in the designs that have been previously approved for similar buildings on-site or that have been approved and implemented at the Western Waste Management Facility or Darlington Waste Management Facility. Project specific design requirements will be submitted to the CNSC in accordance with the PWMF operating licence Licence Condition 3.2 prior to the start of construction. Consistent with OPG's practice, OPG will construct new facilities on an as-needed

basis. In addition, the operation of any building would only begin following OPG's submission of a commissioning report and its acceptance by the Commission or a person authorized by the Commission, in accordance with Licence Condition 2.2.

To provide for safe interim waste storage until long term or permanent facilities are in service, the licensed area will be expanded outside the existing licensed area to accommodate some of the new buildings. The expanded area will include the appropriate security measures required for each additional building, as described in Section 2.12.3. Environmental Assessments confirmed there would be no significant adverse effects from the construction and operation of the DSC Storage Buildings on human and non-human biota, as described in Section 3.1 of this application.

## 1.1 Classification of Radioactive Waste

During the operation of a nuclear facility, waste is produced much like any other industry. Some of this waste becomes radioactive and must be handled using special procedures. OPG categorizes the radioactive waste into low, intermediate and high level waste.

- **Low-Level Radioactive Waste** is radioactive waste having a dose rate less than 10 mSv/h (1 rem/h) at 30 cm. Low level waste consists of minimally radioactive material that has become contaminated during routine cleanup and maintenance, and includes (but is not limited to) lightly contaminated metal objects and parts, incinerator ash, insulation, drummed wastes, solidified liquids and desiccant. These items make up about 95% of the total non-fuel waste volume. The very small quantity of low level waste that is generated at PWSF is sent to Pickering NGS to be transported to the Western Waste Management Facility for processing and storage.
- **Intermediate-Level Radioactive Waste** is radioactive waste having a dose rate greater than or equal to 10 mSv/h (1 rem/h) at 30 cm. Intermediate level waste consists primarily of used reactor core components, ion exchange columns, resins, and filters used to keep the reactor water system clean. Intermediate level waste is more radioactive than low level waste, and requires shielding to protect workers during handling. This waste is not processed for volume reduction, and makes up about 5% of the total volume of non-fuel waste produced by the nuclear station. There is no intermediate level waste generated at PWSF.

PWSF does provide interim storage for retube components received from the Pickering NGS Units 1-4 refurbishment operations from 1984 to 1992. The irradiated reactor components are stored in Dry Storage Modules at the PWSF Phase I site.

- **High Level Radioactive Waste (also referred to as irradiated fuel or used fuel)** is defined as a CANDU (CANada Deuterium Uranium) fuel bundle that was irradiated in a reactor core. It is stored at the nuclear station in irradiated fuel bays, and then transferred into DSCs. Currently, there are three DSC Storage Buildings at PWSF, with plans to construct three additional DSC Storage Buildings.

## Maximum Quantity of Radioactive Waste (Nuclear Substances) at PWMF

The maximum quantity of high level radioactive waste (irradiated uranium) is interpreted as the maximum amount in the form of used fuel bundles that can be stored in DSC Storage Buildings on site.

The maximum quantity of intermediate level waste is interpreted as the maximum amount of non-fuel radioactive waste that can be stored in the structures that have been designed for the purpose of storing the waste that could be accommodated at PWMF, with the proposed expansion.

Table 1 shows the maximum quantities of intermediate and high level radioactive waste that could be accommodated at PWMF, with the proposed expansion.

**Table 1: Maximum Quantity of Radioactive Waste (Nuclear Substances) at PWMF**

Nuclear Substance	Form/Location	Maximum Quantity
Irradiated Uranium	Solid as used fuel bundles stored <ul style="list-style-type: none"> <li>• DSC Storage Building #1</li> <li>• DSC Storage Building #2</li> <li>• DSC Storage Building #3</li> <li>• DSC Storage Building #4</li> <li>• DSC Storage Buildings #5 and #6</li> </ul>	1,152,768 bundles: <ul style="list-style-type: none"> <li>• 185 DSCs</li> <li>• 469 DSCs</li> <li>• 500 DSCs</li> <li>• 648 DSCs</li> <li>• 1200 DCSs</li> </ul> (3002 DSCs x maximum 384 bundles per DSC)
Intermediate Level Waste	Retube components in Dry Storage Modules	2,210 m <sup>3</sup> in 34 Dry Storage Modules

## 1.2 Inventory of Hazardous Materials Stored at PWMF

The PWMF contains a small amount of a variety of non-radiological hazardous materials which are typically found in industrial buildings, including the following:

- **Paint:** Touch-up paint is applied to areas on the DSC that have been affected by the scrapes or scuffs that may have resulted from handling. The total amount of paint stored at PWMF in “purpose-built” storage lockers is approximately 100 L.
- **Consumables for maintenance:** These include items such as adhesives, abrasives, various solvents, lubricants for operations and maintenance equipment as required, and janitorial and cleaning supplies. The total amount of these materials that may be stored onsite in “purpose-built” storage lockers is approximately 400 L, primarily janitorial cleaning supplies. Flammable materials are stored an appropriate cabinets.
- **Fuel:** A small amount of fuel for snow blowers and maintenance equipment is stored on-site. The quantity stored on-site in flammable material storage cabinets is less than 20 L.



### 1.3 Existing Pickering Waste Management Facility

The PWMF (Used Fuel Dry Storage Facility) became operational in 1996 in an area on the Pickering Nuclear site within the Regional Municipality of Durham, Ontario. The PWMF is dedicated to the processing and interim storage of used fuel discharged from the Pickering NGS units. In addition, PWMF provides safe interim storage for retube components received from the Pickering NGS Units 1-4 refurbishment operations from 1984 to 1992.

The PWMF is composed of two sites, as shown in Figures 1, 2 and 3. The PWMF Phase I site is located within the Pickering NGS protected area, southeast of the Pickering NGS Unit 8, adjacent to the east side of the station security fence. The PWMF Phase II site is located approximately 500 m northeast of PWMF Phase I site, east of the Pickering NGS powerhouse, within its own security-protected area in the Pickering Nuclear site.

The Retube Components Storage area, which is now part of the Phase I site, has been operational since 1984.

The PWMF Phase I site consists of a DSC Processing Building, DSC Storage Buildings #1 and #2, and the Retube Components Storage area. This phase was constructed in two stages as follows:

- Stage 1 became operational in 1996, and contains the DSC Processing Building and DSC Storage Building #1. DSC Storage Building #1 has a nominal design capacity of up to 185 DSCs.
- Stage 2 became operational in 2001, and consists of DSC Storage Building #2, which has a nominal design capacity of up to 469 DSCs.

PWMF Phase II site consists of DSC Storage Building #3 with a nominal design capacity of 500 DSCs, which was placed into service in 2009.

The DSC Transporter is used to transfer clamped DSCs between the Pickering NGS irradiated fuel bays and the PWMF DSC Processing Building. The Transporter also transfers seal-welded DSCs between the Phase I and Phase II sites, and for placement and retrieval of the seal-welded DSCs inside the DSC Storage Buildings.

Table 2 provides a summary of the developments at PWMF.

**Table 2: Chronology of Development for Used Fuel at PWMF**

Building	Number	Capacity	In-Service Dates
DSC Processing Building			1996
DSC Storage Building	#1	185 DSCs (nominal)	1996
	#2	469 DSCs (nominal)	2001
	#3	500 DSCs (nominal)	2009

Figure 1 shows the current layout of PWMF.

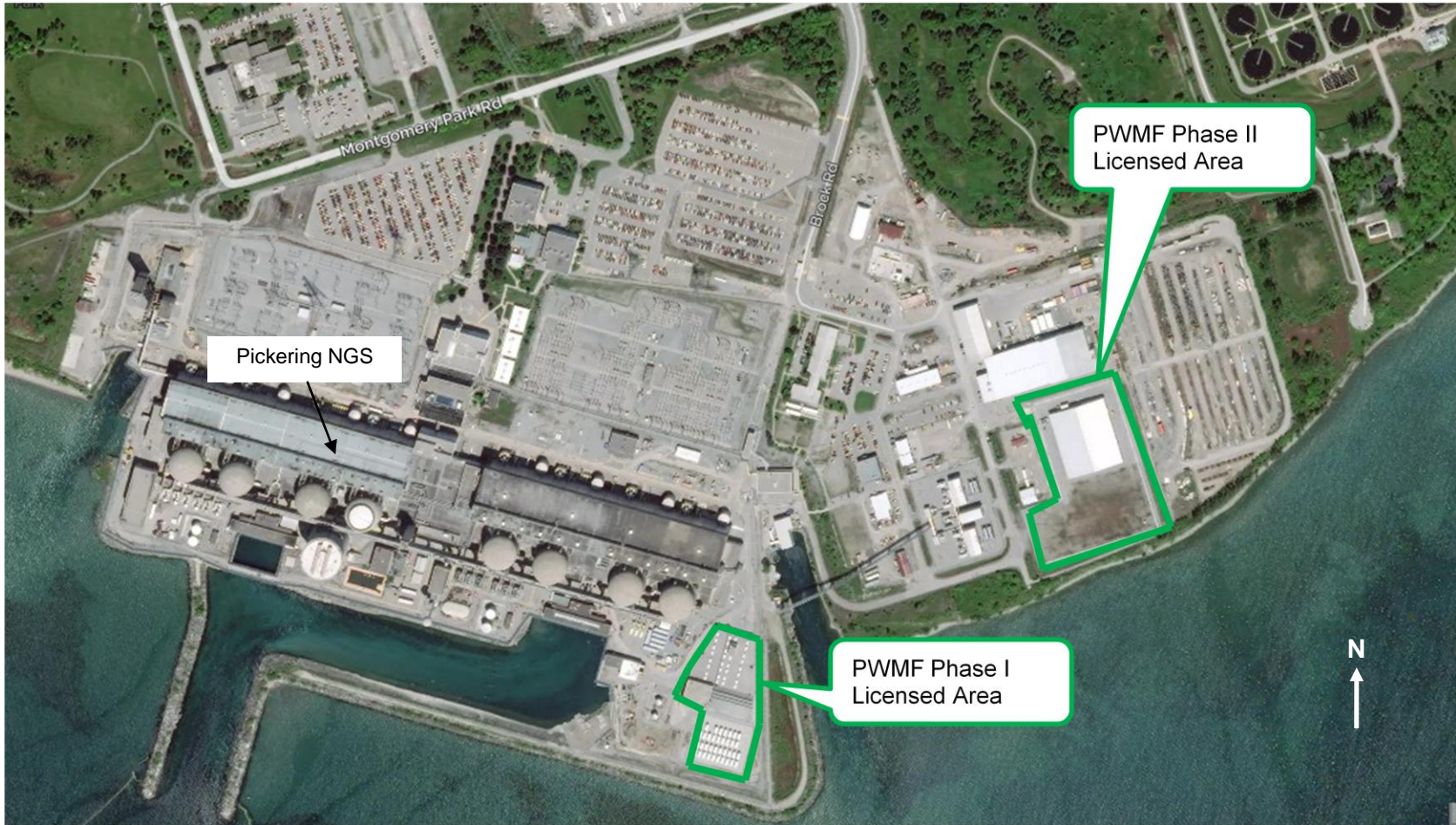


Figure 1: Layout of PWMF in 2016



- 1. Retube Components Storage Area
- 4. DSC Storage Building #2

- 2. DSC Processing Building
- 5. Pickering NGS

- 3. DSC Storage Building #1

**Figure 2: PWF Phase I site**



Figure 3: PWMF Phase II site

## 1.4 Management of Intermediate Level Waste (Retube Components)

The Retube Components Storage area in the PWMF provides interim storage of irradiated reactor components in Dry Storage Modules. The Dry Storage Modules are stored outdoors in a fenced and access controlled area, situated south of the PWMF Phase I DSC Storage Buildings, as shown in Figure 2.

The irradiated reactor components, consisting of pressure tubes, end fittings, shield plugs, and miscellaneous identified components, were removed during the retube of the Pickering NGS Units 1-4 reactors in the period of 1984 to 1992 and were loaded into 34 specifically designed and shielded Dry Storage Modules for interim storage at the PWMF. Two empty Dry Storage Modules are stored in the Retube Component Storage area for contingency and Dry Storage Module aging management and monitoring purposes.

There have been no operational activities for Retube Component Storage since 1993. The Dry Storage Modules currently stored in the Retube Component Storage area on the PWMF Phase I site will continue to be periodically inspected, monitored and maintained for the requested licence period. There are no future plans to store any more intermediate level waste at the PWMF.

## 1.5 Management of High Level (Used Fuel) Waste

The PWMF provides safe interim storage for the used fuel discharged from the Pickering NGS units and cooled for a period of time in the irradiated fuel bays. As of the end of Q4 2015, 809 DSCs were safely stored in the DSC Storage Buildings at the PWMF. Based on annual processing rates of approximately 50 DSCs per year, OPG expects that the next storage building will be needed by 2019.

### 1.5.1 Dry Storage Containers

A DSC is a free standing reinforced concrete container with an inner steel liner and an outer steel shell (Figure 4), for the storage and on-site transfer of used CANDU fuel. It is made of two sub-assemblies, a lid and a base. The base provides the storage space for the used fuel.

The DSC MKII model constitutes the reference container design for the PWMF. The DSC is a double-shell rectangular container, with exterior dimensions of 2.121 m x 2.419 m by 3.557 m in height (including the lid), and an inside cavity of 1.046 m x 1.322 m by 2.520 m. The nominal thickness of each carbon-steel shell is 13 mm. The DSC walls consist of 520 mm (nominal thickness) concrete placed between the inner liner and the outer shell. The reinforced high-density concrete provides radiation shielding and structural strength while maintaining adequate used fuel decay heat dissipation. The concrete has a density in the range of 3.5 to 3.7 Mg/m<sup>3</sup> and a compressive strength of at least 40 MPa. The maximum total mass (including the lid of 11 Mg) is approximately 60 Mg when empty and approximately 70 Mg when loaded with four modules (384 used fuel bundles).

All welds that form this containment system and all welds attaching items to the containment system are classified as "Nuclear Welds". Helium is used as the inert cover gas in the DSC cavity to protect the fuel bundles from potential oxidation reactions and to facilitate leak testing of the containment boundary.

The DSC is designed with the provision for installing safeguards seals. Two separate U-shaped 25.4 mm outer diameter stainless steel tubes are embedded in the DSC walls and floor in the plane of the outer reinforcing grid. These tubes are placed so that each tube runs across the centre of opposite container walls. Two similar tubes are embedded in the DSC lid and run diagonally across the lid. The configuration of the safeguards tubes is shown in Figure 4. These tubes are used for attaching two different types of International Atomic Energy Agency seals.

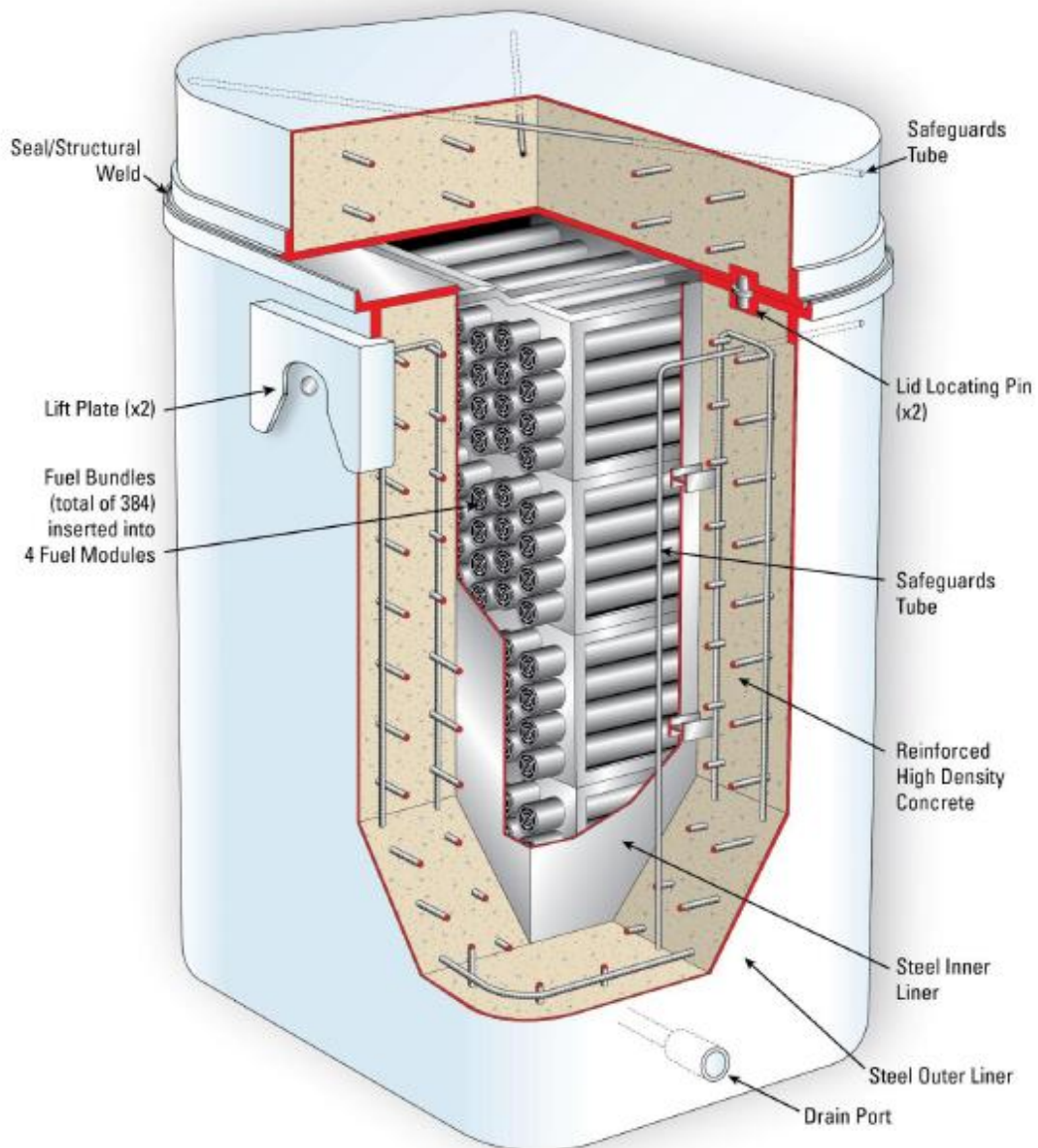


Figure 4: Dry Storage Container

### 1.5.2 Used Fuel Dry Storage Processing

The processing of a DSC begins with the preparation of new DSCs at the DSC Processing Building and ends with the storage of loaded, hermetically sealed DSCs in the DSC Storage Buildings. The steps are summarized in Figure 5.

# The Used Fuel Dry Storage Process

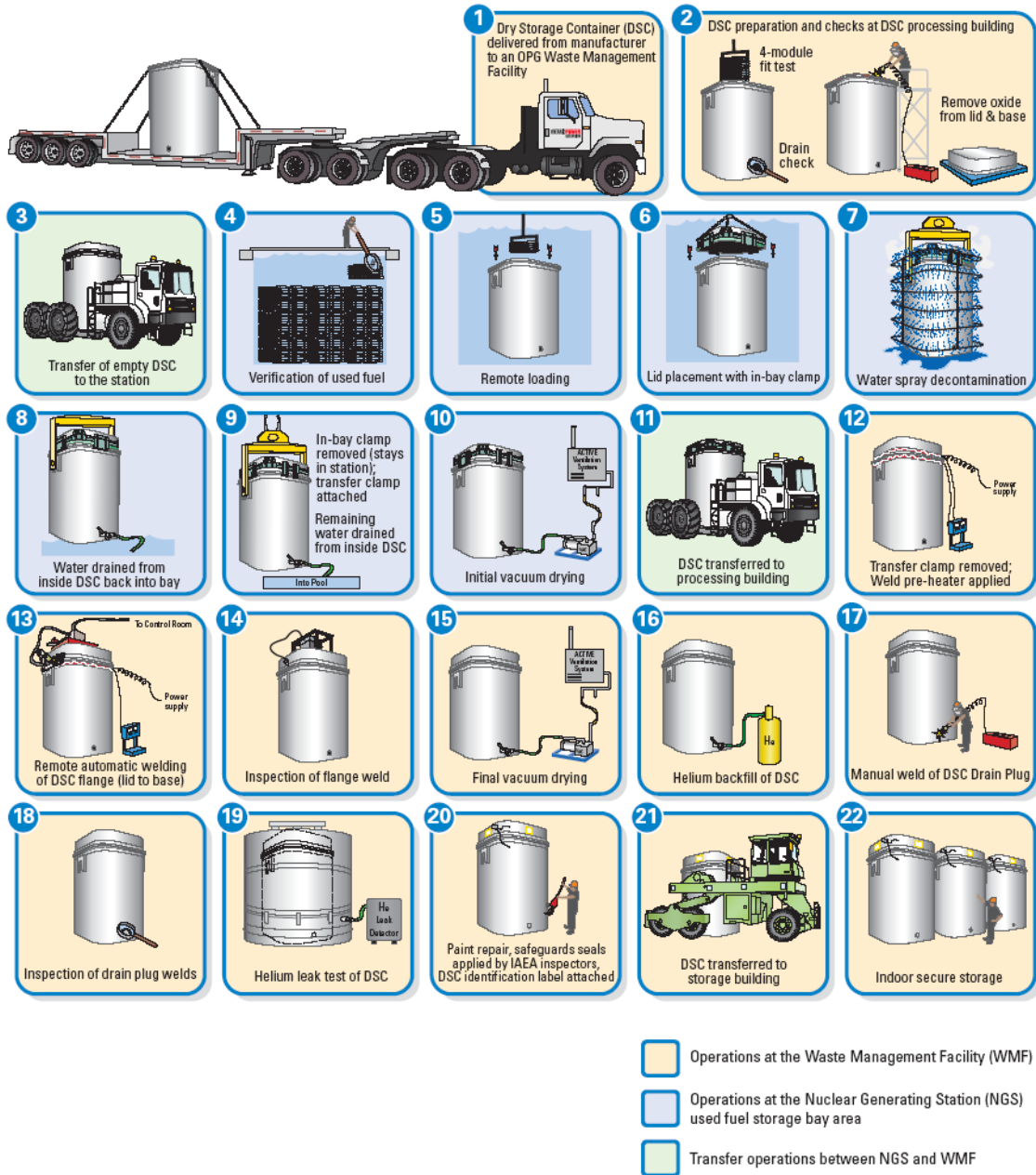


Figure 5: Used Fuel Dry Storage Process

### **Steps 1-3: Preparing and Transferring Empty DSCs**

New, empty DSCs are received at the PWMF Phase I site from the manufacturers. The DSCs are then prepared and then transferred to the Pickering NGS for subsequent loading of used fuel.

The DSC Transporter is used to transfer both new (empty) and loaded DSCs between PWMF and Pickering NGS. On-site transfer of DSCs is discussed in more detail in section 1.5.3.

### **Steps 4 – 10: Loading a DSC at Pickering NGS**

The processes of loading, decontaminating, draining and initial drying are completed at Pickering NGS under the Power Reactor Operating Licence. At the Pickering NGS, fuel bundles are loaded under water into storage modules. After a storage module has been loaded, it is transferred under water to a DSC. Each DSC is designed to hold four storage modules, for a total capacity of 384 bundles per loaded DSC.

While the loaded DSC is still submerged in water in the loading bay, the in-bay clamp is used to secure the DSC lid to the container. The DSC is lifted out of the water, drained and then the DSC exterior is decontaminated. The in-bay clamp is replaced with the transfer clamp, and the DSC interior cavity is vacuum-dried in preparation for on-site transfer to the PWMF.

Prior to leaving the Pickering NGS, the DSC is surveyed and the entire exterior surface of the loaded DSC and its components are decontaminated including lid flange, drain housings, and the transfer clamp to ensure there is no detectable loose contamination as per OPG's Waste Acceptance Criteria.

### **Step 11: DSC transfer between Pickering NGS and the DSC Processing Building at the PWMF**

The DSC Transporter picks up a loaded DSC from the Pickering NGS after confirmation that it meets OPG's Waste Acceptance Criteria. Both the vehicle and the DSC are monitored for contamination and decontaminated, as required, before leaving the station.

The transporter with a loaded DSC then leaves the station and travels along the Pickering NGS site roads to the PWMF Phase I site for further processing in accordance with security and safeguards requirements for on-site transportation. The maximum lift height required during loading or unloading of a DSC is about 0.60 m, which is well within the safety envelope of 2.4 m. When traveling with a DSC, the DSC Transporter operates at low speed and has a short stopping distance where stopping is essentially instantaneous. The vehicle is always operated by a trained vehicle operator.

### **Steps 12 - 20: Processing a DSC at PWMF**

The loaded DSC is transferred on Pickering NGS site roads to the PWMF Phase I site, where it is off-loaded at the DSC Processing Building for further processing, as follows:

- **Receiving a Loaded Dry Storage Container (Step 12)** - After the loaded DSC is received at the DSC Processing Building, movement of the DSC within the DSC Processing Building is performed using the workshop overhead crane and lifting beam.



- **Dry Storage Container Lid Seal Welding (Step 13)** - The DSC is moved to a welding station where the DSC drain port transfer plug, transfer clamp and seal are removed and the weld pre-heater is installed. The pre-heater is used to heat the DSC weld flange to a prescribed temperature. The weld between the lid and base of the DSC is performed with 10 consecutive passes of the semi-automatic welder. At the conclusion of lid welding, the weld machine is removed and the DSC is allowed to cool.
- **Welding Inspections (Step 14)** - The Phased Array Ultrasonic Testing system is used for the inspection of the DSC lid-to-base seal weld. The scanner is mounted on the DSC base's top flange and is held in place by three magnetic wheels. A loading ramp is used to minimize the force required by the operator when engaging and disengaging the scanner. The inspection covers 100% of the weld as well as the Heat Affected Zone.
- **Final Vacuum Drying, Helium Backfill, and Drain Port Seal Welding (Steps 15 – 18)** - After successful completion of the weld inspection, the DSC is lifted into another work station for final vacuum drying and helium backfilling. The lifting beam is removed and the vacuum drying/helium backfilling system connected. Following helium backfill, the drain port is welded and inspected via visual and dye penetrant techniques.
- **Helium Leak Testing (Step 19)** - Helium leak testing is carried out using a vacuum chamber (bell jar). The lid of the bell jar is removed and the seal-welded DSC is lifted into the lower half of the bell jar. The bell jar lid is craned over the DSC and sealed onto the base of the bell jar. Using the vacuum skid, air is first removed from the bell jar and then the helium leak detector is activated. If a leak is detected, the vacuum equipment is removed and remedial work is carried out. A follow-up leak test is then performed. After completion of the lid weld inspection, partially processed DSCs may be transferred inside the DSC Processing Building and temporarily stored for up to one year from the time of loading.
- **Paint Touch Up and Safeguards Seals (Step 20)** - Areas affected by the welding are cleaned and painted. Touch-up paint is also applied to scrapes or scuffs on the DSC that may have resulted from handling. Painting is typically carried out in the paint bays. Documentation and identification labelling are completed and permanent safeguards seals are installed in a designated International Atomic Energy Agency (IAEA) surveillance area.

#### **Steps 21 - 22: Storage of DSC at PWWF**

- **Dry Storage Container Placement and Storage (Steps 21 and 22)** - The DSC is moved, using the Transporter, to a location in a storage building (Figure 6). In the storage building, the Transporter unloads the DSC in a designated storage location.



Figure 6: Storage of DSCs

### 1.5.3 On-Site Transfer of DSCs

#### Dry Storage Container On-Site Transporters

The OPG DSC Transporters are specially designed multi-wheeled vehicles for the transfer of DSCs between the station's irradiated fuel bays and the DSC Processing Building, and from the DSC Processing Building to storage (Figure 7). The DSC Transporters are self-loading and self-powered by a diesel engine and do not require the assistance of a crane when picking up or depositing a DSC. The DSC is lifted and transferred via lifting trunnions mounted on the upper frame of the machines. The DSC is carried at a low lift height (about 20 cm) during transfer. Locking arrangements prevent the DSC from being inadvertently lowered to the ground upon hydraulic failure. The tires on the Transporters are designed not to deflate if punctured.

When travelling with a DSC, the Transporters operate at low speed and have a short stopping distance. When travelling at minimal speeds (e.g. when moving DSCs within the DSC processing and storage buildings), stopping is essential instantaneous. The Transporters are capable of forward and reverse motion and have a tight turning radius. A radio remote control may be used to operate the Transporter either from the cab or remotely. Vehicle lighting is provided for night-time operation, if necessary. The DSC Transporter (Liftking) at PWMF can travel up to a maximum of 4 km/hr.



Figure 7: DSC Transporter

### Transfer Clamp

A transfer clamp is used to securely attach the lid to the DSC base during on-site transfer of a loaded DSC between Pickering NGS irradiated fuel bays and the PWMF. The transfer clamp is designed to prevent the lid from separating from the base under credible accident scenarios during the transfer of loaded DSCs between the station and the DSC Processing Building, and during DSC handling inside the processing building prior to seal-welding the DSC lid.

### 1.5.4 DSC Storage Buildings for Used Fuel

Each DSC Storage Building is designed and constructed to provide for the safe storage of DSCs. Each storage building is a single story, commercial-type, pre-engineered or precast concrete structure with a concrete slab-on-grade floor. The floors are constructed for long service with minimal maintenance, to retain surface alignment and provide a hard, smooth and durable surface. Floors are sloped to provide drainage to floor drains. Building walls consist of precast concrete panels to provide effective radiation shielding. The walls above the concrete panels consist of metal panels. A combination of wall louvers and roof turbines are installed to assist passive ventilation. The building provides weather protection for DSCs in storage. The storage buildings are designed to the *National Building Code of Canada* and the *National Fire Code of Canada*.

The building roof has provisions for drainage of rainwater and melted snow. Access to the roof is by the use of an outside, all weather, and permanent stairway. The building is grounded to protect against lightning.

### **1.5.5 Additional DSC Storage Buildings during the Next Licensing Period**

OPG is currently licensed to construct and operate DSC Storage Building #4 at the Phase II site. In order to support the continued operation of Pickering NGS, and to utilize and optimize the vacant land already within the current PWMF licensed area, OPG plans to construct a storage building which will allow storage of up to 648 DSCs (Figure 8). Storage Building #4 is expected to be in-service in 2019.

OPG also intends to construct two additional storage buildings in the next licensing period to accommodate DSCs from Pickering NGS until the end of commercial operation. The design of the proposed DSC Storage Building #5 and #6 will be similar to the design of the existing storage buildings which are approved and in use at all three of OPG's waste management facilities for the storage of DSCs. Based on the site optimization and conceptual design studies, an amalgamated storage building with a nominal storage capacity of up to 1,200 DSCs is planned.

The proposed location for DSC Storage Building #5 and #6 is east of the existing DSC Storage Building #3 on the PWMF Phase II site (Figure 8). The amalgamated building will be within a designated secured area as required by the *Nuclear Security Regulations* under the *Nuclear Safety and Control Act*.

### **1.5.6 New DSC Processing Building during the Next Licensing Period**

A new DSC Processing Building would be designed to increase the processing capability from 50 DSCs per year at the existing DSC Processing Building to approximately 100 DSCs per year, to support the Pickering NGS end of commercial operation and safe storage. The new DSC Processing Building would receive and process DSCs in the same manner, described in section 1.5.2, as the existing DSC Processing Building.

The existing DSC Processing Building at the Phase I site is small and congested, and many of the support functions, offices and workshop areas are located elsewhere on the Pickering Nuclear site. Since there is no room available for the expansion of the Phase I site, moving DSC processing activities to the Phase II site will increase the space for work activities and improve PWMF performance. At the time of writing, the business approval process is in progress for the new DSC Processing Building.

The design of the new DSC Processing Building to be located in PWMF Phase II would be similar to the DSC Processing Buildings in operation at the Darlington and Western Waste Management Facilities. The building will be within a designated secured area as required by the *Nuclear Security Regulations* under the *Nuclear Safety and Control Act*. The proposed location for the new DSC Processing Building is the area west of the existing DSC Storage Building #3 on the PWMF Phase II site (Figure 8).

The building will be rectangular shaped, approximately 100 m long and 40 m wide. A portion of the south wall of the building will be attached to a portion of the north wall of DSC Storage Building #4. The amenities area will include utility rooms, office areas and other supporting facilities including washrooms, change rooms and a lunch room. There will also be a laundry room, an entrance lobby and a security guard station.

The processing area will include a truck bay area for receiving the DSC delivery truck from the manufacturer, and also the DSC transporter. This area will provide space for storage of new empty DSCs and for the preparation of empty DSCs prior to transfer to

a Pickering irradiated fuel bay for used fuel loading. The length of the truck bay will be designed to enclose the DSC delivery vehicle. The location and configuration of the truck bay are designed to enable receipt or transfer of a DSC out of the facility without interrupting the processing of loaded DSCs.

The DSC processing area includes an area for storage of loaded (unwelded) DSCs received from the irradiated fuel bay plus areas for welding, painting, testing and other DSC processing activities.

The second-floor area of the building will include the welding control center, a Phased Array Ultrasonic Testing analysis room and the DSC painting bay platform.

The preparation of empty DSCs and the processing activities will continue in the existing DSC Processing Building located within the PWMF Phase I site until the new DSC Processing Building on the PWMF Phase II site is in-service.

### **1.5.7 DSC Transporter Route**

The Transporter route from the irradiated fuel bays to a new DSC Processing Building in Phase II for a clamped DSC would be approximately 500 m longer than the current route. A security escort will continue to be used for each transfer.



Figure 8: Indicative PWMF Expansion Areas

## 1.6 Summary of Buildings for Next Licensing Period

Table 3 summarizes previous building construction under past and current PWMF operating licences. The first two columns on the left list the buildings, and show what has already been constructed under previous licence(s). The middle two columns show the construction approved in the current operating licence. The last two columns on the right show what was previously approved and being carried over into the next licensing period, and the additional buildings that are required to support the continued operation, shutdown and safe storage of Pickering NGSs.

OPG is requesting a renewal of the PWMF operating licence with an end date of August 31, 2028. Upon renewal, OPG requests a change to the facilities listed in the current PWMF operating licence Appendix C associated with Part IV d) for the site preparation, construction or construction modification to include, in total as shown in Table 3, authorization for:

- DSC Storage Building #4 (carried over from current licence);
- DSC Storage Buildings #5 and #6 (new), and
- a new DSC Processing Building (new).

The planned in-service dates are shown in Table 3 in brackets for each of the buildings to be constructed over the next licence period. The actual in-service dates will be determined through normal business and project planning processes.

**Table 3: Summary of Existing and Planned Storage Buildings/Structures at PWWF**

Storage Buildings / Structures at PWWF	Constructed under Previous Licences	Current Licence WFOL-W4-350.02/2018		Next Licence Renewal (2017 – 2028)	
		Constructed between 2008 – 2015	Buildings Approved, but not yet built	Approved in Previous Licence, not yet built and carried into Renewed Licence	New Projects to be included in the 2017 – 2028 Licence Period
Dry Storage Modules for retube waste components	Dry Storage Module	Not Applicable	Not Applicable	Not Applicable	Not Applicable
DSC Storage Buildings	Storage Building #1 (1996) Storage Building #2 (2001)	Storage Building #3 (2009)	Storage Building #4	Storage Building #4 (2019)	Storage Buildings #5 and #6 (2024)
DSC Processing Buildings	DSC Processing Building (1996)	Not Applicable	Not Applicable	Not Applicable	New DSC Processing Building (2019)



## 2.0 SAFETY AND CONTROL AREAS

### 2.1 MANAGEMENT SYSTEM

The OPG Nuclear Management System defines the organizational structure, roles and responsibilities, applicable program elements, and the interfaces amongst them and applies to all OPG nuclear facilities. The Management System is compliant to the requirements of CSA N286-12 and establishes the processes and programs required to ensure the OPG Nuclear Waste Management organization achieves its safety objectives, continuously monitoring performance against the objectives, and fostering a healthy safety culture. PWMF staff understands and manages work and financial liabilities to accurately plan and forecast expenditures, ensuring value for money.

OPG's key documents for Management System are listed in the table presented below.

Document Title	Document Number
Nuclear Safety Policy	N-POL-0001
Nuclear Management System	N-CHAR-AS-0002
Nuclear Waste Management	W-PROG-WM-0001

#### 2.1.1 Nuclear Safety Policy

OPG's Nuclear Management System receives its direction from the policies set by the OPG Board of Directors.

OPG's Nuclear Safety Policy was established in recognition that nuclear power poses unique hazards due to the enormous energy in the reactor core, radioactive material and decay heat produced by the fuel. OPG's policy objective is the protection of the workers, the public and the environment from these hazards.

The Nuclear Safety Policy sets expectations for all OPG employees. The policy states that:

*“Nuclear safety shall be the overriding priority in all activities performed in support of OPG nuclear facilities. Nuclear safety shall have clear priority over schedule, cost and production.”*

To meet this expectation, OPG's Board of Directors establishes that everyone shall demonstrate respect for nuclear safety by:

- Knowing how their work impacts on Controlling power, Cooling fuel, and Containing radioactivity;
- Applying Event-Free tools and defences to prevent events, and
- Reporting adverse conditions so they can be corrected.

It is also an expectation that OPG employees will embrace and exhibit the traits of a healthy nuclear safety culture. Based on industry best practice, the following traits of a healthy nuclear safety culture are included in the Nuclear Safety Policy:

- Personal Accountability;
- Questioning Attitude;
- Effective Safety Communication;
- Leadership Safety Values and Actions;
- Conservative Decision-Making;
- Respectful Work Environment;
- Continuous Learning;
- Problem Identification and Resolution;
- Environment for Raising Concerns, and
- Work Processes.

These traits are continuously reinforced, promoted, and applied by staff in all work performed. Many of the daily meetings that occur at PWSMF involve a discussion of the nuclear safety traits and a sharing of good practice respecting the application of the trait or an experience where application of the trait could have been better utilized.

Other policies set by the OPG Board of Directors are also applicable to operations of the PWSMF. For example, the Employee Health and Safety Policy sets the expectations for the protection of workers across OPG, from the conventional hazards associated with the operation of the facilities, and the Environmental Policy establishes expectations both for the protection of the environment and its enhancement through biodiversity initiatives. The implementing management system documents for these policies are applied to the PWSMF operations, as described in the applicable sections of this application.

### **2.1.2 Nuclear Management System Charter**

OPG's Nuclear Safety Policy is implemented through a series of governing documents which together form the Nuclear Management System. The first implementing governing document is the Nuclear Management System Charter. The Charter establishes the programs that provide the specific measures that are applied in the day to day, safe, reliable operation of the OPG nuclear facilities. The Charter defines the organization responsibilities, interfaces, and applicable program elements to achieve the requirements of:

- *CSA N285.0, General Requirements for Pressure-retaining Systems and Components in CANDU Nuclear Power Plants;*
- *CSA N285.6, Material Standards for Reactor Components for CANDU Nuclear Power Plants, and*
- *CSA N286-12, Management System Requirements for Nuclear Facilities.*

The programs identified in the Charter describe the measures that are applied as activities are performed in the facilities or in support of ongoing safe operation.

The Nuclear Management System implementation is monitored through a series of activities, including external and internal audits, performance metrics designed to capture the key outcomes of the programs, management assessments, and the corrective action and continuous improvement processes, including benchmarking of industry best practices. All of these activities allow OPG to identify opportunities to improve performance and make its operations safer and more reliable.

### **2.1.3 Nuclear Waste Management Program**

One of the programs in the Nuclear Management System is the Nuclear Waste Management Program.

Activities at the PWF are largely performed in accordance with the same processes as are applied at the other OPG nuclear facilities; however there are instances where it has been necessary to develop specific procedural documents to address the unique aspects associated with nuclear waste operations. Some examples of procedural documents specific for PWF are the work management and emergency response procedures. The Nuclear Waste Management Program identifies the specific procedural documents, together with any necessary exceptions to the generally applicable Nuclear Management System procedures. Most of the specific procedural requirements apply to the handling of waste at the PWF, such as the handling and storage of the used fuel DSCs.

As with all other parts of the OPG Nuclear Management System, implementation of the management system for PWF is assessed on an on-going basis.

### **2.1.4 Current Operations**

During the current licensing period, PWF achieved several improvement objectives targeted at making the management system more effective and efficient. The results from the Governance Simplification and Fleetview Program Health and Performance Reporting are described in detail below.

#### **Governance Simplification**

In 2011, OPG's Nuclear Waste Management Operations transitioned from a complete set of stand-alone processes into the OPG nuclear fleet processes. A team was created to ensure a smooth transition to the OPG Nuclear governance framework. The Governance Simplification project was a major undertaking as it worked towards reducing, simplifying and aligning the number of governing documents that are maintained.

The Decommissioning and Nuclear Waste Management (DNWM) Governance Simplification Project mandate included:

- Reducing the number of program documents for nuclear waste operation;
- Superseding or obsoleting DNWM governance by adopting OPG Nuclear governance where appropriate and where it makes good business sense, and
- Streamlining the DNWM processes to avoid duplication of procedures and instructions throughout the DNWM facilities.

During the current licensing period, all programs applicable to DNWM transitioned to CSA N286-12, to meet the requirements of the new Darlington NGS licence (effective

January 1, 2016). This helped build on the strengths of the Nuclear Management System, including implementation of industry best practices. This initiative is now complete.

### **Fleetview Program Health and Performance Reporting**

Fleetview Program Health and Performance Reporting is a fleetwide functional review and reporting process to monitor and routinely report on overall program effectiveness of those programs as defined within the Nuclear Management System.

Each program executing the Nuclear Management System is reviewed in accordance with management system principles in three defined areas including oversight and leadership, execution performance, and program action plan. This review is conducted by the Nuclear Executive Committee on a pre-established review schedule, and enhancements or new initiatives are identified based on performance.

The annual Fleetview Program Health and Performance Reporting process includes Nuclear Waste Management Facilities along with OPG Nuclear Power Plants as applicable.

As with all Fleetview programs, oversight of the Fleetview initiative is performed collectively by the Nuclear Executive Committee.

### **2.1.5 Business Continuity**

The objectives of the OPG Business Continuity Program are to ensure approved response strategies and recovery priorities are in place for critical functions during incidents that threaten continuity, and recovery guidance is in place for recovering from incidents.

Approved strategies are intended to:

- Protect employee and public health and safety;
- Limit significant impacts to the environment as well as to OPG's assets, reputation and operational continuity, and
- Maintain financial viability.

To ensure OPG's business continuity, OPG performs Business Impact Analyses and develops Continuity Plans in response to the analysis. This involves conducting a risk analysis of the impacts that a temporary disruption of the processes would have on the company. Continuity Plans are established to mitigate the identified risks, if necessary.

Pursuant to this process, DNWM has conducted a Business Impact Analysis. The activities performed by DNWM were all assessed as being capable of being unavailable for more than a week (up to several weeks or months) without significant consequences. As the activities were assessed to be low risk, Continuity Plans were not developed.

### **2.1.6 Nuclear Safety Culture**

OPG routinely monitors the health of its nuclear safety culture through Nuclear Safety Monitoring Panels. These panels were established based on the industry best practices documents in the Nuclear Energy Institute's NEI-09-07, *Fostering a Strong Nuclear Safety Culture*. The Nuclear Safety Monitoring Panel examines information from a variety of the processes that have been implemented, such as the corrective action

process, the human performance program, audits and self-assessments, external inspections such as CNSC inspections or industry evaluations, employee concerns, and business performance monitoring. This information is evaluated against the traits of a healthy nuclear safety culture to identify strengths and areas for focused attention within the organization. The panel is composed of all of the managers and senior leadership within DNWM. The panel evaluates the information and approves any initiatives or reinforces communications as needed.

In 2015 a Nuclear Safety Culture Assessment was performed, based on information from a review of Station Condition Records and other documents, an 81 question survey sent to all DNWM personnel, and interviews and field observations. The Assessment found that DNWM has a healthy Nuclear Safety Culture. Areas for improvement include improving the communication of operating experience, enhancing employee awareness of the processes for the effective escalation and timely resolution of issues, and improving the communication between work groups. DNWM's Nuclear Safety Culture will be assessed again in 2018, in accordance with the three year cycle required by OPG's Nuclear Safety Culture Assessment Procedure.

### **2.1.7 Independent Assessments**

OPG evaluates the effectiveness of the management systems and controls on key business and operating risks. This is accomplished through internal audits, nuclear oversight audits and assessments, and management self-assessments. The Internal Audit organization's annual audit plan identifies the specific audits to be conducted in the coming year and it is approved by the OPG Board of Directors. The annual audit plan is based on key risk areas, legal and regulatory requirements.

The Nuclear Oversight organization audits OPG's Nuclear Management System as required by CSA N286-12 and in accordance with OPG's Independent Assessment program. Nuclear Oversight has implemented a risk informed scheduling process for audits of programs under the OPG Nuclear Management System which ensures that the highest risk programs and activities receive the greatest level of oversight.

Findings from the independent audits and assessments are resolved through OPG's Corrective Action Program. Improvements arising from the independent assessments are noted in the specific safety and control areas.

### **2.1.8 Self Assessment and Benchmarking**

The OPG Nuclear Self Assessment and Benchmarking procedure requires that Directors and Managers plan and schedule divisional and departmental level Self Assessments and Benchmarking for each upcoming year.

OPG participates in a number of industry peer groups, facilitating good opportunities to benchmark OPG's nuclear management practices with other utilities. Similarly, peers from other utilities visit OPG facilities to gain insights. These relationships are important to ensure OPG continues to gain insight on industry best practice in all areas.

### **2.1.9 Management of Contractors**

OPG has extensive practice in the use of contractors to engineer, procure, and construct new facilities or to implement design improvements to OPG's existing facilities.

Contractors are qualified by OPG Supply Chain Quality Services under a process that ensures that the contractor has developed and implemented a management system that meets the applicable requirements outlined in CSA N286-12.

The contractors OPG uses have a long history of working in the nuclear industry and with OPG in particular. They have proven capability to meet the quality standards necessary for a nuclear facility. OPG's Items and Services Management Program includes provisions for extending applicable requirements to sub-contractors. OPG requires that any sub-contractors work under the contractor's quality program to ensure there is an assurance that the agreed upon quality standards and expectations will be met, regardless of who is performing the work in the field. Field verification / surveillance activities are performed by OPG personnel to ensure that the quality program requirements are being achieved.

Where possible, OPG will temporarily turn the contractor work area over to the contractor as a Construction Island where the contractor assumes the role of 'Constructor' as defined in the *Ontario Occupation Health and Safety Act*. As Constructor, the contractor assumes responsibility and liability for conventional safety and environmental safety associated with the contractor work. The contractor produces a site specific Health and Safety Plan and Environmental Safety Plan which is accepted by OPG prior to the contractor work start. Radiation protection remains the responsibility of OPG.

Where a Construction Island is not feasible, OPG maintains the role of Constructor and provides oversight to the contractor. In this case, all contractor work will be carried out in accordance with OPG processes and procedures. OPG maintains responsibility and liability for conventional safety, environmental safety, and radiation protection of the contractor work.

### **2.1.10 Organization**

During the current licensing period, OPG adopted a center-led organizational model. Under this structure, there are two types of functional organizations: those accountable for delivering company-wide programs; and those accountable for operations.

Central functions establish one point of accountability for an entire function, to deliver functional support across all business units. Examples of such central functions include Human Resources, Supply Chain, Finance, Records, Environment, and Corporate Relations and Communications. These central functions ensure best practices are implemented across all of OPG's facilities, and enable the development of the expertise necessary to provide operations support.

The Senior Vice-President, DNWM has the authority to act for OPG in dealings with the Commission, and is responsible for the management and control of licensed activities at the PWMF. The day-to-day operations and management of the PWMF is the responsibility of the Operations Manager, who reports to the Director of Used Fuel Operations. Only those persons authorized by the Operations Manager supervise operations at the PWMF. The operations organizations receive direct support from the central functions.

Organizational changes are managed following OPG's Organization Design Change procedure. OPG submits updates to CNSC on persons authorized to act on behalf of OPG in dealings with the CNSC, as required per subsection 15(c) of the *General Nuclear and Safety Control Regulations*. The organization chart for PWF and supporting center-led organizations is shown in Figure 9.

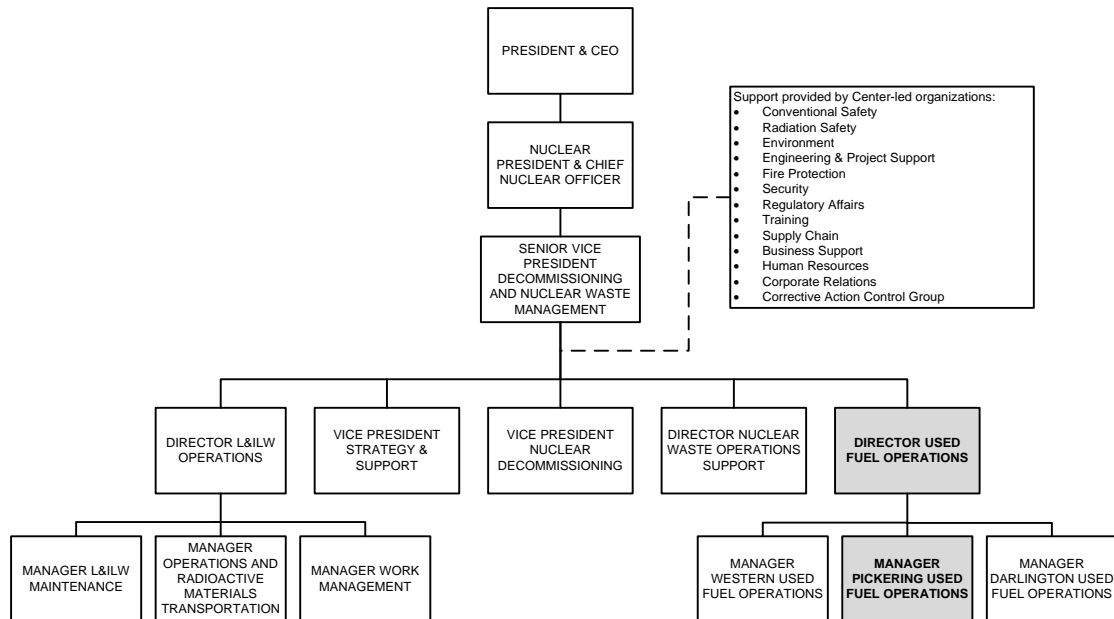


Figure 9: PWF Organization Chart

### 2.1.11 Event Reporting

For events at PWF that are determined to be reportable to the CNSC, preliminary reports are submitted to the CNSC which include the location and circumstances of the situation and of any action that PWF has taken or proposes to take with respect to the event in accordance with the *General Nuclear Safety and Control Regulations* subsection 29 (1). A full event report is then submitted to the CNSC in accordance with *General Nuclear Safety and Control Regulations* subsection 29 (2).

A listing of OPG's Waste Management Facilities' reportable events from 2010 to the present is posted on OPG's public website, [www.opg.com](http://www.opg.com).

During the current licensing period, there were 11 CNSC reportable events at PWF. The reportable events are discussed in the applicable safety and control areas, except for the four events related to security protected information.

### **2.1.12 Future Plans for Improvement**

PWMF will continue to make incremental improvements in work processes and program implementation through:

- Continued adoption of OPG Nuclear governance as appropriate;
- Ongoing use of Fleetview Program Health and Performance Reporting to assist with overall program effectiveness;
- Management of the business to ensure a focus on long-term sustainable performance excellence, and
- Development of leadership and management capability at all levels of the organization with a bias toward teaching and learning moments.

OPG does not foresee, during the next licensing period, any substantive changes to the management system. The main focus for the next licensing period at the PWMF will be the safe handling and interim storage of used fuel in support of Pickering NGS continued operations, shutdown and safe storage. These are not expected to result in substantive changes to the management system.

The other focus at the PWMF will be safe storage of the Dry Storage Modules and preparedness for the anticipated transfer of the intermediate level waste into the proposed Low and Intermediate Level Waste Deep Geologic Repository. New operational processes are expected to be needed to address the handling of the waste in preparation for its placement in the repository; however, the majority of the management system will not be affected. Work on these changes will start after the Low and Intermediate Level Waste Deep Geologic Repository has received the necessary approvals.

## **2.2 HUMAN PERFORMANCE MANAGEMENT**

The Human Performance Program at PWMF is defined by the OPG Nuclear Human Performance Program. OPG's goal is to continually reduce the frequency and severity of events through the systematic reduction of human error and the management of defences in pursuit of zero events of consequence. The key principles that are the foundation for the OPG Nuclear Human Performance Program are:

- People are fallible;
- Error-likely situations are predictable, manageable, and preventable;
- Individual behaviour is influenced by organizational processes and values;
- People achieve high levels of performance based largely on the encouragement and reinforcement received from supervisors, peers, and subordinates, and
- All events are preventable.



OPG's key documents for Human Performance are listed in the table presented below.

Document Title	Document Number
Human Performance	N-PROG-AS-0002
Training	N-PROG-TR-0005

The Human Performance Program includes tools that have been developed to reduce error, to establish and maintain defences, to identify and resolve latent organizational weaknesses, for early identification and response to precursors, and to identify and implement necessary improvements. By systematically identifying and addressing error-likely situations, reducing organizational vulnerability to errors and events and by questioning or enhancing the integrity of defenses, PVMF is positioned to continually improve organizational effectiveness through the use of best practices, enhanced behaviours and learning.

An OPG fleetwide strategic plan is developed each year in response to human performance trends and events noted in the previous year. The strategic plan is also influenced by industry developments and emerging best practices in sustaining high levels of human performance. The strategic plan focuses on individual, supervisory, and organizational enhancements.

### 2.2.1 Human Performance Program

The Human Performance Program includes the key behavioural expectations that guide worker activities, the supervisory activities that are applied to observe, recognize, and improve behaviours, and the reporting and evaluation activities that are used to assess performance and identify needed improvement initiatives. Activities within the program include the following:

- Pre-job and post-job briefing to identify expected outcomes and to drive ongoing improvement;
- Established expectations for procedural use and adherence;
- Tools to prevent errors in understanding, such as use of three-way communications and the phonetic alphabet;
- Self-checking and situational awareness before beginning an activity or when returning to an activity after a break;
- Conservative decision making, and
- Identifying, evaluating, trending, and acting upon human performance issues and accomplishments.

### 2.2.2 Current Operations

Industry standard performance measures are used to monitor human performance. In addition, coding is applied to Station Condition Records created as part of the Corrective Action Program that supports trending of human performance.

The overall effectiveness of the Human Performance Program is measured through the analysis of events that occur to determine whether the event free operations “clock” should be re-set. Targets are set every year based on previous performance to strive for ongoing reduction in the number of clock resets. The resets are divided into Site and Department levels based on their consequence. The more significant events that have consequences in terms of safety or production and that span several organizations or departments are identified as Site Event Free Day Resets. Less significant events are considered to be Department Event Free Day Resets. Each reset triggers a process of communication within the organization that identifies the underlying behavioural aspects of the event and the event-free tools that, if properly applied, may have prevented the occurrence.

Events that are not Event Free Day Resets are assigned Human Performance codes in the Station Condition Record process and trended to identify patterns of behaviour that are contrary to the expectations set by OPG. Trending of Station Condition Records across all of the OPG nuclear fleet identified that Procedural Use and Adherence requires focused attention. The identified trend resulted in a specific campaign to re-communicate the behavioural expectation.

Each year for the resets that occurred, the results of the review of the trend codes, and other data collected through the implementation of the Human Performance Program is assessed and responding initiatives are developed. For example, as described above, initiatives have been developed to enhance procedural use and adherence.

During the current licensing period, there were no Site Event Free Day Resets as a result of operations at the PWMF. However, there were three Human Performance related events reportable to the CNSC. Two events occurred in 2011. The first event involved two snow removal vehicles exiting the PWMF Phase II site without radiological monitoring, which was caused by operators failing to comply with Radiation Protection procedures. The second event was due to a missed quarterly retube component storage area surface drainage sample, resulting from a temporary suspension of the groundwater program. A third event related to security occurred in 2013. Detailed investigations were performed following these events and corrective actions to prevent recurrence were implemented.

### **Procedure Use and Adherence**

OPG staff is expected to follow procedures as written. Employees are required to stop and consult their supervisor where procedures cannot be followed as written.

Activities that support improvements in procedure use and adherence include the following:

- Observation and coaching by managers in the field;
- Pre- and post-job briefing process;
- Staff communication meetings, and
- Training.

#### **2.2.2.1 Observation and Coaching**

Manager coaching in the field reinforces expectations of procedure use and adherence through observation during pre-job briefings at the work location. Observations are recorded by supervisors with the purpose of the identification of strengths and

weaknesses in human performance behaviors. Strengths are positively reinforced. Results are collected to evaluate areas of excellence and areas needing improvement. Gaps to excellence are addressed through additional targeted improvements.

#### **2.2.2.2 Pre-Job and Post-Job Briefings**

The pre-job and post-job briefing component of the Human Performance Program has been an essential element to provide the necessary review and focus for the job at hand. Pre-job briefings are routinely delivered, with enhancements provided by operating experience. Worker led pre-job briefings are being promoted, and found to be very successful due to increased employee interaction and adherence to the required procedures. Post-job briefings are either formal lessons learned exercises or informal in the form of operating experience delivered to the next crew.

#### **2.2.2.3 Staff Communication Meetings**

A variety of communication tools are used to establish and reinforce the expectations respecting procedural use and adherence. The most effective tool is face to face meetings between managers and their staff to discuss the events that have occurred at the facility, or in other facilities, that reinforce the importance of procedural use and adherence. Employees are engaged in the conversation and actively share their own experiences.

#### **2.2.2.4 Training**

Compliant to the requirements in REGDOC-2.2.2, *Personnel Training*, OPG's Nuclear Training Program is used to develop and maintain competent personnel to safely operate, maintain, and improve plant performance, and to drive human performance improvements in a cost effective manner.

Through the Training Program, OPG personnel acquire the skills and knowledge required to discharge the responsibilities of their positions within the organization.

Operations, maintenance, and support staff are trained and qualified under OPG's Nuclear Training Program. The staff training and qualifications includes initial training, on-the-job training, and evaluation. This training is then maintained by periodic re-qualification and refresher training as appropriate.

A training plan is developed for each occupation using a systematic approach to training, which identifies the training needed to meet the skill and knowledge requirements of the position. Specialized training is provided where appropriate. The employees' training status is maintained in a Training Information Management System.

The Training Program is closely linked to the Human Performance program. Enhanced or focused training is often utilized in the effort to improve safety and reduce errors at PVMF. The human performance expectations are built into the training courses; for example, the nuclear general employee training that is taken annually by all employees contains human performance content.

#### **2.2.2.5 Situational Awareness**

Situational Awareness involves improving the ability of individuals to recognize hazards by anticipating changes and taking action. It is being aware of the surroundings,

recognizing changes, and ensuring new hazards are controlled. It is a frame of mind where individuals are actively looking for potential hazards, assessing the hazards, and ensuring controls are in place.

OPG expects that employees perform a two-minute job site drill when they reach their job site on first instance and after any breaks, to confirm that the hazards are as expected, the preventative measures identified in the pre-job brief are adequate, that they are on the right equipment, and have the tools and protective equipment necessary to safely perform the assigned work activities. Any employee that has concerns is to stop and speak to their supervisor. Managers reinforce this expectation through field observations and perform coaching when necessary to ensure the expectation is being achieved.

### **2.2.3 Future Plans for Improvement**

Going forward, PWMF will continue to implement the Human Performance Program and the Training Program. As described above, the programs include an ongoing aspect of reviewing performance and identifying the areas that would benefit from planned enhancements. Best practices from the nuclear industry will also continue to be evaluated and incorporated into the programs where there is an identified benefit.

## **2.3 OPERATING PERFORMANCE**

### **2.3.1 Operations Program**

OPG operates and manages the Nuclear Waste Management Facilities in accordance with the facility licensing basis and applicable regulations and standards. Procedures are used for all aspects of PWMF's operation, including safety related activities, regulatory requirements, plant and equipment operation and maintenance, work authorizations, equipment labelling, facility access, and plant status.

OPG's key documents for Operating Performance are listed in the table presented below.

<b>Document Title</b>	<b>Document Number</b>
Nuclear Waste Management	W-PROG-WM-0001
Conduct of Regulatory Affairs	N-PROG-RA-0002
Corrective Action	N-PROG-RA-0003

### **2.3.2 Current Operations**

In order to ensure adequate irradiated fuel bay space for operation of the Pickering NGS, the PWMF is operated to safely and reliably transfer, process, and store DSCs from the Pickering NGS until a long-term waste management facility for used fuel becomes available.

During the current licensing period, the safety performance of the PWMF used fuel processing and storage facilities has been excellent while meeting all production targets. PWMF has operated safely without a Lost Time Accident for all 22 years the facility has been in operation.

## **DSC Transfer**

Empty DSCs, and those loaded with used fuel, are transferred on-site between the Pickering NGS and the PWMF. Since the inception of the PWMF to the end of 2015, there have been more than 800 on-site transfers of loaded DSCs without incident. Table 4 shows 348 DSCs were processed and stored between 2008 and 2015.

To improve operational flexibility, a second entrance to the existing DSC Processing Building in the Phase I area was assessed and approved during the current licensing period.

## **DSC Reverse Loading**

In the current licence period, OPG has demonstrated that all of the required DSC reverse loading steps to safely return fuel to an irradiated fuel bay can be performed should it be required. This demonstration included full weld removal using a combination of arc gouging, chipping and grinding. Full weld removal was confirmed by performing a freedom of movement check using a feeler gauge to confirm that the DSC lid was separated from the base. Removal of used fuel from a DSC was performed where a partially loaded DSC was submerged in the irradiated fuel bay and one of the used fuel modules was removed. A DSC drain port was successfully removed by grinding and unscrewing of the drain plug. The remaining steps in the reverse loading process include craning and transfer of the DSC which are routine operations performed regularly at PWMF.

## **DSC Weld Wire Quality**

In 2013, 6 DSCs at PWMF (12% of production) had issues with the quality of the completed welds. These were discovered during the post welding inspection using Phased Array Ultrasonic Testing. The root cause was discovered to be a manufacturing change that introduced contaminants in the weld wire that directly influenced the quality. As a result, defects were detected in some welds. The specifications for the weld wire were revised by OPG and as a result there have been no further weld porosity issues that can be attributed to this issue. With the exception of 2013, the weld quality defects from 2008 through 2015 have been less than the rework target of 10%.

All of the 6 DSCs that demonstrated porosity in the welds during Phased Array Ultrasonic Testing in 2013 were repaired, processed and placed in storage.

## **Phased Array Ultrasonic Testing**

Phased array ultrasonic testing was introduced for inspecting the DSC lid-to-base containment weld. Phased Array Ultrasonic Testing is a volumetric, non-destructive inspection method that involves electronically steering a beam of sound waves through the weld (and adjacent base materials) to inspect the weld. Phased Array Ultrasonic Testing replaces radiographic inspection, thereby eliminating the health and safety hazards of the latter method's radiation exposure. Use of radiography to inspect DSCs ceased in 2010. The change in the inspection method was supported through third party expert review and approval of OPG's technical justification (which included the results of physical testing) provided under the auspices of the CANDU Inspection Qualification Bureau in 2009. The Phased Array Ultrasonic Testing method also improves inspection sensitivity.

## Production History

The number of DSCs loaded at PWMF between 2008 and 2015 is shown in Table 4. PWMF has met its target for number of DSCs loaded per year every year during this reporting period. Lower targets were set for 2009 to 2011 due to reduced station equipment availability and the campaign to move DSCs from Phase I to Phase II.

**Table 4: DSCs Loaded at PWMF per Year**

<b>Year</b>	<b>Number of DSCs Loaded at PWMF between 2008-2015</b>
2008	51
2009	40
2010	20
2011	35
2012	50
2013	51
2014	51
2015	50
<b>TOTAL</b>	<b>348</b>

## Spare Weld Head

A Divisional spare weld head for the DSC welding system was procured and commissioned at the PWMF in October 2016. The spare weld head increases the reliability of the DSC welding system.

## Retube Component Storage Area

The purpose of the Retube Component Storage area at the PWMF is to provide interim storage for components removed during retubing of the Pickering NGS Units 1-4 reactors from 1984 to 1992. The retube waste is stored and treated as nuclear waste using Dry Storage Modules.

During this current licensing period, radioisotope inventories inside the Dry Storage Modules have been steadily decreasing due to radioactive decay. Operational activities at the Retube Component Storage area have been limited to periodic inspection, monitoring, maintenance, and refurbishment of the Dry Storage Modules and the Retube Component Storage area since 1993.

There are 36 Dry Storage Modules located in the Retube Component Storage area; two of these are empty and are stored for contingency and Dry Storage Module aging management and monitoring purposes. Results of this program are discussed in Section 2.6. The remaining 34 Dry Storage Modules contain irradiated reactor components for interim storage.

In the fall of 2009, the Dry Storage Modules and Retube Component Storage area were refurbished. The Dry Storage Modules and saddle supports both received a fresh coat of paint. The asphalt surface of the Retube Component Storage area was repaired, as

necessary, and a rubber membrane was applied to the surface of the asphalt. The Retube Component Storage area fence was also replaced.

### **Reportable Events**

One CNSC reportable event under Operating Performance occurred during the current licensing period. In 2011, Operations noticed that the frequency of sampling of the Active Liquid Waste tanks was different in the work order than in the operating procedure and safety report. The work order had a frequency of 26 weeks, whereas the safety report and operating procedure stated a frequency of four weeks. The work order was corrected and monthly sampling has continued without any further events. All corrective actions were completed.

### **2.3.3 Future Plans for Improvement**

The proposed new DSC Processing Building would increase the annual rate of DSCs being placed into storage at the PVMF from the current rate of 50 DSCs per year to a rate of approximately 100 DSCs per year.

Improvements to the Retube Components Storage area will continue to be monitored to maintain Dry Storage Module integrity. Radiological monitoring and access control to the area remains in effect.

At PVMF, the following future improvements are planned:

- Construct a new DSC Processing Building to replace the existing, and increase production capacity to approximately 100 DSCs annually, starting in 2019;
- Construct DSC Storage Buildings #4, #5 and #6 to support Pickering NGS;
- Refurbishment of Liftking vehicles by 2018 to ensure continued reliability;
- Implementation of a Work Management process that closely aligns with the Nuclear Generating Stations, commenced in 2016. Work Management will become centralized for DNWM, meaning all facilities under the DNWM will follow one common planning process. The work management process promotes event-free execution of work, improves productivity, system and component reliability, and availability of facility systems. As well, the work management process will help to align the support organizations, to ensure operational excellence at each facility, and
- By October 31, 2017, PVMF will be compliant with the requirements of CSA N292.0-14, *General principles for the management of radioactive waste and irradiated fuel*; CSA N292.2-13, *Interim dry storage of irradiated fuel*; and CSA N292.3-14, *Management of low-and-intermediate-level radioactive waste*.

## **2.4 SAFETY ANALYSIS**

Safety Analysis is a systematic evaluation of the potential hazards associated with the conduct of a proposed activity or facility and considers the effectiveness of preventative measures and strategies in reducing the effects of such hazards. It evaluates the risk and consequences of normal, abnormal and accident conditions to ensure that the facility does not pose an unacceptable risk to workers or the public. The results of the safety analysis are used in the development of the operating limits and conditions for a facility. Safety analyses and assessments of structures, systems, components or

facilities are carried out to determine the impact on workers and the public. Safety assessments are presented in each nuclear waste facility safety report, which also provides an overview of the facility design and operations.

To assess the overall safety of the operation of PWMF storage buildings and structures, deterministic safety analyses are used. Computational tools are used for the dose consequence calculations when required. Bounding (worst-case) accident scenarios are conservatively identified, and the results of off-site dose consequence calculations are then compared against the regulatory dose limits.

OPG's key document for Safety Analysis is listed in the table presented below.

<b>Document Title</b>	<b>Document Number</b>
Reactor Safety Program	N-PROG-MP-0014

### **2.4.1 Current Operations**

Nuclear Waste Safety Assessment adopted OPG Reactor Safety Program governance effective March 31, 2015. It defines organizational responsibilities and key program elements for the management of issues related to Nuclear Safety Analysis. Specifically the Reactor Safety Program defines the processes associated with maintaining the following areas: Safety Analysis Basis, Beyond Design Basis Accident Management and Nuclear Waste Management Facilities Safety Reports and Safety Analysis.

Upon completion of the Safety Analysis, using the safety analysis assumptions and results, the relevant Safety Report and Safety Design Envelope are updated. The operation documentations such as operation manuals and predefined maintenance on specific equipments are assessed if any revisions are required as a result of the new or updated Safety Analysis.

The PWMF safety report is reviewed every five years and updated as required to reflect changes in operational experience and information supporting the assumptions made in the assessments. The safety report update process encompasses the systematic identification of safety issues, their prioritization, their resolution, and the physical updates of the safety report.

The current version of the PWMF safety report was submitted to the CNSC in 2013, and accepted by the CNSC in 2014. The current safety report was updated in accordance with PWMF operating licence Licence Condition 4.2. The safety report demonstrates that dose rates and emissions from the PWMF under normal and abnormal operating conditions as well as postulated accident conditions are within allowable limits, and operation of the facility continues to pose a negligible risk to the public, the workers, and the environment. The next PWMF safety report update will be in 2018.

### **2.4.2 Safety Assessment Results for PWMF Structures**

#### **2.4.2.1 Used Fuel Dry Storage Safety Analysis - Normal Operating Conditions**

Shielding analysis is performed to determine dose rates from individual DSCs, and both inside and outside the storage buildings. Dose rates external to the buildings are determined for workers on-site and for members of the public off-site. In all cases,



predicted dose rates at the site boundary and for the nearest residence are estimated to result in doses well below the CNSC regulatory public dose limit of 1 mSv/year.

#### **2.4.2.2 Used Fuel Dry Storage - Safety Assessment of Malfunctions and Accidents**

The assessment of malfunctions and accidents considered the following main stages of the out-of-station used fuel dry storage operations:

- On-site transfer operations;
- Operations inside the DSC Processing Building; and
- Storage.

Each potential event was screened to determine if it could result in any radiological impact to the public and workers. Common mode incidents such as seismic events, flooding, etc. were considered. Design provisions and procedural measures that could prevent the event or mitigate its consequences were also evaluated.

Although considered unlikely, for on-site transfer and processing of DSCs (e.g. welding, inspecting, testing, sealing and moving to storage), the bounding accident was identified to be a drop of the DSC, with subsequent 30% fuel sheath failures. The total doses to the public at the Pickering Nuclear site boundary and the occupational doses due to this event were assessed to be below the regulatory dose limits.

During the DSC storage phase, the bounding dose consequences are associated with a hypothetical event in which 10% of the DSC seal-welds fail. During storage, both the fuel sheath and the DSC seal-weld must fail for a release of radionuclides to occur. Used fuel with a known damaged or defective sheath is not loaded into a DSC. Failure of the sheath is not expected to occur during the operating life of the storage facility. The total doses to the public at the Pickering Nuclear site boundary and the occupational doses due to this event were assessed to be below the regulatory dose limits.

In March 2010, OPG identified potential abnormal scenarios involving multiple vehicles in the DSC Processing and Storage Buildings at the PWWF. OPG performed the appropriate assessment and confirmed that the consequences of the postulated scenarios involving operation of multiple vehicles inside the DSC Processing and Storage Buildings at the PWWF are within the safety and design envelope.

#### **Criticality**

Criticality assessments have been completed for the used fuel stored in DSCs for the PWWF. Consistent with expectations for irradiated natural uranium fuel, the analyses and assessments have yielded adequate sub-criticality margin and have demonstrated that there can be no criticality of used CANDU fuel.

Used fuel stored in DSCs cannot achieve criticality under normal conditions or under any postulated accident scenario at the PWWF.

#### **2.4.2.3 Retube Component Storage Area – Normal Operating Conditions**

Waste structures are designed and constructed such that dose rate targets at exterior surfaces of the structures, at the facility fence and at site boundaries are achieved. Dose rates in the Retube Component Storage area are routinely monitored and shown to be within facility targets, well below regulatory limits.

#### **2.4.2.4 Retube Component Storage Area – Abnormal Operating Conditions**

Potential exposures from the Retube Component Storage area under abnormal operating conditions have been reviewed and no credible events that would lead to a failure of the Dry Storage Modules have been identified. Conservative estimates of worst case doses from extreme conditions, such as a lightning strike or impact of a small aircraft, are well below the regulatory limits.

#### **2.4.3 OPG's Response to Fukushima**

Following the 2011 event at Fukushima, OPG assessed the impact of consequential event sequences on the existing PWMF safety envelope. The initiating and consequential events considered a seismic event, fire, explosion, loss of power, tornado and thunderstorm. In all scenarios assessed for the PWMF, the consequences of the resulting events were found to be within the existing safety envelope as defined in the safety report for the nuclear waste facility. Further details of OPG's response to this event are described in Section 3.4.

#### **2.4.4 Future Plans for Improvement**

##### **Safety Analysis Methodology**

The methodology for performing safety assessments is routinely assessed and updated in order for the methodology to be as up-to-date and accurate as possible. DSC shielding analysis methodology is being updated to incorporate the use of the Monte Carlo N-Particle transport code for dose rate calculations. DSC models (including fuel) are being updated to better represent actual geometries, and analysis assumptions are being reviewed to ensure reasonable conservatism exist. This demonstrates OPG's goal of continuous improvement. These improvements are expected to be used for the 2018 PWMF Safety Report update.

##### **Support for Additional Facilities**

In the current PWMF operating licence, there is provision and authorization for DSC Storage Building #4 to be built at the PWMF Phase II site.

Three additional buildings are being requested, namely a new DSC Processing Building (similar in design and function to the existing processing buildings currently in use at the Darlington Waste Management Facility and the Western Waste Management Facility) and two additional DSC storage buildings. Detailed safety assessments will be performed for these new buildings once additional design and specific location information is available. This is to ensure that the designs of the buildings are adequate and that all radiological safety requirements provided in the *Nuclear Safety and Control Act* and its Regulations are met.

##### **Safety Analysis Update**

Safety analyses are reviewed as necessary prior to construction and/or prior to safety report updates, to confirm that facility operations will not result in any significant radiological consequences to the health and safety of the workers and the public, under normal and abnormal operating conditions as well as postulated accident conditions.

## 2.5 PHYSICAL DESIGN

Physical design relates to activities that impact on the ability of systems, structures and components to meet and maintain their design basis given new information arising over time and taking changes in the external environment into account.

DNWM has robust processes to ensure that the physical design of the PWMF complies with the current safety basis and that all changes are authorized and performed in a controlled manner, and in accordance with the PWMF Operating Licence.

OPG's key documents for Physical Design are listed in the table presented below.

Document Title	Document Number
Conduct of Engineering	N-PROG-MP-0007
Design Management	N-PROG-MP-0009
Engineering Change Control	N-PROG-MP-0001
Pressure Boundary	N-PROG-MP-0004

### 2.5.1 Design Programs

Management of the design basis at the PWMF is now governed by the OPG Nuclear Conduct of Engineering Program. This program provides the framework for performing engineering work in a consistent manner across all OPG Nuclear facilities.

Engineering activities, including design management, are implemented via procedures and work instructions to satisfy the following requirements:

- The PWMF configuration is maintained in accordance with the design basis and the facility is operated within its safety envelope;
- All modifications to the facility are designed, constructed, installed, and commissioned in accordance with the design basis;
- Essential facility systems, structures, and components perform their functions safely and reliability within the design basis;
- All relevant legal and regulatory requirements are met, and
- Continuous improvement is encouraged and fostered to improve facility performance.

The Conduct of Engineering Program is supported by the Design Management Program, Engineering Change Control Program, and Pressure Boundary Program.

The Design Management Program provides the requirements to manage existing and new designs in accordance with the requirements of the licence, regulations, and industry best practice. It includes specific requirements for creating or modifying design basis documents, performing design verification and assurance activities, and providing the appropriate content and format of design basis documents. The Design Management Program provides direction for preparing detailed designs within DNWM or managing design agencies that prepare designs on behalf of DNWM.

The Engineering Change Control Program provides requirements to ensure that:

- All modifications to systems, structures, and components are designed correctly;
- Modification designs are reviewed by all stakeholders and authorized by the DNWM Design Authority before being implemented;
- Modifications are installed in accordance with approved procedures;
- Modifications are commissioned and tested to demonstrate that design requirements have been met, and
- Commissioning results are reviewed and accepted by the appropriate stakeholders before the modified system, structure, or component is placed into service.

The Pressure Boundary Program provides a managed process for performing repairs, replacements and modifications on pressure retaining systems and components, and reflects the requirements of a pressure boundary quality assurance program. Work on PWMF pressure boundary systems meets the requirements of CSA N285.0-08 (including Update 1 & Update 2) and additional requirements per Appendix D of the PWMF operating licence. OPG also maintains a pressure boundary program document roadmap in compliance with Annex N of CSA N285.0-12 and Update 1. The CNSC has regulatory jurisdiction over pressure boundary requirements, including approval of any deviations from those requirements. OPG's Authorized Inspection Agency is currently the Technical Standards and Safety Authority.

## 2.5.2 Current Operations

DNWM adopted OPG Nuclear Conduct of Engineering governance effective December 31, 2012, including the associated programs for Design Management, Engineering Change Control, and Pressure Boundary. The transition from legacy DNWM governance was accomplished through a managed process of governance management records that ensured a controlled and thorough adoption process.

During the current licensing period, OPG also implemented improvements for its pressure boundary related activities including code classification for all pressure retaining systems.

The following codes and standards are currently used in design:

- NRCC NBCC (2005), *National Building Code of Canada*;
- NRCC NFCC (2005), *National Fire Code of Canada*;
- ASME B31.1, (2010) *Power Piping*;
- CSA B51 (2009 & Update 1) *Boiler, Pressure Vessel and Pressure Piping Code*, and
- CSA N285.0 (2008 & Updates 1 and 2; and 2012 Annex N), *General Requirements for Pressure Retaining Systems and Components for CANDU Nuclear Power Plants*.

DNWM has executed various small and large modifications with no impact on the PWMF's ability to operate within its safety envelope. These modifications have been undertaken to improve the overall performance of the PWMF and to improve safety in

design and operations. The significant modifications in the current licensing period are listed below:

- (1) A modified design of the DSC (referred to as Mark II or MKII) was introduced at the PWMF. Principal changes from the original DSC design include the removal of the vent port and a smaller drain port. These changes took into account operating experience. Elimination of the vent port also simplified the containment of the DSC. Commissioning of the DSC MK II was completed at the PWMF in 2009.
- (2) Phased Array Ultrasonic Testing was introduced for inspecting the DSC lid-to-base containment weld. As described in Section 2.3.2, it replaced radiographic inspection, thereby eliminating the health and safety hazards of radiographic inspection method's radiation exposure, and improved inspection sensitivity.
- (3) In April 2013, a modification was undertaken to install visual fire alarm devices (strobe lights) in the welding area ventilation rooms. This was to address the concerns that the audible fire alarms might not be heard by personnel due to the high levels of noise generated from the ventilation equipment. The modification was designed to comply with requirements of the *National Building Code of Canada* (2005), and was completed in 2014.
- (4) To facilitate interim storage of used fuel on site, DSC Storage Building #3 was constructed and placed in-service in 2009. Further expansion of the Phase II PWMF site is planned as described within Section 1.5.

In 2012, DNWM adopted the standard OPG Nuclear fleet metrics for physical design. The current suite of metrics includes measures of the health of the Engineering Change Control process within DNWM. Quality of design products is monitored using recorded verification results and cold-body design review boards within DNWM. A monthly report card is used to record and track DNWM's performance and to ensure that corrective actions are being taken to address any weaknesses or deficiencies that are observed.

### **2.5.3 Future Plans for Improvement**

DNWM will be compliant with the following new codes and standards or new editions of existing codes for any new designs upon issuance of the new licence and Licence Conditions Handbook:

- CSA N393-13, *Fire Protection for Facilities that Process, Handle, or Store Nuclear Substances*;
- NRCC NBCC (2010), *National Building Code of Canada*;
- NRCC NFCC (2010), *National Fire Code of Canada*;
- ASME B31.1, (2010) *Power Piping*;
- B51-09 (2009 & Update 1), *Boiler, Pressure Vessel and Pressure Piping Code*, and
- CSA N285.0 (2008 & Updates 1 and 2; and 2012 Annex N), *General Requirements for Pressure Retaining Systems and Components for CANDU Nuclear Power Plants*.

PWMF follows the OPG Nuclear governance for pressure boundary. OPG Nuclear has a current agreement with the CNSC that freezes the code effective dates of applicable pressure boundary codes and standards throughout the duration of the Darlington NGS Refurbishment project. These frozen code effective dates are in place for PWMF as well. Once the Darlington NGS Refurbishment project is completed, the new code effective dates for applicable pressure boundary codes are to be accepted by CNSC staff and will be incorporated into OPG Nuclear governance. The anticipated PWMF Licence Conditions Handbook would reflect the new code effective dates as necessary at that time.

## 2.6 FITNESS FOR SERVICE

Fitness for Service covers the activities that impact the physical condition of systems, components and structures to ensure that they remain effective over time. This includes programs that ensure the equipment is available to perform its intended design functions when called upon to do so. Fitness for Service ensures the safety of the public and site personnel, protects the environment and ensures that equipment reliability is maintained at high operating performance standards.

OPG is committed to maintaining PWMF systems, structures, equipment and components that are critical to the safe, reliable and economic transportation, processing and storage of nuclear waste in a fit-for-service state. The implementation of OPG's Reliability and Aging Management Programs ensures the ongoing fitness-for-service of these systems.

OPG's key documents for Fitness for Service are listed in the table presented below.

Document Title	Document Number
Equipment Reliability	N-PROG-MA-0026
Nuclear Waste Management	W-PROG-WM-0001
Conduct of Engineering	N-PROG-MP-0007
Integrated Aging Management	N-PROG-MP-0008

### 2.6.1 Equipment Reliability

Under OPG's Equipment Reliability Program, system performance monitoring is performed on critical PWMF systems to ensure ongoing reliable operation.

System performance monitoring involves the trending of system performance and initiation of investigations or maintenance activities before failures occur. Process parameters, field observations, maintenance work order backlogs, Station Condition Records, inspection results and spare parts status are some of the typical sources of data for performance monitoring. Where appropriate, equipment critical to system reliability are identified and maintenance strategies for these equipment are prepared. Actions to maintain or improve system health are also prepared.

Meetings with facility management, including representation from Operations, Maintenance, Performance Engineering, Design Engineering, Supply Chain, Radiation Protection and Licensing are routinely held to review system health status, maintenance strategies and improvement plans, and ensure alignment between these work groups for

the implementation of improvement plans. There are currently 11 systems at PWMF that are included in the system performance monitoring program. Other systems are monitored to address specific issues. Ongoing management oversight of these improvement plans provides assurance that the plans are being implemented and the improvements are being achieved.

## **2.6.2 Maintenance**

Under DNWM's Program, recurring preventive maintenance activities are planned, scheduled and executed according to the preventive maintenance program. The management and scheduling of preventive maintenance activities are completed using OPG's enterprise software system 'Asset Suite' which also retains records of all maintenance tasks completed. Feedback inputs from maintenance staff and changes to preventive maintenance activities are managed in the Preventive Maintenance Living Program.

Non-routine maintenance (corrective maintenance) activities are requested, planned and executed using Asset Suite as well. Significant corrective maintenance issues may be identified using the Corrective Action Program and tracked to completion in Asset Suite's Action Tracking module.

As part of system performance monitoring, the status of the maintenance program is routinely assessed and reported to facility management for their review. Metrics for the completion of preventive and corrective maintenance activities are presented, and Station Condition Records are issued to address adverse conditions related to equipment health or the execution of maintenance activities. Corrective actions to address maintenance issues are provided for management approval and are monitored to completion.

## **2.6.3 Structural Integrity**

OPG conducts various activities to ensure the structural integrity of the storage structures to protect the health and safety of persons and the environment.

At the PWMF, OPG conducts Phased Array Ultrasonic Testing to verify the integrity of the lid closure weld on each loaded DSC. As of the end of 2015, approximately 264 DSCs have been inspected with the Phased Array Ultrasonic Testing system.

## **2.6.4 Current Operations**

### **2.6.4.1 Aging Management Programs**

Aging is effectively managed if aging effects are understood and controlled, and if aging related degradation mechanisms are mitigated through implementing appropriate corrective actions to prevent the loss of primary safety functions through the asset's service life.

#### **Dry Storage Containers Aging Management Program**

The DSC Aging Management Plan addresses aging mechanisms, such as corrosion, which could potentially affect DSCs.

Current aging management activities include:

- General visual check of the condition of the protective coating on the exterior of the DSC, with emphasis on the condition of the coating on the containment welds;
- Periodic inspection and re-inspection of the base plates of a baseline population of DSCs;
- Ultrasonic inspection of indications in the metal of the base perimeter flange, and
- Monitoring of chloride levels which have the potential to accelerate corrosion.

Results to date:

- Condition of the coating on the containment welds and the Dry Storage Containers themselves remain in good-to-excellent condition. To date, very few areas on the containment welds have required re-coating (i.e. touch-up);
- No changes have been observed in the condition of the base plates between the time of their initial inspection and re-inspection (CNSC is provided with annual summary reports of the inspections), and
- Measured chloride levels to date have a negligible effect on the potential corrosion of the DSC external surfaces.

With the ongoing implementation of this Aging Management Program, OPG is confident of DSC integrity throughout and beyond the next licence period.

### **Dry Storage Modules Aging Management Program**

During the current licensing period, annual visual inspections of the Dry Storage Modules were performed. Recommendations were identified for future improvements based on the 2008 inspection and implemented in 2009. In the fall of 2009, the Dry Storage Module storage area underwent refurbishment. The modules were repainted, with new nameplates and covers installed. The surrounding asphalt area was resealed with a membrane, and new fencing was replaced around the site. Fluorescent magnetic particle inspection on the bottom half of circular weld and all of the support saddle welds were also performed on two of the oldest Dry Storage Modules, and inspection results were acceptable.

Twice annually, dose rates at the Dry Storage Modules are recorded, and surfaces checked for contamination, to confirm Dry Storage Module integrity. No loose contamination has been recorded to date. Dose rate measurements taken at the east and south fences of the Retube Component Storage area show no significant change over the current licensing period.

As part of the on-going aging management plan, the Dry Storage Modules with the higher contact dose rates are monitored to confirm Dry Storage Module integrity has not changed and contents remain in design configuration. With the ongoing implementation of this Aging Management Program, OPG is confident of Dry Storage Module integrity throughout and beyond the next licence period.



#### **2.6.4.2 Periodic Inspection Programs**

##### **PWMF Floor Slabs Periodic Inspection Program**

The PWMF underwent an assessment in 2014 to determine the structural condition of the Stage 1 and Stage 2 floor slabs, with the conclusion that the floor condition was acceptable for continued operation.

With implementation of recommendations from the assessment, OPG will ensure that the slabs are available for continued operations for the projected end of facility service.

In 2014 and 2015, no condition inspections were expected to be completed under the assessment plan. Floor deflection inspections are scheduled to commence in 2016. Repairs to the existing floor slabs are in progress.

##### **Phase I Processing Building Periodic Inspection Program**

In 2014, the commencement of the System Health Reporting was initiated for the Building Envelope system. Preventative Maintenance tasks are in place for yearly inspection and maintenance (roof anchor points, drains, floor crack, overall building health, etc).

#### **2.6.5 Future Plans for Improvement**

OPG has planned a number of initiatives to address aging, obsolescence and to ensure ongoing fitness for service of critical structures, systems and components through the next licence period:

- LiftKing transporter upgrades are planned to address reliability and obsolescence issues. There are no safety issues with the LiftKing transporter.
- Implementation of PWMF Phase 1 floor slab recommendations to ensure the continued operations for the projected end of facility service. Deflection measurements and visual inspections are ongoing to confirm that the floor slab integrity is maintained. Repairs to the existing floor slabs are in progress. A floor slab re-assessment is scheduled for 2019 as per the floor slab analysis recommendation.
- OPG is updating the list of safety-related SSCs for PWMF. This plan will then be used to assist in determining which SSCs shall be subjected to aging management evaluations and actions.
- OPG is updating the aging management plan for the Dry Storage Modules to reflect the information from recent condition assessment report as well as current aging management practices.
- PWMF will be compliant with REGDOC-2.6.3, *Aging Management* by July 15, 2017, as part of continuous improvement.

### **2.7 RADIATION PROTECTION**

#### **2.7.1 Radiation Protection Program**

OPG has established a comprehensive Radiation Protection Program to protect workers and the public. This program is in place to support OPG's nuclear waste facility

operations and to assure compliance with the *Nuclear Safety and Control Act* and its Regulations, applicable provincial legislation, and OPG's Management System described in Section 2.1.

OPG's key document for Radiation Protection is listed in the table presented below.

Document Title	Document Number
Radiation Protection	N-PROG-RA-0013

The Radiation Protection Program is implemented through a series of standards and procedures for the conduct of activities within nuclear sites and with radioactive materials intended to achieve and maintain high standards of Radiation Protection including the achievement of the following objectives:

- (1) Controlling occupational and public exposure by:
  - Keeping individual doses below regulatory limits;
  - Avoiding unplanned exposures;
  - Keeping individual risk from lifetime radiation exposure to an acceptable level, and
  - Keeping collective doses As Low As Reasonably Achievable.
- (2) Preventing the uncontrolled release of contamination or radioactive materials from the nuclear sites through the movement of people and materials, and
- (3) Demonstrating the achievement of (1) and (2) through monitoring.

### **Radiation Protection Program Monitoring and Oversight at PWWF**

Established performance indicators include Radiation Protection Program effectiveness measures commonly used in the nuclear industry and OPG defined indicators established for the purpose of monitoring particular program elements. These are captured in OPG's Electronic Performance Reporting systems as well as DNWM Scorecards and Radiation Protection Indices. Specific measures include personnel contamination incidents, regulatory infractions, as well as dose performance versus dose targets.

In addition to Fleetview reporting and assessments described in Section 2.1, the design and execution of the Radiation Protection Program is subject to ongoing monitoring through mechanisms including but not limited to:

- Management review and assessment which includes:
  - Joint Committee on Radiation Protection, and
  - Monthly Management Oversight Meeting.
- Exceptional dosimetry and dose control device measurement results;
- Dose trends;
- Annual review of As Low As Reasonably Achievable targets;
- Worker and worker representative's input to the Radiation Protection Program through their local Joint Health and Safety Committees;

- Radiation Protection program self-assessments;
- Independent audits;
- Investigation of events in which an Action Level has been exceeded;
- Improvements to the Radiation Protection Program, such as enhanced alpha monitoring through workplace controls and specialized alpha radiation protection equipment;
- Trending of Radiation Protection Program measures commonly used in the nuclear industry;
- Benchmarking of OPG practices with the rest of the nuclear industry, and
- Reviews of industry operating experience.

### **Management Control over Worker Practices for Dose and Contamination Control**

Performing radioactive work within PWWF requires a systematic approach and is managed via the OPG Radiation Protection program which includes the following processes:

- Limiting individual worker dose;
- Managing dose as a resource, in terms of constraints on work activities;
- Establishing facility design consistent with As Low As Reasonably Achievable principles;
- Assessing hazards for planning and maintaining knowledge of conditions;
- Controlling the use of licensed radioactive devices and equipment, and
- Planning all radioactive work taking into account personnel, hardware, procedures, supervision, and the physical environment of the job.

The planning process includes the anticipation and evaluation of radiation hazards and the selection of appropriate protective measures and dosimetry. The degree of formalization of the planning process and the approval levels for a job are proportional to the potential for exposure. Plans include backout conditions and contingencies. Radiation protection planning decisions are documented in a radiation exposure permit.

The program elements described in this section ensure compliance with the regulatory requirements to keep exposures As Low As Reasonably Achievable, implement control of occupational and public exposure, and plan for unusual situations.

Radioactive contamination controls are in place to reduce occupational and public exposure, and to minimize the release of radioactive materials to the environment. The objectives are to prevent a loss of radioactive contamination control, to minimize the area affected if contamination occurs, and to restore the condition to acceptable levels as soon as possible.

## 2.7.2 Current Operations

### Dose and Contamination Control

During the reporting period there have been no action level exceedances related to worker dose at PWMF or any loss of contamination control events in excess of PWMF's contamination control action levels.

The current action levels for dose to workers and for contamination control are shown in Table 5.

Table 5: Radiological Action Levels for PWMF

Application	Action Level	Observations
<u>Dose To Workers</u>  Individual worker external whole body radiation dose received on a job greater than planned.	1 mSv (100 mrem)	The Action Level is exceeded if a person receives an external whole body radiation dose of greater than 1 mSv above the planned dose per shift.
<u>Contamination Control</u>  Surface contamination levels greater than a predetermined activity in the DSC Storage Area.	$3.7 \times 10^4$ Bq/m <sup>2</sup> (1 $\mu$ Ci/m <sup>2</sup> )	The Action Level is exceeded if two or more surface contamination events exceeding $3.7 \times 10^4$ Bq/m <sup>2</sup> (1 $\mu$ Ci/m <sup>2</sup> ) occur per quarter.

OPG is currently reviewing the above action levels (see Section 2.7.4 Future Plans for Improvement).

### Collective Dose and Maximum Individual Dose per Year

OPG's administrative limits include two control levels for exposure: (1) the Exposure Control Level is 10 mSv/year, and (2) the Administrative Dose Limit is 20 mSv/year. Exposure control levels are set below administrative control levels, which are in turn below the regulatory limits. In particular, the OPG individual exposure control level of 10 mSv (1 rem) per calendar year is significantly below the single year regulatory limit of 50 mSv (5 rem) in a year, and the five-year regulatory limit of 100 mSv (10 rem) averaged over five years for a nuclear energy worker. Use of exposure control levels encourage As Low As Reasonably Achievable performance at the individual level and the distribution (sharing) of exposure across the workers.

Figure 10 and Table 6 outline the key dose statistics for PWMF. Worker doses were maintained consistently below OPG Individual Exposure Control Levels and well below regulatory limits in the *Radiation Protection Regulations* over the current licensing period.

As noted in Section 2.3.2, the number of DSCs loaded at PWMF increased in 2012 as compared to previous years, resulting in an expected corresponding increase in collective dose. However, with the dedicated application of As Low As Reasonably Achievable principles, the collective dose decreased back to pre-2012 levels, demonstrating the commitment to As Low As Reasonably Achievable at PWMF.

OPG's exposure control program continues to be in full compliance with regulatory requirements. As Low As Reasonably Achievable targets are set yearly for PWMF.

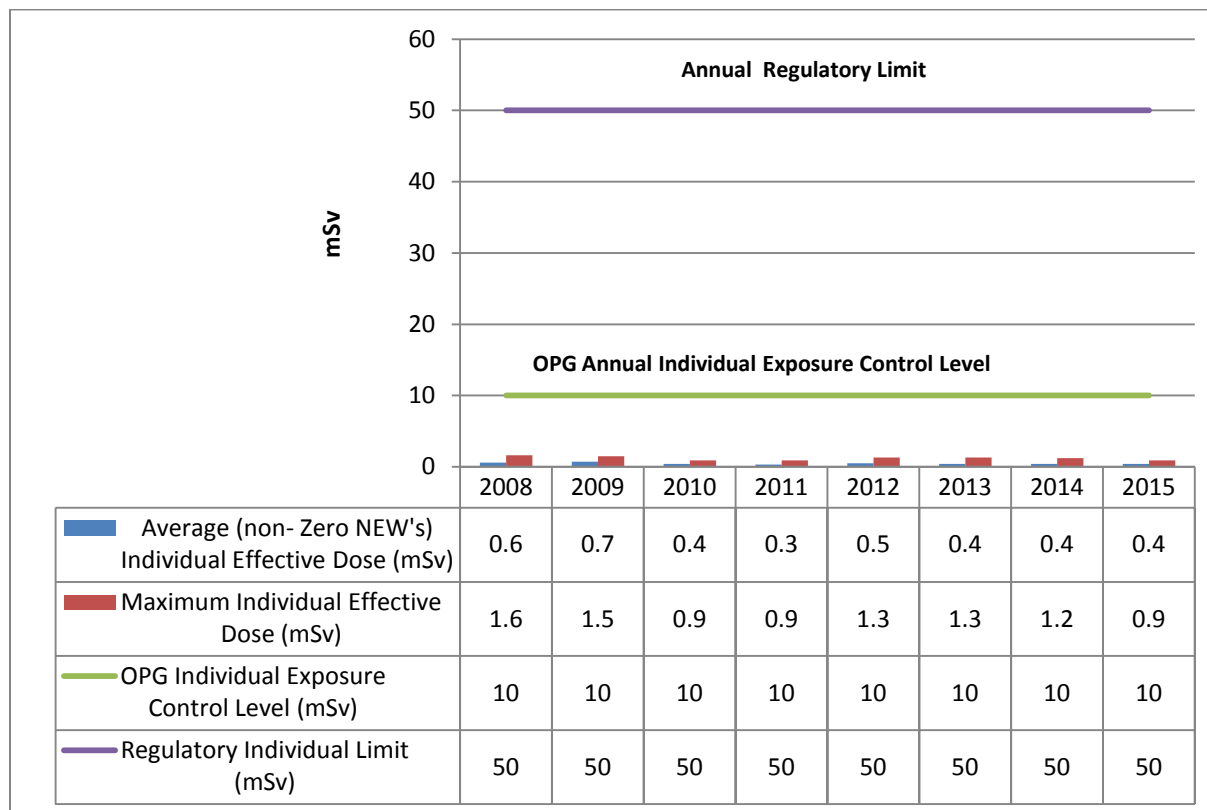


Figure 10: Average and Maximum Dose at PWMF

Table 6: Key Dose Statistics for OPG's Pickering Waste Management Facility

Year	Total Number of Staff Monitored	Total Number of NEW's* Monitored	Collective Dose	Average (total) Individual Effective Dose	Average (non-Zero NEW's) Individual Effective Dose	Maximum Individual Effective Dose	Regulatory Individual Limit	OPG Individual Exposure Control Level	DSCs Loaded per Year
	#	#	Person-mSv	mSv	(mSv)	(mSv)	(mSv)	(mSv)	#
2008	37	37	9.7	0.3	0.6	1.6	50	10	51
2009	39	39	11.2	0.3	0.7	1.5	50	10	40
2010	47	45	7.3	0.1	0.4	0.9	50	10	20
2011	51	49	6.0	0.1	0.3	0.9	50	10	35
2012	45	42	10.6	0.2	0.5	1.3	50	10	50
2013	38	37	9.4	0.2	0.4	1.3	50	10	51
2014	40	38	8.8	0.2	0.4	1.2	50	10	51
2015	40	38	6.7	0.2	0.4	0.9	50	10	50

\* NEW – Nuclear Energy Worker as defined by the *Nuclear Safety and Control Act*

### **PWMF Perimeter Dose Monitoring**

Environmental Thermoluminescent Dosimeters are mounted on the perimeter fence of both PWMF Phase I and Phase II sites as shown on Figure 11 and Figure 12, and are changed and analyzed quarterly. The Thermoluminescent Dosimeters are located on the inner fence of the Retube Components Storage area, DSC Storage Building #3 and the eastern perimeter wall of the PWMF Phase I. Data is reported to the CNSC in the PWMF quarterly operations report. Target Dose Rates for the Retube Component Storage area and DSC Storage Building #3 have been set to less than 0.5  $\mu\text{Gy/h}$ , and less than 1.75  $\mu\text{Gy/h}$  at the eastern perimeter wall of the PWMF Phase I.

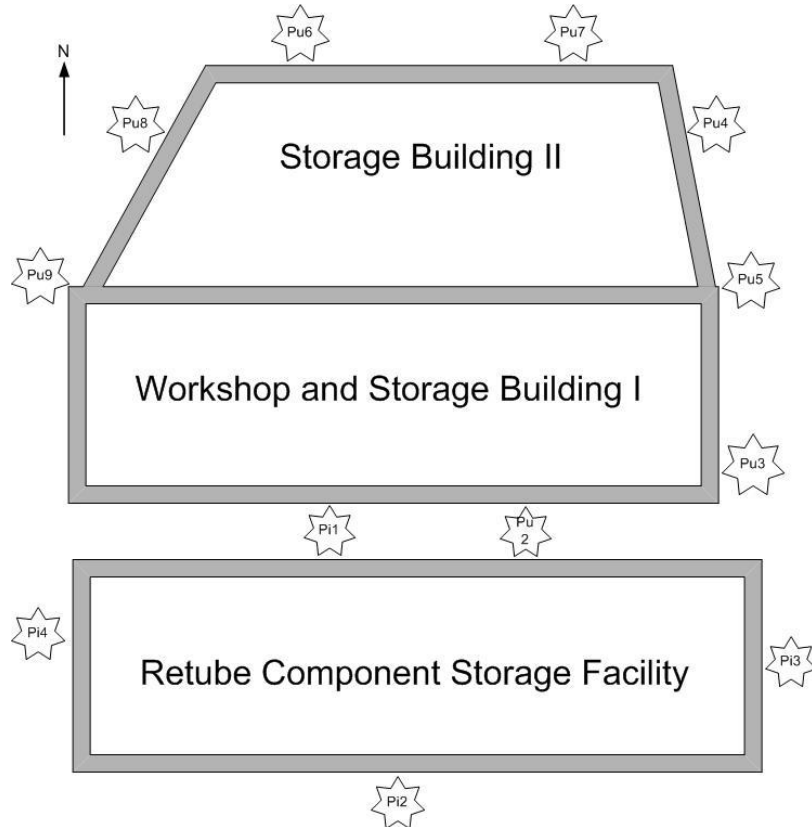
A dose rate of 0.5  $\mu\text{Sv/h}$  for 2,000 hours of exposure would result in a dose to the public of 1 mSv, the regulatory annual limit. The average actual perimeter dose rate at the PWMF has consistently been less than the 0.5  $\mu\text{Sv/h}$ , with an overall average less than 0.1  $\mu\text{Sv/h}$ . The maximum potential dose at the site boundary over the course of a year to a member of the public is well below the regulatory annual dose limit of 1 mSv for a member of the public.

Since 2008, all measured dose rates have been below target. Annual performance is reported as the average of all dose rates. Any contributions from PWMF to the public dose from this perimeter monitoring program are incorporated into the Pickering Environmental Monitoring Program.

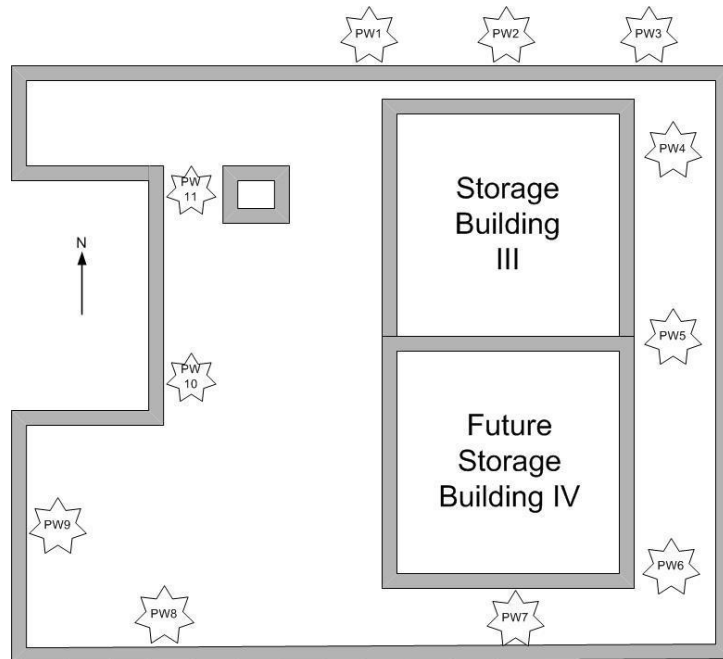
### **Results of Corporate-wide Radiation Protection Audit**

A corporate wide Radiation Protection audit was completed in 2015. A formal corrective action plan was prepared and approved at the corporate level. No major non-conformances were found specific to the PWMF; however, improvements in the application of Radiation Protection fundamentals (use of personal protective equipment) were cited and that operating experience has been shared with all OPG Nuclear Waste sites.

**Note:** The following figures show the general arrangement of Thermoluminescent Dosimeters around the Pickering Waste Management Facility sites. The drawings are not to scale since they are for Thermoluminescent Dosimeters layout information only.



**Figure 11: Thermoluminescent Dosimeters Locations around the PWMF Phase I Site**



**Figure 12: Thermoluminescent Dosimeters Locations around the PWMF Phase II Site**

### 2.7.3 Other CNSC Licences

Current revisions of OPG's Nuclear Substances and Radiation Devices Licences at the time of writing this application include:

- Licence # 12861-2-20.3 for consolidated uses of nuclear substances (815) for nuclear substances and prescribed equipment;
- Licence # 12861-15-17.1 for temporary possession – no use (918) for nuclear substances, and
- Licence # 12861-17-20.0 for servicing, installation and dismantling of devices – basic servicing (822) for prescribed equipment.

OPG also holds Dosimetry Service Licence # 12861-11-25.0 for in-house dosimetry services – consolidated (598) for the operation of a dosimetry service.

### 2.7.4 Future Plans for Improvement

Development of a Nuclear Waste specific radiation protection action level document is in progress to align and standardize parameters for both dose and contamination control. The planned submission of this document to CNSC is December 2016. OPG expects to have this document complete during the current licence period.

## 2.8 CONVENTIONAL HEALTH AND SAFETY

### 2.8.1 Conventional Safety Program

OPG's key documents for Conventional Health and Safety are listed in the table presented below.

Document Title	Document Number
Employee Health and Safety Policy	OPG-POL-0001
Health and Safety Management System Program	OPG-PROG-0010

The goal of OPG Nuclear's Conventional Safety Program is to ensure the safety and well-being of its workers. This is achieved by ensuring that safety is a core value and by managing conventional risks in the workplace associated with PWSM's operations. The Conventional Safety Program is designed to be an integrated system with OPG Nuclear business managed processes, where appropriate, and considers the current organizational structure.

The Employee Health and Safety Policy states:

- OPG shall meet or exceed all applicable health and safety legislative requirements, as well as, other associated health and safety standards to which OPG subscribes. OPG shall require that its contractors maintain a level of safety equivalent to that of OPG employees while at OPG workplaces;
- OPG shall ensure that employees are involved in decisions that have an impact on their health and safety, either individually, as a group, or through their employee representative groups;



- OPG shall ensure that work is planned and performed to protect workers. It shall provide its employees with the information, training, tools, procedures and support required to do their jobs safely, and
- OPG shall set health and safety targets as part of its annual business planning process. Health and safety performance against these targets shall be regularly measured and evaluated to ensure the effectiveness of OPG's health and safety systems.

The Employee Health and Safety Policy further commits to the prevention of workplace injuries and ill health, and to continuous improvement of its employee health and safety performance.

Additionally, the Internal Responsibility System is a system applied consistently throughout OPG Nuclear, where everyone has personal and shared responsibility for working together co-operatively, to prevent occupational injuries and illnesses. The duties for a healthy and safe workplace fall on every individual, to the degree they have:

- Authority to do so (based upon their position), and
- Ability to do so (based upon their expertise and qualifications).

Each person is expected to take the initiative on health and safety issues, work to solve problems, and make improvements on an on-going basis. The Internal Responsibility System is based on the principle that employees themselves are in the best position to identify health and safety problems and identify solutions. The Internal Responsibility System outlines the appropriate resolution level for timely corrections.

To ensure that the overall objective of managing occupational hazards is met, OPG monitors the following performance indicators:

- All Injury Rate;
- Accident Severity Rate, and
- High Maximum Reasonable Potential for Harm Events.

## **2.8.2 Current Operations**

In July 2016, PVMF demonstrated its commitment to safety by working without a lost time accident for its entire operational period. This period has lasted 22 years.

The following section provides the results on All Injury Rate, Accident Severity Rate, and high Maximum Reasonable Potential for Harm events for the reporting period. The performance indicators (All Injury Rates and Accident Severity Rates) identified in Figure 13 and Figure 14 are inclusive for the entirety of DNWM (which the PVMF is part of). Specific safety events at PVMF that impact the All Injury Rate and Accident Severity Rate are discussed below.

### **All Injury Rate**

The All Injury Rate is defined as is the number of fatalities, lost-time injuries and medical treatment injuries multiplied by 200,000 person-hours, divided by the total exposure hours worked.

DNWM's All Injury Rate performance was better than target from 2010 through 2015 as shown in Figure 13. Although there was no All Injury Rate target for 2008, PVMF did

have one medically treated injury due to an allergic reaction to dust in the eye. In 2009, there were two medically treated injuries at PWNF that contributed to the All Injury Rate target not being met for that year. Both of them were related to musculoskeletal injuries due to over-exertion. Since 2009, the PWNF site has shown an improved safety performance where there have not been any injuries at the PWNF impacting the All Injury Rate. The target was reduced throughout the licence period to drive continuous improvement.

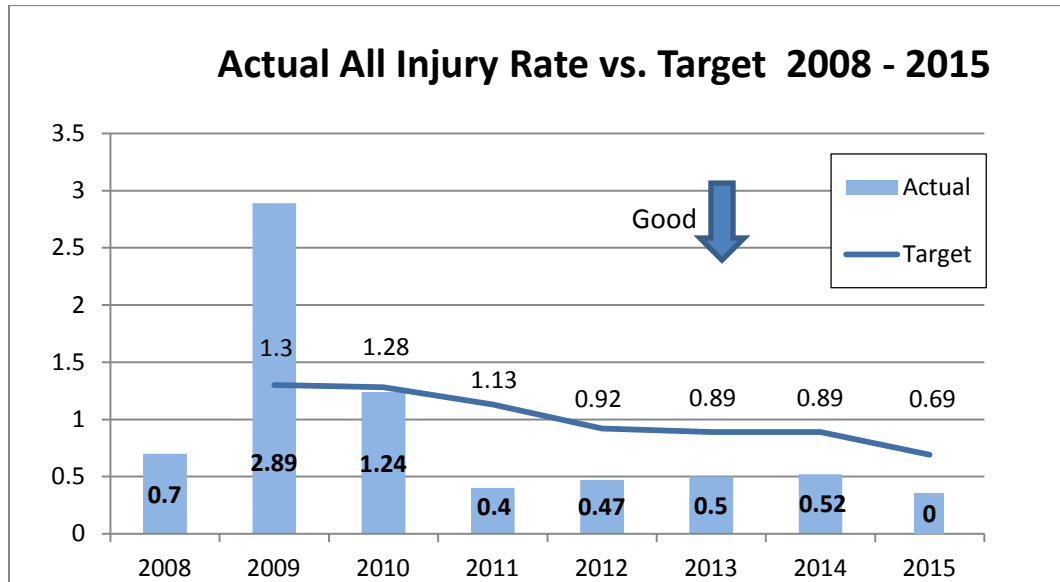


Figure 13: DNWM All Injury Rate vs. Target

### Accident Severity Rate

The Accident Severity Rate is defined as the total number of calendar days lost due to a work-related injury multiplied by 200,000 person-hours, divided by the total exposure hours worked.

DNWM's Accident Severity Rate was better than target from 2010 through 2015 as shown in Figure 14. There was no Accident Severity Rate target for 2008. In 2009, one long-duration Musculoskeletal Disorder overexertion lost time event was recorded at one of the DNWM locations which exceeded the Accident Severity Rate target for that year.

Specifically at PWNF, to date, there have not been any lost time safety events throughout its operational period. This shows a strong commitment to safety with an exceptional performance of 22 years without a lost time event at PWNF.

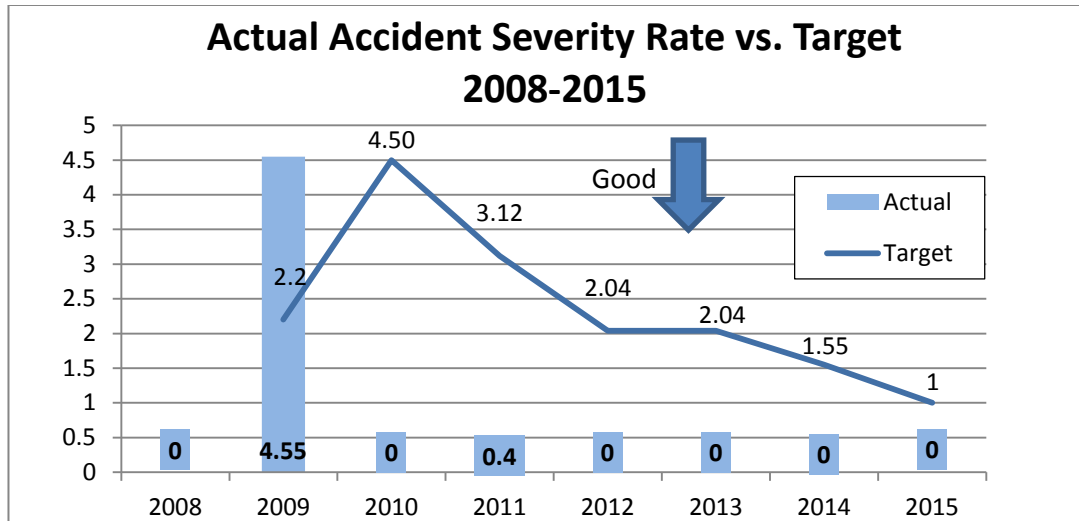


Figure 14: DNWM Accident Severity Rate vs. Target

### High Maximum Reasonable Potential for Harm Events

The Maximum Reasonable Potential for Harm is an OPG rating system used to classify incidents, and to determine the potential severity of safety incidents. These are incidents with potential for injury to personnel; however, no actual injury may have occurred. High Maximum Reasonable Potential for Harm incident investigations offer learning opportunities for continued improvement in safety performance.

During the current licensing period, there was one High Maximum Reasonable Potential for Harm event that occurred at PWMF. In April 2015, the inner section of the southwest roof ventilation turbine fell to the floor. There was no one in the area when the roof ventilation fell to the floor. Access to the area was restricted, but staff were authorized to work nearby. To prevent recurrence of such an event, PWMF maintenance staff installed enclosures and fall prevention equipment (i.e. tethers) to all ventilators. Also, an annual inspection of roof turbines was added to the inspection program.

### Safety Enhancements

During the current licensing period, a number of safety enhancements have been made to equipment and systems at the PWMF. Some examples are listed below:

- Strobe lights were added as a visual enhancement to the fire emergency notification system in the fan room;
- The DSC welding preheater was strategically moved to the catwalk to create a clear pathway below the catwalk;
- An ergonomic enhancement was made to the welding height of the DSC drain plug which provides additional working space, and
- A DSC turning tool and turbine stand hook were procured for ease of turning DSCs without direct contact with the load while positioning the DSC turbine stands.

### 2.8.3 Future Plans for Improvement

A number of health and safety improvement initiatives have been identified for the PWMF as part of the continuous improvement cycle of the health and safety management system, which include:

- Implementation of the OPG Nuclear Human Performance Program tools and processes;
- An increased focus on Situational Awareness (Section 2.2.2.5), particularly around routine activities such as walking and continued focus on improvements to the Internal Responsibility System, and
- Implementation of a “Total Health Initiative” supporting employees and their families in their efforts to achieve an optimal level of health and functioning, primarily through health education, health promotion, disease and injury prevention, and crisis intervention.

In addition, OPG’s commitment to continuously improve performance is reflected by setting challenging targets for the All Injury Rate.

## 2.9 ENVIRONMENTAL PROTECTION

### 2.9.1 Environmental Protection Program

Compliant to the requirements of REGDOC-2.9.1 (2013), *Environmental Protection Policies, Programs and Procedures*, PWMF has in place an Environmental Protection program.

OPG’s key documents for Environmental Protection are listed in the table presented below.

Document Title	Document Number
Environmental Policy	OPG-POL-0021
Environmental Management System	OPG-PROG-0005
Environmental Management	N-PROG-OP-0006

The Environmental Policy states:

- OPG shall establish an environmental management system and maintain registration for this system to the ISO 14001 *Environmental Management System* standard;
- OPG shall work to prevent or mitigate adverse effects on the environment with a long-term objective of continual improvement in its environmental management system and its environmental performance;
- OPG shall manage its sites in a manner that strives to maintain, or enhance where it makes business sense, significant natural areas and associated species of concern. OPG will work with its community partners to support regional ecosystems and biodiversity through science-based habitat stewardship. Where

disruption is required, OPG shall take reasonable steps to manage the residual impact to these areas and species;

- OPG shall set environmental performance targets as part of its annual business planning process. Performance against these targets will be monitored, and
- OPG shall communicate its environmental performance to employees, governments, local communities, and other stakeholders.

## **2.9.2 Current Operations**

### **2.9.2.1 Radiological Emissions and Effluent Monitoring**

PWMF is designed to operate within regulatory limits and to ensure that radiological exposure to workers and the public and impacts to the environment are As Low As Reasonably Achievable. OPG has established environmental monitoring programs in support of its nuclear facility operations to assure compliance with the *Nuclear Safety and Control Regulations*, applicable Provincial Legislation and OPG requirements. The program is administered on a site-wide basis and encompasses all nuclear facilities at the Pickering Nuclear site, including the PWMF.

The applicable environmental monitoring program elements at the PWMF include:

- Airborne emissions from the building ventilation stack, and
- Liquid effluent discharged from the PWMF site (i.e., stormwater and subsurface drainage).

The effluent monitoring program is used to ensure releases are within the regulatory limits and provides confirmation that systems are performing as designed.

The results of the effluent monitoring program are provided to the CNSC in the quarterly operations reports and are available to the public on the OPG website at [www.opg.com](http://www.opg.com). A summary of the results since 2008 are provided in the following subsections.

#### **Derived Release Limits**

Derived release limits are derived using CSA N288.1, *Guidelines for Calculating Derived Release Limits for Radioactive Material in Airborne and Liquid Effluents for Normal Operation of Nuclear Facilities*, and approved by the CNSC. Derived release limits are used to establish controls on the releases of radioactive materials. Derived release limits are calculated for radionuclides of potential dose significance in effluent streams, to facilitate the control, reporting, and regulation of radionuclide emissions.

The emissions from PWMF have been consistently orders of magnitude below the derived release limits. The derived release limits as shown in Table 7 are for the Pickering Nuclear site which includes both Pickering NGS and the PWMF. PWMF reports against the derived release limits of Pickering NGS Units 5-8.

**Table 7: Pickering Nuclear site Derived Release Limits**

Release Category	Radionuclide	Derived Release Limit (Bq/y) Pickering NGS Units 1-4	Derived Release Limit (Bq/y) Pickering NGS Units 5-8**
<b>Air</b>	Tritium (HTO)	1.2x10 <sup>17</sup>	1.9x10 <sup>17</sup>
	Iodine (mixed fission products)	9.9x10 <sup>12</sup>	8.9x10 <sup>12</sup>
	Carbon-14 (CO <sub>2</sub> )	2.2x10 <sup>15</sup>	2.0x10 <sup>15</sup>
	Noble Gases*	3.2x10 <sup>16</sup>	4.7x10 <sup>16</sup>
	Particulate – Gross Beta-Gamma (Co-60)	4.9x10 <sup>11</sup>	7.2x10 <sup>11</sup>
	Particulate – Gross Alpha (Pu-239, Pu-240)	8.7x10 <sup>10</sup>	1.2x10 <sup>11</sup>
<b>Water</b>	Tritium	3.7x10 <sup>17</sup>	7.0x10 <sup>17</sup>
	Carbon-14 (as carbonate)	3.2x10 <sup>13</sup>	6.0x10 <sup>13</sup>
	Gross Alpha (Pu-239/Pu-240)	1.4x10 <sup>13</sup>	2.6x10 <sup>13</sup>
	Gross Beta-Gamma (P-32)	1.7x10 <sup>12</sup>	3.2x10 <sup>12</sup>
<b>Sewage</b>	Tritium	5.4x10 <sup>16</sup>	
	C-14	9.9x10 <sup>13</sup>	
	Gross beta-gamma (limited by Co-60)	1.2x10 <sup>11</sup>	

\* Unit for noble gases derived release limit is Bq-MeV

\*\*PWMF reports against the derived release limits of Pickering NGS Units 5-8.

### Action Levels

The *Radiation Protection Regulations* state that an “action level” means “a specific dose of radiation or other parameter that if reached, may indicate a loss of control of part of a licensee’s radiation protection program and triggers a requirement for specific action to be taken”. Action levels are set at a fraction of the derived release limits to provide early detection of a potential loss of control and ensure appropriate action is taken to prevent emission from approaching a derived release limit. Exceeding an action level requires notification and reporting to the CNSC, investigation of the cause and corrective action as required.

In accordance with the PWMF operating licence Licence Condition 4.2, OPG assesses any proposed changes to the derived release limits and action levels, to ensure they are within the existing safety and design envelope, and not likely to adversely affect the safe conduct of any licensed activities, nor outside the scope of the licence.

PWMF does not have any specific environmental action level as the emissions from the facility have historically been an extremely small fraction of the Pickering NGS emissions. The action levels in Table 8 are for the Pickering Nuclear site which includes the Pickering NGS and PWMF. PWMF reports against the action levels of Pickering NGS Units 5-8.

**Table 8: Pickering Nuclear Environmental Action Levels**

Release Category	Radionuclide	Action Levels: Gaseous releases (Becquerel/year) Pickering NGS Units 1-4	Action Levels: Gaseous releases (Becquerel/year) Pickering NGS Units 5-8**
<b>Air</b>	Tritium (HTO)	$2.5 \times 10^{14}$	$3.7 \times 10^{14}$
	Iodine	$2.0 \times 10^{10}$	$1.8 \times 10^{10}$
	Carbon-14	$4.4 \times 10^{12}$	$4.0 \times 10^{12}$
	Noble Gases*	$6.3 \times 10^{13}$	$9.4 \times 10^{13}$
	Particulate	$9.8 \times 10^8$	$1.4 \times 10^9$
<b>Water</b>	Tritium	$3.0 \times 10^{15}$	$5.6 \times 10^{15}$
	Carbon-14	$2.6 \times 10^{11}$	$4.8 \times 10^{11}$
	Gross Beta-Gamma	$1.4 \times 10^{10}$	$2.5 \times 10^{10}$
<b>Sewage***</b>	Tritium (HTO)	$4.3 \times 10^{14}$	
	Carbon-14	$7.9 \times 10^{11}$	
	Gross beta-gamma	$9.7 \times 10^8$	

\*Units for noble gas action level are Bq-MeV/week

\*\*PWMF reports against the action levels of Pickering NGS Units 5-8.

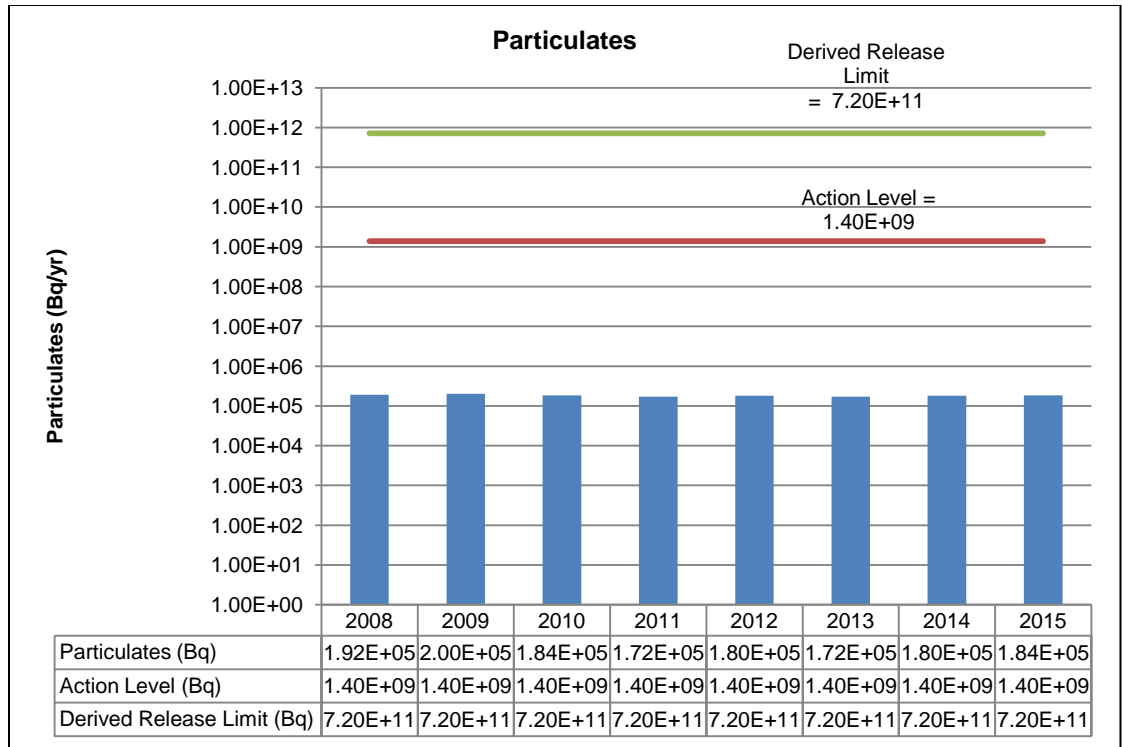
\*\*\*All sewage from the Pickering Nuclear site is reported as a release from Pickering NGS Units 1-4.

### 2.9.2.2 Radiological Airborne Emissions

The active ventilation exhaust from the DSC Processing Building is monitored for radioactive particulates. A continuous emission sample is passed through a particulate filter that is replaced and analyzed on a weekly basis. The concentration of particulate matter on the samples has typically been below the Minimum Detectable Activity of  $3.3 \times 10^3$  Bq.

Although there is no significant particulate emissions expected from the exhaust at the PWMF, it is monitored for confirmation purposes. All data is reported to the CNSC in the PWMF's quarterly operations report.

Figure 15 shows a summary of the radiological airborne emissions from the DSC Processing Building stack at the PWMF since 2008. During the current licensing period, there have been no derived release limit or action level exceedances for airborne particulates from the DSC Processing Building stack sampler. The emissions from the PWMF have been orders of magnitudes below the Pickering NGS Units 5-8 derived release limit and action levels for which PWMF reports. The overall trend has been stable.



Note: Airborne particulate data (Bq/yr) was calculated by multiplying the reported airborne contamination (weekly average) by the number of fiscal weeks per month, then summing the months into an annual total.

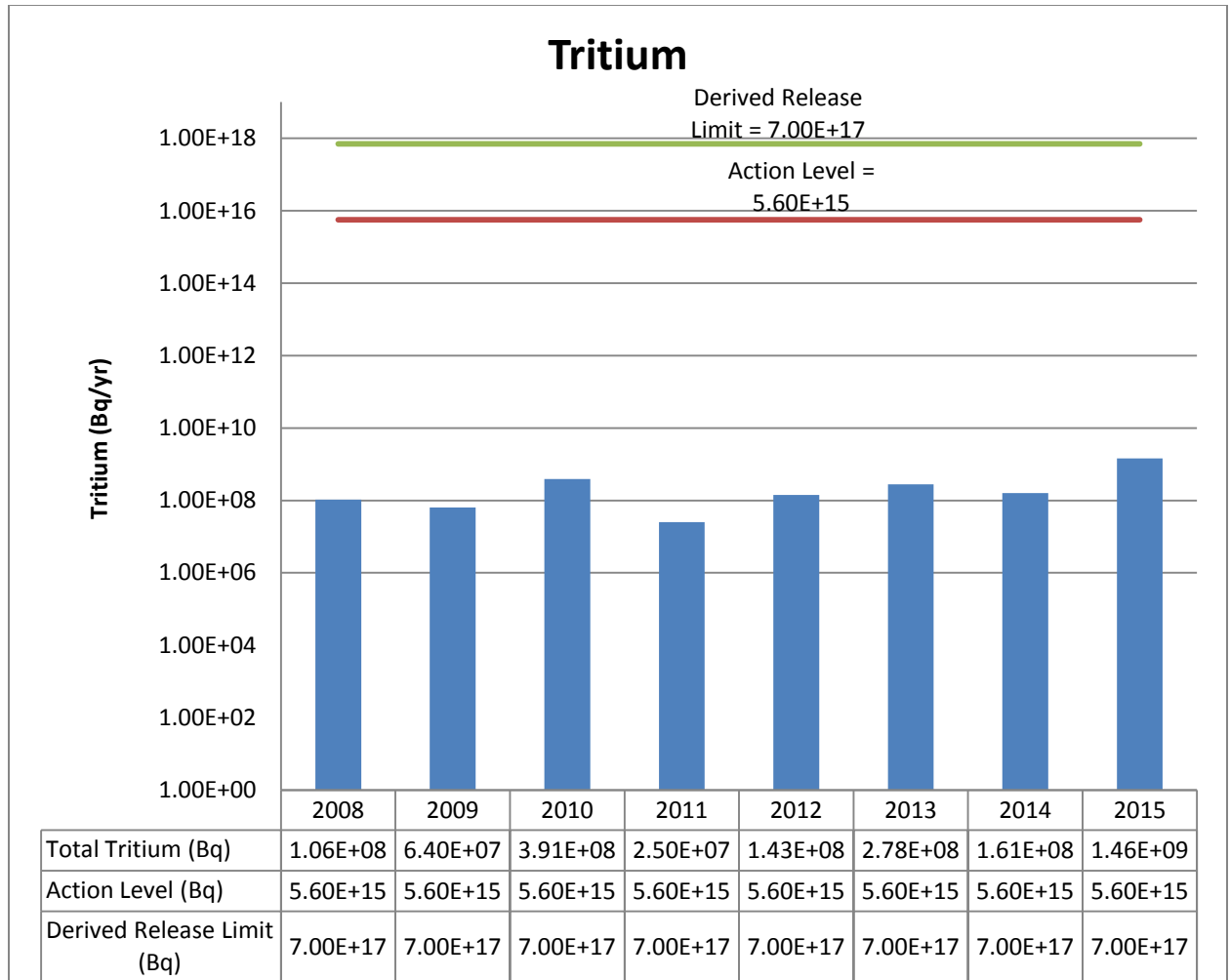
**Figure 15: Airborne Particulates from DSC Processing Building Stack Sampler**

### 2.9.2.3 Radiological Waterborne Effluent

The small quantity of radioactive liquids from the PWMF Phase I buildings that may be generated during DSC decontamination in the DSC Processing Building is routed to the Pickering NGS's active liquid waste management system where it is monitored and accounted with the station's emissions. The active liquid waste tanks in the DSC Processing Building are sampled for tritium, and gross beta-gamma, prior to being pumped out and discharged into the Pickering NGS's active liquid waste management system.

Figure 16 shows a summary of the tritium in waterborne effluents from the Active Liquid Waste Tanks at the PWMF since 2008. During the current licence period, there have been no derived release limit or action level exceedances for waterborne tritium found in the Active Liquid Waste Tanks. The emissions have been several orders of magnitude below the derived release limit and action levels. The overall trend has remained stable.

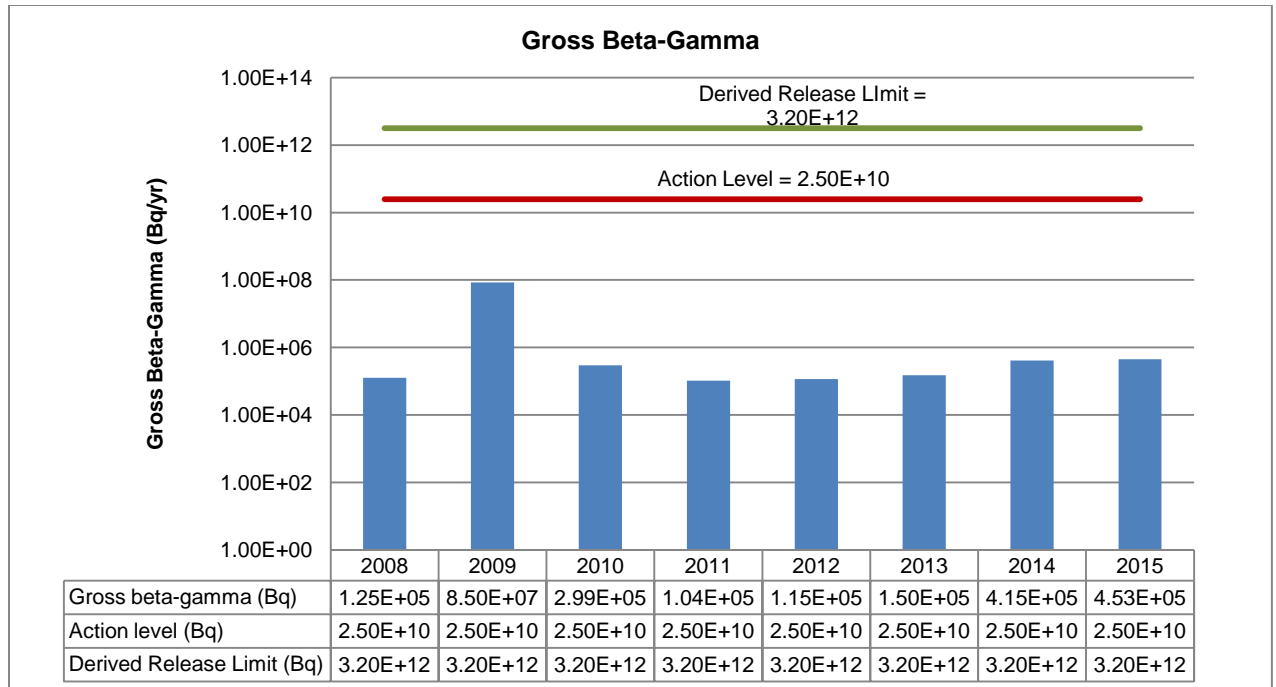




Note: Active Liquid Waste Tanks were not sampled every quarter; therefore tritium effluent is only the total of tritium reported in the quarterly operations reports.

**Figure 16: Tritium Waterborne Effluent found in the PWF Active Liquid Waste Tanks**

Figure 17 shows a summary of the gross beta-gamma waterborne effluents from the Active Liquid Waste Tanks at the PWF since 2008. Any gross beta-gamma data below the Minimum Detectable Activity was assumed to be at the Minimum Detectable Activity of  $1.15 \times 10^{-2}$  Bq/mL for data analysis. The total emissions (Bq) were calculated by multiplying the concentration by the amount of liquid pumped out of the tank.



Note: Active Liquid Waste Tanks were not sampled every quarter; therefore gross beta-gamma effluent is only the total of gross beta-gamma reported in the quarterly operations reports.

**Figure 17: Gross Beta-Gamma Waterborne Effluent found in the PWF Active Liquid Waste Tanks**

Water is sampled from the Retube Component Storage area surface drainage system and catch basins for gross beta-gamma activity on a quarterly basis. This provides assurance that any radioactive contamination in the surface water originating from the Retube Component Storage area is detected. The gross beta levels have been typically below the Minimum Detectable Activity of  $1.51 \times 10^{-2}$  Bq/mL and generally no detectable levels of activity are found in the surface water runoff.

Since 2008, only two quarters (Q2 2009 and Q3 2010) were reported to be slightly above the Minimum Detectable Activity limit while all other quarters were equal to or less than the Minimum Detectable Activity. During the current licensing period, there have been no derived release limit or action level exceedances for waterborne gross beta-gamma associated with the Retube Component Storage area drainage system.

Beginning in 2009, two water sample stations from DSC Storage Building #3, located on the PWF Phase II site, have been sampled for gross beta-gamma on a quarterly basis. The contamination levels have been typically below the Minimum Detectable Activity of  $1.51 \times 10^{-2}$  Bq/mL. Since 2009, only three quarters (Q3 2009, Q2 2010 and Q1 2013) were reported to be above the Minimum Detectable Activity limit while all other quarters were equal to or less than the Minimum Detectable Activity. During the current licensing period, there have been no derived release limit or action level exceedances for waterborne gross beta-gamma associated with the DSC Storage Building #3 sampling stations.

All data is reported to the CNSC in the PWF's quarterly operations report, and posted on OPG's website at [www.opg.com](http://www.opg.com).

#### **2.9.2.4 Groundwater Monitoring Program**

The Pickering NGS groundwater monitoring study in 1999/2000 used extensive background research to determine potential locations of contamination in order to accurately represent at-risk areas (Figure 18). The direction of groundwater flow beneath the Pickering NGS and PWMF has been established based on groundwater elevation contours.

The PWMF groundwater monitoring around the facility is integrated into the Pickering NGS groundwater monitoring program. The assessment conducted in the PWMF Phase II Environmental Assessment concluded that the project works and activities (including site preparation, construction and operation of DSC Storage Buildings #3 and #4) would not result in any likely effects to the environment. In addition, no Environmental Assessment follow-up activities pertaining to groundwater monitoring at PWMF Phase II were required.

#### **2.9.2.5 Non-Radiological Emissions**

Non-radiological emissions at the PWMF are negligible. DSC paint touch-up operations involve minimal paint quantities. Residual paint aerosols from the paint bays are removed through filters before exhausting to the active ventilation system. Due to small quantities, painting methods, and the use of appropriate filtration, no significant emissions of paint materials are expected. Welding fumes from DSC seal-welding operations are additionally exhausted through the High Efficiency Particulate Air filtered active ventilation system. The emissions from the welding operations are also considered negligible. Consequently, there is no monitoring program required for non-radiological emissions at the PWMF.

#### **2.9.3 Estimated Dose to the Public from the overall Pickering Nuclear site**

Radiological emissions from the PWMF are an extremely small fraction of the overall emissions from the Pickering Nuclear site. The off-site radiological impacts from the operation of the PWMF, in addition to the other facilities on the Pickering Nuclear site, are monitored under Pickering Nuclear Environmental Monitoring Program. The Pickering Nuclear Environmental Monitoring Program monitors off-site air, water (municipal, well, lake/stream), aquatic samples (fish, sediment, sand), and terrestrial samples (animal feed, and vegetation). Data gathered from this program, along with emissions data, are used to assess the annual radiological dose to members of the public living or working in the vicinity of the Pickering Nuclear site.

Results of monitoring and public dose assessment are published in the Pickering NGS annual Environmental Monitoring Program report which is submitted to the CNSC and made available to the public on [www.opg.com](http://www.opg.com). Dose to the public from the operation of facilities on the Pickering Nuclear site (including the PWMF) is a very small fraction of the public dose limit. The PWMF is covered by the Pickering Nuclear Environmental Monitoring Program which is in compliance with CSA N288.4, *Environmental Monitoring Program at Class I Nuclear Facilities and Uranium Mines and Mills*.

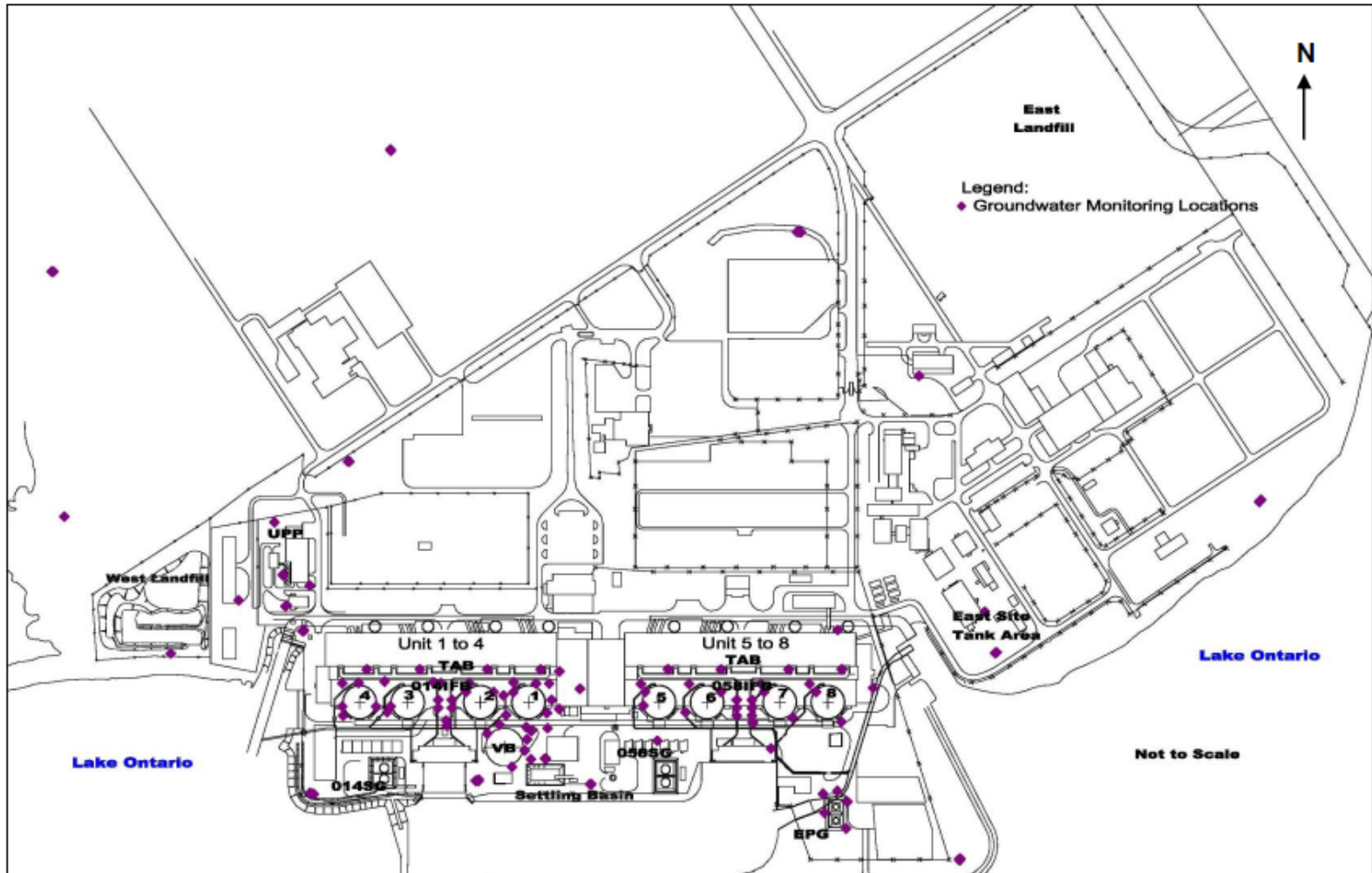


Figure 18: 2015 Groundwater Monitoring Locations

## 2.9.4 Environmental Management Program/System

OPG's Board of Directors has established an environmental policy that requires OPG to maintain an Environmental Management Program consistent with the International Organization for Standardization 14001 *Environmental Management System Standard*. OPG's Environmental Management Program requires assessment of environmental risks associated with the facility's activities, and to ensure that these activities are conducted such that any adverse impact on the natural environment is As Low As Reasonably Achievable. This program includes OPG's approach to ensure compliance with applicable statutory and regulatory requirements.

OPG has implemented its Environmental Management System at the PVMF which is aligned with OPG's Environmental Management Program and its Plan-Do-Check-Act business model. Through this model, objectives, targets and programs are established, executed, monitored and reviewed with the commitment for continual improvement.

OPG's Environmental Management System defines the requirements for:

- Planning the work;
- Implementing the Requirements of the Planning Process;
- Monitoring and Measurement of Success of the Planning, and
- Process and Management Review of the Environmental Management System and Environmental Performance.

The Environmental Management System provides the structure and processes to ensure implementation and follow-up on management programs needed to deliver the environmental policy are achieved. As part of OPG's Environmental Management System, environmental performance targets, including reportable spills and environmental compliance are reviewed annually to ensure that opportunities for continuous improvement are identified and implemented.

Identification of the OPG Significant Environmental Aspects which apply to PVMF allows for more focus on areas where there is the potential to have a negative (or positive) impact on the environment. The Significant Environmental Aspects that have been identified for the PVMF include the following:

- Habitat and Wildlife Biodiversity Conservation, and
- Spills prevention and mitigation.

Risks associated with these Significant Environmental Aspects are managed through operational controls and quality control/assurance. Performance measures are established to ensure the controls perform as designed and are corrected and/or improved under the Environmental Management System framework.

For example, spill and compliance targets have been established and tracked during the licence period. Since that time, OPG has consistently met or surpassed these targets. Since 2008, there have been no reportable spills and no environmental infractions at the PVMF.

OPG is committed to maintaining registration of the ISO 14001 *Environmental Management System Standard*. Verification that the Environmental Management

System Standard is effectively maintained is completed through annual internal audits and compliance audits.

### **Biodiversity Management**

OPG has had a very extensive and diverse biodiversity program at the Pickering Nuclear site for many years. The site's conservation vision follows the four R's:

- Retain what is significant;
- Restore habitats that have been degraded;
- Replace habitats that have been lost, and
- Recover species that are at risk.

The PWMF biodiversity plan has been integrated into the Pickering NGS biodiversity plan. Multiple site biodiversity and Natural Area Management plans have been made throughout the years in order to maintain a diverse site and achieve the Wildlife Habitat Council Certification. The Wildlife Habitat Certification adds value to programs by providing third party credibility and an objective evaluation of projects.

The major initiatives implemented since 2008 at the Pickering Nuclear site under the Biodiversity Program are as follows:

Accomplishments between 2008 and 2011:

- Terrestrial Long-term Monitoring Project - initiated in 2009 for a five year plan based on the monitoring methodology used by the Toronto and Region Conservation Authority's regional terrestrial long-term monitoring initiative. Forests, wetlands and meadow habitat types were included in order to assess the response of the terrestrial system to various landscape changes, effects of reforestation efforts or urbanization, and then using the natural system changes to better guide management actions on site to improve biodiversity. The monitoring program is ongoing;
- Monitoring - amphibian, bird nest box, habitat structures (wood duck boxes, hibernaculum, bat boxes), butterfly and dragonfly inventory, and participation in electrofishing monitoring;
- On-Site Habitat Enhancements - beaver controls to reduce damage to mature trees, Naturalization areas created, removal of Garlic Mustard, and planting of native pollinator garden;
- Off-Site Habitat Enhancements - funding to Duffins Creek Marsh Rehabilitation Project and installation of a boardwalk in Altona Forest to reduce soil compaction;
- Wildlife Habitat Council Re-certification - Wildlife Habitat Council Corporate Lands for Learning Recertification obtained in 2009 and Wildlife Habitat Council Wildlife at Work Recertification obtained in 2010, and
- Partnerships - maintained with many local communities, conservation groups and government agencies.

Accomplishments between 2012 and 2016:

- G.L Cinquefoil/Barrier beach - continued naturalization along north shore, amphibian monitoring and Monarch Larva monitoring;

- Hydro Marsh/Krosno Creek - amphibian monitoring, Durham Region Coastal Wetland monitoring, on-site biodiversity, delivered Yellow Fish Road Program to facilitate improvement in water quality, repairs to common tern nesting raft and maintenance of wood duck nest boxes;
- Kinsmen Woodlot, Park Pond, Alex Robertson Park Woodlot, Alex Robertson Park and Brock Road Woodlot - on-site biodiversity monitoring;
- Pickering NGS Lake Ontario Aquatic Nearshore - Durham Region Coastal Wetland monitoring, on-site biodiversity monitoring, and installation of Fish Diversion System, and
- Other programs supported by Pickering Nuclear site - Bring Back the Salmon yearlings release and hatchery, Great Canadian Shoreline Clean-up, Sustainable Pickering Day, and more.

OPG's ongoing Beyond Compliance Biodiversity Management Plan continues to incorporate the restoration, retention, replacement and recovery of multiple Priority Natural Areas. Specifically, future plans have been made for Duffin's Creek Marsh, Frenchman's Bay, the Krosno Creek Hydro Marsh, and the Great Lakes Cinquefoil/Barrier Beach. Pickering Nuclear, including the PWMF, will be submitting their Wildlife Habitat Council Recertification application in December 2016. The application is being submitted for Pickering Nuclear and Darlington Nuclear as the OPG Nuclear Beyond Compliance Biodiversity Application to achieve recertification by 2017.

### **2.9.5 Environmental Risk Assessment**

An Environmental Risk Assessment has been prepared for the Pickering Nuclear site in accordance with the requirements of CSA N288.6-12, *Environmental Risk Assessment at Class I Nuclear Facilities and Uranium Mines and Mills*. The Environmental Risk Assessment characterized the baseline environment and assessed the human health and ecological risks from operations of the facilities located on the Pickering Nuclear site. The Environmental Risk Assessment had the specific objectives to:

- To evaluate the risk to relevant human and ecological receptors resulting from exposure to contaminants and stressors related to the Pickering Nuclear site and its activities, and
- To recommend potential further monitoring or assessment as needed based on the results of the Environmental Risk Assessment.

This Environmental Risk Assessment identified a number of areas where supplementary monitoring studies were recommended in order to clarify risk and reduce uncertainty in future human health and ecological risk assessments.

To support the licensing process for the continued operations and eventual Safe Storage of the Pickering NGS, OPG is in the process of updating the Pickering Nuclear site Environmental Risk Assessment. The Pickering Nuclear site Environmental Risk Assessment will be updated in advance of the five year cycle to ensure that it reflects the most up to date information and to support the licensing process for Pickering NGS. As such, the Environmental Risk Assessment is being revised with the last five years of data (2011 to 2015) from ongoing environmental programs (i.e. groundwater,

fish impingement, environmental monitoring, thermal discharges and species inventory). In addition, a baseline environmental monitoring program was conducted in 2015 for media and parameters that are not routinely analyzed (on-site soil, storm water, lake water, sediment and noise), in order to reduce uncertainty in the Environmental Risk Assessment and address the recommendations identified in the previous Environmental Risk Assessment.

Specific to the operations of the PVMF facilities, emissions from the PVMF are accounted for in the overall emissions reported for the site and the environmental measurements. This revised Environmental Risk Assessment will include a description of the PVMF facilities and capture the human health and ecological risk associated with the operations of the PVMF.

### **2.9.6 Future Plans for Improvement**

The ISO 14001 standard embodies the expectation of continual improvement of the Environmental Management System and, as a consequence, environmental performance. To this end, a review of environmental performance and re-evaluation of objectives and targets in key areas which may impact on the environment is performed.

DNWM will continue to implement best practices at the PVMF, which have been aimed at reducing the environmental and radiological risk associated with the handling, processing, and/or storage of used fuel. This is done by the continuation of following procedures and protocols, training and by following safe practices. PVMF will continue to be included in the Pickering NGS Biodiversity initiatives, which are continuously developing. Refer to section 2.9.4, Biodiversity Management for present and future Biodiversity plans.

The derived release limits for the Pickering Nuclear site will be updated to reflect the 2014 version of CSA N288.1 during the next five year review.

## **2.10 EMERGENCY MANAGEMENT AND FIRE PROTECTION**

OPG's key documents for Emergency Management and Fire Protection are listed in the table presented below.

<b>Document Number</b>	<b>Title</b>
Nuclear Waste Management	W-PROG-WM-0001
Consolidated Nuclear Emergency Plan	N-PROG-RA-0001
Fire Protection	N-PROG-RA-0012

### **2.10.1 EMERGENCY MANAGEMENT**

#### **2.10.1.1 Emergency Management Program**

NWMD's goals for Emergency Management at PVMF are to protect the health and safety of all people (employees, public, and responders) and limit the damage to OPG and third party assets as well as the environment during emergencies and other non-



routine conditions. Emergency Management encompasses emergencies arising from both nuclear and conventional hazards.

The Nuclear Waste Management program references OPG's Consolidated Nuclear Emergency Plan which documents the emergency response capability to a nuclear emergency at OPG's nuclear stations. The Emergency Plan deals with nuclear emergency situations that endanger the safety of on-site staff, the environment and the public. Although event scenarios at PWSMF would not result in a radiological danger to the public or any required protective actions as defined in the Provincial Nuclear Emergency Plan, the procedures developed under the Consolidated Nuclear Emergency Plan would be implemented to support a PWSMF event if it resulted in a Station Emergency being declared, or at the nuclear station Shift Manager's discretion. Staff on-site at the PWSMF participate in site wide emergency drills that involve assembly and accounting or site evacuation.

### **2.10.1.2 Current Operations**

#### **Emergency Management**

The Pickering NGS Emergency Response Team is the primary responder for PWSMF Phase I, since it is within the nuclear generating station security-protected area. For Phase II, emergency, medical, and fire response is provided by the city of Pickering, with the Pickering NGS Emergency Response Team as the secondary responder.

The Pickering NGS Emergency Response Team conducts two fire response drills per crew per year and one medical response drill per year. PWSMF staff participate in all emergency response drills (fire and radiological) conducted by Pickering NGS which affect the PWSMF facility.

Hazardous Material spill drills are conducted annually at the Pickering site that include consideration of Pickering NGS and PWSMF during the reporting period. Upon completion of each drill, a report is issued which captures lessons learned, corrective actions and valuable operating experience. Spill Drills are one component of spill response improvement and organizational learning as described in the OPG Nuclear Spill Management Standard.

#### **Response to Fukushima Event**

OPG reviewed the initial lessons learned from the Fukushima event in Japan, and re-examined the safety case for the PWSMF. In particular, OPG re-examined the underlying defence-in-depth concepts with a focus on external hazards such as seismic, flooding, fire, and extreme weather events, measures for the prevention and mitigation of severe accidents, and emergency preparedness.

For a summary of PWSMF's response to the Fukushima event, refer to Section 3.4. No significant gaps and no compensatory actions were identified during these reviews; however, some additional technical studies were performed such as beyond design basis seismic event analysis and flood hazard assessment for the PWSMF. The technical studies identified the following opportunities to improve the response to design basis events and beyond design basis events:

- For design basis events, OPG has enhanced the post-event worker response procedures, and

- For beyond design basis events, internal programs and procedures were revised to improve the post event response. OPG also purchased additional emergency equipment such as emergency provisions and satellite phones for the PVMF.

A mutual aid agreement that formalizes support among Canadian nuclear operators in the event of a major emergency at any of the nuclear stations was created between Bruce Power, OPG, Hydro Quebec, New Brunswick Power and Atomic Energy of Canada Limited.

### 2.10.1.3 Future Plans for Improvement

DNWM anticipates new codes and standards or new editions of existing codes and standards to be referenced in the new licence. DNWM will perform gap analyses and formulate transition plans as necessary to ensure compliance. The codes and standards anticipated in the new licence are:

- REGDOC 2.10.1 (2014), *Nuclear Emergency Preparedness and Response*

PVMF will meet the requirements of REGDOC 2.10.1, *Nuclear Emergency Preparedness and Response (2014)* by December 31, 2018.

## 2.10.2 FIRE PROTECTION

### 2.10.2.1 Fire Protection Program

DNWM's goals for Fire Protection are to:

- minimize the risk of radiological releases that are a result of fire;
- protect facility occupants from death or injury due to fire;
- minimize economic loss resulting from fire damage to structures, equipment, and inventories, and
- minimize the impact of radioactive or hazardous material on the environment as a result of fire.

The fire protection provisions for PVMF are currently required to conform to the:

- NFCC (2005), *National Fire Code of Canada*;
- NBCC (2005), *National Building Code of Canada*, and
- OSHA, *Occupational Health and Safety Act*.

DNWM's facility specific Fire Protection Program has been incorporated into OPG Nuclear's Fire Protection Program to ensure a consistent approach to fire protection across all the nuclear sites. DNWM fire protection procedures and other elements derive their authority from the OPG Nuclear Fire Protection Program. A comprehensive Fire Protection Program ensures adequate fire protection by minimizing both the probability of occurrence and the consequences of fire at the facilities.

DNWM governance is being reviewed to ensure effective alignment with OPG Nuclear's Fire Protection Program. The revision of DNWM's Impairment Manual and

associated documentation is currently underway, to ensure it aligns with the OPG Nuclear impairment process.

### **Key Program Elements for PWMF**

The Fire Safety Plan at PWMF meets the requirements of the *National Fire Code of Canada*. The Fire Safety Plan provides direction with respect to fire prevention, fire protection, emergency procedures, training and drills. The Fire Safety Plan is reviewed, and revised accordingly, on an annual basis to ensure it reflects current field conditions and practices.

Inspection and testing of the fire detection and protection system is performed at the required frequency as stipulated in the *National Fire Code of Canada*. Fire Drills are performed annually in accordance with the *National Fire Code of Canada*. A tri-annual independent third party review of PWMF's *National Fire Code of Canada* compliance to the Inspection, Testing and Maintenance report is performed.

A *Memorandum of Understanding* between the City of Pickering and OPG applies to the provision of fire protection services, including coordinated emergency response.

## **2.10.2.2 Current Operations**

### **Fire Protection**

Fire protection and detection systems at the PWMF are designed and constructed to comply with applicable fire and building codes (e.g. *National Fire Code of Canada* and *National Building Code of Canada*). During the reporting period, these systems were required to comply with:

- Updated pressure boundary code requirements, such as CSA N285.0-08, Update 1, *General Requirements for Pressure-Retaining Systems and Components in CANDU Nuclear Power Plants*;
- CSA B51-03 , *Boiler, Pressure Vessel and Pressure Piping Code*, and
- ASME B31.1, *Power Piping Code*, 2010 Edition.

All design modifications are reviewed for fire protection impact through the Engineering Change Control process.

In accordance with the PWMF operating licence, inspection, testing and maintenance of the fire detection and protection system is performed at the required frequency as stipulated in the *National Fire Code of Canada*. These inspections and testing are performed by OPG with review by a third party at PWMF. During the reporting period, independent third party reviews were completed tri-annually to confirm the PWMF fire systems have been operated, inspected, tested and maintained in accordance with the *National Fire Code of Canada* and the standards listed therein. The reports received indicate that PWMF is in general compliance with the *National Fire Code of Canada* requirements. Corrective actions resulting from the reviews that have been completed include:

- revising the Preventative Maintenance Identifications to complete visual inspection for self contained emergency lighting units;
- ensuring hydrants must be flowed a minimum of one minute and including their maintenance requirements;

- revising the operating instructions of the Fire Protection system to include a drain test, and
- incorporating maintenance requirements of screw and yoke valves.

The results of the compliance reviews have been submitted to the CNSC as required by the licence.

Fire Drills were also performed in accordance with the *National Fire Code of Canada*. Findings from drills have been satisfactory with no major findings. Recommended minor improvements to procedures and facilities have been assessed and are being implemented as appropriate.

Additionally, in March 2012, OPG provided a review to CNSC staff of the Fire Protection Program at PWF undertaken by independent third party organizations. This review concluded that the Fire Protection Program at the PWF substantially fulfills operating licence requirements, and OPG operates, maintains, tests and inspects the fire protection systems in general compliance with the applicable requirements of the *National Fire Code of Canada*. Corrective actions have been completed on any items resulting from the reviews.

Internal audits of the Nuclear Fire Protection Program were also conducted to evaluate effectiveness of the program. An audit conducted in 2013 resulted in two findings relevant to PWF: unclear DNWM Fire Protection program ownership, and deficiencies in DNWM Fire Protection governance. The DNWM Fire Protection program standards and procedures are being revised to address these deficiencies.

An organizational realignment to functionally move the ownership of the Fire Protection Program to one organization within OPG Nuclear has been implemented, thereby addressing the audit finding on program ownership. This realignment will ensure programmatic consistency, implementation of actions to address past challenges regarding managed system controls, plus a unified approach across OPG Nuclear.

During the current licensing period, there was one CNSC reportable event related to fire protection. In February 2015, two air relief valves of the fire protection system were discovered to have a maximum operating pressure lower than the system design. A corrective action to replace them was undertaken and code-compliant valves were installed in December 2015.

### **Fire Protection Response**

A *Memorandum of Understanding* between the City of Pickering and OPG applies to the provision of fire protection services, including coordinated emergency response. In the event of an on-site incident, City of Pickering's Fire Services will be called for assistance.

The initial response for the PWF Phase II portion within its own protected area rests with Pickering Fire Service with support from the Pickering NGS Emergency Response Team. The initial response for the PWF portion inside the Pickering NGS protected area (Phase I) rests with Pickering NGS Emergency Response Team with support from Pickering Fire Service. Pickering Fire Service is familiar with PWF.

### **Nuclear Waste Management Division Fire Impairment Manual**

At time of writing, OPG is in the process of issuing a new revision of its Nuclear Waste Management Division Fire Impairment Manual which describes how OPG manages impairments for OPG's Nuclear Waste Management Facilities, including PWF. This

manual provides resource information to guide trained staff who are directly involved with planned and unplanned impairment to the fire protection system in evaluating, establishing, planning, controlling and executing outages on fire systems. The purpose of this manual is to provide detailed compensatory measure information to ensure:

- fire protection systems are available when called upon to perform emergency functions;
- the number and duration of any impairments to fire protection systems are minimized;
- the risk is minimized for the duration of any fire protection system impairment, and
- the downtime of any fire protection system is minimized by closely controlling their impairments.

### **2.10.2.3 Future Plan for Improvement**

Fire Protection governance will be reviewed to further align PVMF with OPG Nuclear. DNWM anticipates new codes and standards or new editions of existing codes and standards to be referenced in the new licence. DNWM has performed gap analyses and formulated transition plans as necessary to ensure compliance. The codes and standards anticipated in the new licence are:

- CSA N393-13, *Fire Protection for Facilities That Process, Handle or Store Nuclear Substances*;
- NBCC (2010), *National Building Code of Canada*, and
- NFCC (2010), *National Fire Code of Canada*.

PVMF has completed a gap analysis and prepared an implementation plan for meeting the requirements of CSA N393-13, *Fire Protection for Facilities That Process, Handle, or Store Nuclear Substances*. Execution of the implementation plan is in progress and includes completion of the following:

- Code Compliance Review;
- Emergency Response Needs Analysis;
- Fire Protection Program Audit, and
- Site Condition Inspection and Fire Hazard Assessment.

OPG will provide the CNSC with a compliance date for transition to CSA N393-13 by December 15, 2017. Compliance to *NBCC* (2010) and *NFCC* (2010) will also be achieved with compliance to CSA N393-13.

When the PVMF Phase II licensed area is expanded as proposed, the new buildings within that area will comply with CSA N393-13 and applicable fire codes and standards.

## 2.11 WASTE MANAGEMENT

### 2.11.1 Waste Management Program

DNWM's Waste Management Program is aligned with, and based on OPG Nuclear's Environmental Management program. The Nuclear Waste Management Facilities work in collaboration with the OPG nuclear generating stations in order to implement strategies for waste minimization and waste management.

DNWM's Decommissioning Program provides the requirements and processes required to safely and cost effectively decommission OPG owned nuclear facilities and provides assurance that decommissioning work will be performed in accordance with regulatory requirements.

OPG's key documents for Waste Management are listed in the table below.

Document Title	Document Number
Nuclear Waste Management Program	W-PROG-WM-0001
Radiation Protection	N-PROG-RA-0013
Decommissioning Program	W-PROG-WM-0003

### 2.11.2 Current Operations

Employees at PVMF use waste management procedures to ensure that waste generated at the facility is separated properly. Waste receptacles are located throughout the PVMF for likely clean and active waste. Minimal radioactive waste is generated from activities conducted at the PVMF. Low level waste generated by PVMF typically is restricted to floor sweepings that have a potential to contain contamination from preparing and welding DSCs. Annual volumes amount to less than one drum and are sent to Pickering NGS for segregation as necessary and eventual transportation to the Western Waste Management Facility. PVMF does not generate intermediate level waste.

### 2.11.3 Future Plans for Improvement

By October 31, 2017, PVMF will be compliant with the requirements of CSA N292.0-14, *General Principles for the Management of Radioactive Waste and Irradiated Fuel*, CSA N292.2-13, *Interim Dry Storage of Irradiated Fuel*, and CSA N292.3-14, *Management of Low-and-Intermediate-Level Radioactive Waste*.

The volume of low level radioactive waste produced at PVMF will remain minimal during the next licensing period with an expected slight increase proportional to the number of DSCs processed.

### 2.11.4 Decommissioning

Planning for the eventual decommissioning of the PVMF is an ongoing process, taking place throughout each stage of the licensed facility lifecycle. A Preliminary Decommissioning Plan is prepared in accordance with CSA Standard N294-09 *Decommissioning of Facilities Containing Nuclear Substances* and using CNSC's

Regulatory Guide G-219 *Decommissioning Planning for Licensed Facilities*. The Preliminary Decommissioning Plan is updated and submitted every five years or when required by the Commission.

OPG's strategy for decommissioning its nuclear waste facilities, including PVMF, is to dismantle the facilities once all the waste is removed and the facility is no longer required. Since all the wastes will be removed from the facility prior to decommissioning, little residual radioactivity is expected to be present at PVMF and as such there will be no radiation hazard driver for deferment of decommissioning. In some cases however, decommissioning activities may be deferred to align with other related activities on site. At this time, OPG plans to place Low and Intermediate Level Waste generated during decommissioning in the Low and Intermediate Level Waste Deep Geologic Repository expected to be located in Kincardine. Under the Nuclear Waste Management Organization's Adaptive Phased Management program established by the federal government, the long term facility for used fuel is expected to be in service no earlier than 2043, at which time used fuel will start to be transferred from the interim storage location at PVMF to the Adaptive Phased Management facility.

The PVMF Preliminary Decommissioning Plan describes the activities that will be required to decommission and restore the site for other uses. It demonstrates that decommissioning is feasible with existing technologies and it provides a basis for estimating the cost of decommissioning. The Preliminary Decommissioning Plan includes schedules and cost estimates based on the assumptions that form the basis for the plan. OPG will update this plan as required to incorporate lessons learned, updates to regulatory requirements, and industry best practices.

OPG is planning to update the PVMF Preliminary Decommissioning Plan in support of the 2018 to 2022 Financial Guarantee submission (discussed also in Section 3.5). This revision of the Preliminary Decommissioning Plan includes the expansion of PVMF Phase II. The requirements of CSA N294-09 as well as any relevant domestic and international experience obtained in the previous five years are incorporated into this revision.

OPG continuously monitors and incorporates best practices from the industry and has a high degree of confidence that the current plans are appropriate and sufficient.

## **2.12 SECURITY**

### **2.12.1 Security Program**

The OPG Security Program supports OPG's need to manage residual risk to the public created by the operation of its facilities, protect assets, and respond to security events that impact operations and the public. Key elements of this program include response to threats and maintaining compliance with legislative requirements, while minimizing the adverse impact on legitimate staff and plant operations. The objective of the program is to establish a state of security readiness to ensure safe and secure operation of OPG stations and facilities. OPG's security program includes measures to protect against unauthorized disclosure of prescribed information.

PVMF Phase I is contained within the Pickering NGS protected area and as such the security program with respect to that site is described in documentation relating to the Pickering NGS. These meet all regulatory requirements and are consistent with the

measures described below. PWMF Phase II is contained within a separate protected area located on the Pickering NGS controlled area site. The security provisions described in this section relate to both phases of the PWMF unless stated otherwise.

The security program for PWMF currently meets the requirements of the *Nuclear Security Regulations* and:

- RD 321 (2010), *Criteria for Physical Protection Systems and Devices at High-Security Sites*;
- RD-363 (2008), *Nuclear Security Officer Medical, Physical and Psychological Fitness*;
- RD 361 (2010), *Criteria for Explosive Substance Detection, X-Ray Imaging and Metal Detection Devices at High-Security Sites, and*
- REGDOC 2.12.2 (2013), *Site Access Security Clearance*.

OPG's key document for Security is listed in the table below.

Document Title	Document Number
Nuclear Security	N-PROG-RA-0011

OPG's Cyber Security policy outlines OPG's commitment to operate Information Technology and Industrial Control Systems in a secure, vigilant, and resilient manner that minimizes cyber risks to our information assets and generation facilities. In conjunction with that policy, OPG's Cyber Security program protects the cyber-critical assets for nuclear safety, physical protection and emergency preparedness functions from cyber-attacks.

The Cyber Security program includes the following elements:

- Roles and responsibilities;
- Policies and procedures;
- Staff training and awareness;
- Overall approach to cyber security;
- Configuration management;
- Incident response and recovery;
- Periodic self-assessments;
- Security controls, and
- Identification and classification of cyber-critical assets.

### **2.12.2 Current Operations**

OPG's security program ensures the security of the PWMF's assets through physical and administrative security measures utilizing equipment, personnel, and procedures. The security program at the sites has continued to evolve to meet industry best practices and all regulatory requirements.



The OPG security program includes the following:

- Security measures for PWWF are evaluated against annual OPG threat and risk assessments to ensure credible threats are mitigated;
- Training programs are in place to enhance and sustain improved performance of OPG's Security Divisions;
- A comprehensive drill program is in place as a means of validating security practices, ensuring regulatory compliance, and identifying areas for improvement in security operations. CNSC evaluated force on force exercises, conducted at the nuclear generation sites, which provide performance testing of the nuclear security program. Lessons learned through OPG security drills and exercises are applied to enhance the program at PWWF;
- OPG continues to participate in an Inter-Utility Security Working Group, which includes representation from all nuclear power operators in Canada. This group provides benchmarking opportunities to ensure that the program meets industry standards;
- OPG conducts regular meetings with CNSC staff to ensure open communication and that evolving security requirements are understood, and
- Security requirements in accordance with the *Nuclear Security Regulations* are in effect at OPG's High Security Sites, including PWWF.

Details of the Security Program for PWWF, including the measures to prevent loss or illegal use, possession or removal of nuclear substances, prescribed equipment or prescribed information, are contained in the security protected PWWF Security Report.

OPG has conducted an assessment with respect to REGDOC-2.12.3 *Security of Nuclear Substances – Sealed Sources* in relation to Category 1, 2 and 3 sealed sources and has determined that OPG is in compliance with the requirements of this Regulatory Document. Sealed sources are not included in the PWWF Operating Licence, but are separately licensed under a Nuclear Substance and Radiation Device Licence (*Consolidated Uses of Nuclear Substances (B15)*, Licence No. 12861-2-20.3). OPG does not have any category 1, 2 or 3 sealed sources at the PWWF, nor any lower activity category 4 and 5 sealed sources at PWWF.

Improvements made to the OPG Security Program during the current licensing period include:

- Major enhancements to the OPG nuclear security training program, incorporating systematic approach to training principles, and the addition of dedicated Security training positions;
- Completion of the transition from the Durham Regional Police Service to a proprietary armed Nuclear Security Response Team enhancing overall site security, and
- Enhancements to the security clearance program including additional OPG staff receiving an enhanced security clearance level.

Additionally, the following security improvements were made at Pickering NGS which enhances security to the PWWF Phase I area:

- The addition of the physical barrier system at Pickering NGS, which is a comprehensive detection system and delay barrier surrounding the Pickering NGS security-protected area, and
- The replacement of aging weapons detection, explosive detection and baggage x-ray devices, used for search of persons entering the Pickering NGS, with devices utilizing industry leading technology.

### 2.12.3 Future Plans for Improvement

#### Expansion of the PWMF Phase II Protected Area

OPG is planning on building three additional DSC storage buildings for used fuel in the PWMF Phase II site as shown in Figure 8 and described in section 1.5.5. In addition, OPG is planning on building a new DSC processing building at the Phase II site (also shown in Figure 8 and described in section 1.5.6) to replace the existing DSC Processing Building at the Phase I site. Until completion of the new DSC Processing Building at the Phase II site, the Phase I DSC Processing Building will continue to be used.

The design will incorporate additional security measures, and include enhancements to existing facilities and structures designed to meet the requirements of subsection 9(3)(b) of the *Nuclear Security Regulations*.

Changes to the Phase II area include:

- Expansion of the current Phase II protected area boundary to enclose the footprint of the new DSC Processing Building;
- Construction of temporary protected area barriers which will be placed into service at PWMF to separate the operating facility from the area where construction is occurring. These temporary protected area barriers will be placed into service during construction and remain in place until the conclusion of the construction;
- Replacement of the existing entrance to the PWMF Phase II area with a new security entrance to the Protected Area. The entrance will be constructed to facilitate the search of persons and packages for weapons and explosives through the use of explosives detection and baggage x-ray devices upon access; and for nuclear materials upon egress, utilizing industry leading technology carried out by nuclear security officers, and,
- Further expansion of the protected area boundary at a future date to enclose the footprint of DSC Storage Building #5 and #6.

Both permanent and temporary protected area barriers will be constructed to meet the requirements of the *Nuclear Security Regulations* and CNSC Regulatory Documents RD-321 and RD-361. OPG will submit a security-protected Security Report Annex in support of this application to detail the measures that will be put in place for these new structures at PWMF.

## 2.13 SAFEGUARDS

PWMF, under its current operating licence, is required to have in place a program that ensures all obligations arising from the Canada and International Atomic Energy Agency Safeguards agreement are met.

### 2.13.1 Safeguards Program

The objective of OPG's Safeguards Program is to support OPG's compliance with the governing agreement made between the Government of Canada and the IAEA. This is done in connection with the *Treaty on the Non-proliferation of Nuclear Weapons* and any arrangement between Canada and the IAEA made under that agreement. It also provides additional protocols to the agreement between member States and the IAEA for the application of safeguards.

The OPG nuclear safeguards program includes the following elements:

- A communication protocol between the IAEA, the CNSC, and OPG;
- Obligations to meet applicable regulatory requirements and the requirements of safeguards agreements, and
- Reporting to meet applicable regulatory requirements and the requirements of safeguards agreements.

OPG's key documents for Safeguards are listed in the table below.

Document Title	Document Number
Nuclear Safeguards	N-PROG-RA-0015
Nuclear Safeguards Implementation	N-STD-RA-0024

### 2.13.2 Current Operations

As of February 2007, in accordance with the IAEA requirements, OPG has adopted the integrated safeguards protocol. Under the integrated safeguards protocol, all safeguards commitments were met at the PWMF for the current licensing period.

In 2014, the ownership for Safeguards programs in OPG Nuclear moved from the Director, Regulatory Affairs, to the Director, Nuclear Waste Engineering.

PWMF has met all safeguards conditions in its operating licence, and the terms of the agreement between Canada and the IAEA pursuant to the *Treaty on Non-proliferation of Nuclear Weapons*. The PWMF staff have fully co-operated with the IAEA and facilitated achievement of IAEA safeguards goals. All reports and information necessary for safeguards implementation and compliance continue to be provided on a timely basis. No compliance issues have been identified by IAEA or CNSC staff.

Since 2008, there have been three CNSC reportable events at PWMF under the Safeguards Regulations. In 2008, there were two reportable events related to the loss of electrical power to the IAEA modem because it was connected to Class IV power which is interruptible. The modem is now connected to Class II power which is uninterruptible. The third reportable event which occurred in 2012 was a DSC that was loaded without advanced IAEA notification or subsequent reporting. The IAEA

was subsequently notified. In recent years, there have been no subsequent events demonstrating programmatic improvement.

The IAEA Fuel Verification Program includes material accounting, IAEA monthly remote monitoring report and the use of surveillance equipment such as cameras, portable verification equipment and containment equipment.

PWMF's compliance with the IAEA's Fuel Verification Program is met through the following, ongoing activities:

- Complying with the Safeguards Agreement and the Additional Protocol;
- Providing services and assistance for IAEA staff tasks and equipment operation;
- Disclosing any records to the IAEA upon request;
- Installing, servicing and operating Safeguards equipment;
- Not interfering in any way with Safeguards equipment, samples or seals;
- Making no changes to operations, equipment or procedures that would affect Safeguards implementation without prior written CNSC approval, and
- Preparing and submitting nuclear inventory reports per CNSC Regulatory Document RD-336, *Accounting and Reporting of Nuclear Material*.

PWMF staff completes an annual Physical Inventory Taking as part of licence conditions pursuant to the implementation of safeguards by the IAEA. A Physical Inventory Taking is a snapshot of the fuel physical inventory at any given time. Canadian facilities are selected at random by the IAEA for a Physical Inventory Verification that follows the Physical Inventory Taking. If a facility is not chosen for Physical Inventory Verification then CNSC Safeguards Staff may perform limited confirmation activities following the annual Physical Inventory Taking process. The IAEA completed a Physical Inventory Verification at PWMF in October 2015.

These IAEA inspections are attended by CNSC staff to review the facility's support for IAEA inspectors, including: escorts and equipment; the provision of accountancy information and supporting documents; the facility compliance with safeguards licence conditions relevant to the inspection activity, and the IAEA's adherence to its rights and obligations relevant to the inspection. No significant compliance issues were identified.

PWMF also performs annual self-assessments to ensure adherence to the OPG Nuclear Safeguards program.

As of June 2012, PWMF has been in full compliance with the CNSC Regulatory Document, RD-336, *Accounting and Reporting of Nuclear Material*. CNSC Guidance Document, GD-336, *Guidance for Accounting and Reporting of Nuclear Material* is also used. This includes updating the *Nuclear Fuel Location and Storage History* (NuFLASH) program to support RD-336 reporting requirements.

OPG Nuclear management stays current with the IAEA's safeguards requirements and is committed to meeting OPG's safeguards obligations in an efficient and timely manner.

Trilateral Working Group meetings between the IAEA, CNSC Safeguards Division, and Industry have been initiated and continue to be held to discuss improvements and to address stakeholder issues.

Figure 19 shows DSCs in storage with their IAEA wire seals in place.



Figure 19: DSCs in Storage with IAEA Wire Seals

### 2.13.3 Future Plans for Improvement

OPG plans to continue to perform annual self-assessments at PWWF to ensure adherence to the Safeguards program. Findings will be addressed in a timely manner.

Safeguards personnel will continue to be trained to OPG qualification requirements for safeguards. Safeguards governance will be updated, as required, to reflect any new regulatory standards or guides related to implementation of safeguards measures.

OPG will implement the CNSC requirement for electronic reporting of fuel inventory.

### **Laser Mapping Container Verification System**

The Western Waste Management Facility's Used Fuel Dry Storage Facility has finished trials for a new IAEA technology intended to become a new seal verification system. The IAEA are now analyzing the data to determine if this system is feasible for large scale implementation. The Laser Mapping Container Verification system (Figure 20), designed by the IAEA, is a digital weld identification scanner created to verify and uniquely identify DSC in-situ, a powerful tool for acquiring and verifying the "weld fingerprint" of the DSC.

Since 2012, OPG has been working closely with the CNSC International Safeguards Division and the IAEA, and recently applied the Laser Mapping technology to DSCs at the Western Waste Management Facility.

If accepted for use in Canada, this scanning will replace the current metal seal system for DSCs at PWMF which is costly for the IAEA and labour intensive for both IAEA and OPG during seal replacement activities.



**Figure 20: Laser Mapping Container Verification System**

The IAEA are informed of expansion plans to the PWMF in the Annual Additional Protocol which is electronically submitted to the CNSC, and then forwarded to the IAEA. During the design phase of an expansion to the PWMF, OPG will request the IAEA to identify any IAEA measures required for the expansion.

## 2.14 PACKAGING AND TRANSPORT

### 2.14.1 Packaging and Transport Program

At the Pickering Nuclear site, the transportation of low and intermediate level waste off-site is conducted under the Pickering NGS Power Reactor Operating Licence. There are no off-site shipments of radioactive waste directly from PWMF.

Under the PWMF operating licence, used fuel in DSCs is transferred on-site from the Pickering NGS irradiated fuel bays to the PWMF. CNSC's *Packaging and Transport of Nuclear Substances Regulations* does not apply to the on-site transfer of used fuel in DSCs between the Pickering NGS and the PWMF. Nonetheless, in the absence of any specific regulations for on-site packaging and transport, OPG provides an equivalent degree of safety to workers, the general public and the environment as would have been achieved for off-site transportation.

OPG's key document for Packaging and Transport is listed in the table below.

Document Title	Document Number
Radiation Protection	N-PROG-RA-0013

### 2.14.2 Current Operations

OPG has been safely transporting radioactive materials on public roads for over 45 years, and has never had an accident resulting in a radioactive release or serious personal injury. There have been no dangerous occurrences, accidental releases or imminent accidental releases reportable under the *Packaging and Transport of Nuclear Substances Regulations* and *Transportation of Dangerous Goods Act* during the reporting period. OPG drivers transporting radioactive materials have an excellent safety record on the roads.

The on-site transfer of used fuel in DSCs from the Pickering NGS to the PWMF is conducted on designated transfer routes in accordance to OPG's procedures. As of Q4 2015, OPG has safely transferred 809 loaded DSCs from the Pickering NGS to the PWMF for processing and storage since 1996 without any collisions.

### 2.14.3 Future Plans for Improvement

OPG maintains (renews and amends, as necessary) a Certificate for Transport Package Design (CDN/2054/B(U)-96) issued by the CNSC for the DSC Transportation Package. The Transportation Package design consists of a DSC plus a reusable protective packaging for impact resistance. The protective packaging is composed of a stainless steel shell filled with rigid polyurethane foam. Maintaining the certificate ensures that a valid means of off-site transportation exists to support the long-term planning for used fuel management. Since the inception of PWMF, no off-site shipments of DSCs have occurred.

### 3.0 OTHER MATTERS OF REGULATORY INTEREST

#### 3.1 ENVIRONMENTAL ASSESSMENTS

##### 3.1.1 Pickering Waste Management Facility Phase II Environmental Assessment

Prior to PWMF expanding to a Phase II site (Figure 21), OPG performed a screening level Environmental Assessment in 2003 in accordance with the Canadian Environmental Assessment Act 1992 to provide additional storage capacity of used fuel in dry storage containers [R1]. The scope of the project included construction and operation of DSC Storage Buildings #3 and #4.



Figure 21: PWMF Phase I and Phase II Sites

The results of the assessment identified no significant residual adverse environmental effects of the PWMF Phase II project with the proposed mitigation measures in place. In 2004, the Commission concluded that the project, taking into account the appropriate mitigation measures identified in the Screening Report, was not likely to cause significant adverse environmental effects, and approved the Environmental Assessment [R2]. The PWMF operating licence was amended in 2005 to include the construction of DSC Storage Buildings #3 and #4.

As part of the PWMF Phase II project, OPG submitted an Environmental Assessment Follow-up Plan which outlined the monitoring requirements for the project. The Environmental Assessment follow-up plan included monitoring related to the following:



- Stormwater Management: Stormwater drainage was monitored during the construction of DSC Storage Building #3 which included daily inspection of storm water, erosion, and check dam. The constructor's records indicate that there were no significant problems with storm water drainage [R3];
- Visual Screening: Original plantings along the east perimeter fence of the Pickering Nuclear site were substituted with larger, more mature trees which enhanced the screening and have better survival rates. The trees now provide adequate visual screening of the buildings from the Waterfront Trail, and
- Public Attitude Research Survey: The results from the 2009 survey were compared to the results from the 2002 survey. The results suggest that the PWMF Phase II project did not result in a change in attitude in the local community.

The Environmental Assessment Follow-up Plan, accepted by the CNSC, assumed that DSC Storage Building #4 would be constructed by 2016, and the monitoring results submitted to the CNSC in 2016. Given that DSC Storage Building #4 is not expected to be in-service until 2019, the Environmental Assessment follow-up activities which include stormwater monitoring were rescheduled to align with the timing of the construction and operation of this building.

### **3.1.2 Pickering NGS Units 5-8 Refurbishment and Continued Operation Project**

As part of its planning process, OPG conducted an Environmental Assessment study for the Pickering NGS Units 5-8 Project to refurbish one or more of the Pickering NGS Units 5-8 reactors. The scope of the Environmental Assessment included the construction and operation of additional waste storage structures to accommodate wastes resulting from reactor refurbishment activities, and from on-going operation of the reactors.

The Environmental Assessment study report and nine technical supporting documents were submitted to the CNSC in December 2007 [R4]. After considering the screening report, the mitigation measures, and comments filed from the public, the CNSC Commission accepted that the project would not cause significant adverse effects [R5].

No specific Environmental Assessment follow-up activities related to the construction and operation of additional storage buildings were identified in the Pickering NGS Units 5-8 Refurbishment and Continued Operation Environmental Assessment.

In 2010, OPG announced that it would not proceed with refurbishing Pickering NGS. Currently OPG is pursuing its plans to operate Pickering NGS to 2024. In consideration of operation to 2020 or potentially to 2024, and to support the need for transfer of all Pickering NGS used fuel to DSCs, OPG plans to proceed with the construction of additional waste storage structures for used fuel, namely DSC Storage Buildings #5 and #6.

## **3.2 INDIGENOUS COMMUNITY ENGAGEMENT**

OPG is committed to engaging with Indigenous communities about its nuclear waste operations and future projects. OPG is directed by a corporate-wide Indigenous Relations policy that provides a framework for engaging with Indigenous peoples and supporting community programs and initiatives.

OPG also maintains a Public Information and Disclosure Program to comply with the *Nuclear Safety and Control Act* and associated Regulations. OPG's programs are in accordance with CNSC RD-99.3, *Public Information and Disclosure*. OPG also maintains an Indigenous Relations program in accordance with REGDOC-3.2.2 *Aboriginal Engagement*.

Of particular interest are the four communities that make up the Williams Treaties First Nations; Scugog Island, Curve Lake, Hiawatha, and Alderville, in whose traditional territory the Pickering Nuclear site is located. OPG is also engaged with the local Oshawa and Durham Region Métis Council.

In 2016, tours were undertaken by Indigenous communities that have rights and/or interests in current and planned OPG Nuclear and related operations, usually as a study for the Adapted Phase Management plan currently underway with the Nuclear Waste Management Organization. There were two Indigenous community specific tours in 2016 of the PWF, with twenty-two participants. Planned tours are ongoing, including one for Williams Treaties First Nations and local Métis Council before the end of 2016. Previously, in 2013, members representing three Métis Councils from southern Ontario toured Pickering NGS including PWF.

### **3.2.1 Indigenous Relations Program**

An Indigenous relations work plan is developed and executed on a yearly basis between the Indigenous Relations Division and Corporate Relations Communications, due to the shared touch points these functions have with Indigenous communities.

OPG holds regular meetings regarding OPG's nuclear operations, including waste operations and transportation with Indigenous communities. The purpose of these meetings is to share information, to identify issues and concerns for resolution, and work collaboratively on areas of common interest.

OPG meets with those Indigenous communities who have an interest in OPG's nuclear operations including the current PWF Waste Facility Operating Licence renewal application and the longer term PWF operating license in order to ensure that they are informed in a timely manner and that they can engage in these licensing processes, if desired. The meetings also cover topics such as current, future facility operations, and the Deep Geologic Repository project. As well, areas of interest or concern such as opportunities for procurement from Indigenous suppliers, skills training and employment are included.

On a local basis over the reporting period, OPG met regularly on these topics with:

- Members of the Williams Treaties First Nations:
  - Scugog First Nation;
  - Hiawatha First Nation;
  - Curve Lake First Nation, and
  - Alderville First Nation.
- Durham Region Métis Council.

In support of Indigenous community relations and the licensing processes for both PWF and the Pickering NGS Power Reactor Operating Licence, OPG continues to:

- Inform local Indigenous communities about future site operations proposed in the licences;
- Take appropriate steps for local Indigenous engagement and consultation, and
- Address and resolve concerns as appropriate.

Based on work undertaken through Indigenous engagement, OPG believes the following specific Indigenous communities continue to have a primary interest with respect to OPG's waste operations at the PWF:

- Williams Treaties First Nations;
- Mississaugas of the New Credit First Nation;
- Métis Nation of Ontario;
- Oshawa and Durham Region Métis Council, and
- Toronto and York Region Métis Council.

Further information on current operations, events of significance and the PWF operating licensing process will continue to be shared with the above communities and any others that identify an interest.

OPG continued its engagement with Indigenous communities through 2016 to raise awareness about its nuclear operations and its nature and scope. Discussion of potential timing of the PWF operating licence renewal process, how to access the Participant Funding Program from the CNSC, and determination of a community's level of desired engagement was also included.

Engagement with Indigenous communities during the re-licensing process will include timely communication by e-mail, phone, in-person meetings, community information sessions and presentations. As noted, a number of site tours to the PWF have been conducted with interested Indigenous communities and this will continue to be accommodated.

### **3.2.3 Future Plans for Improvement**

OPG continues to build upon its relationships with Indigenous communities regarding the PWF.

In 2015 OPG participated in the Progressive Aboriginal Relations program offered by the Canadian Council for Aboriginal Business. The summary report from the Canadian Council for Aboriginal Business identified opportunities to enhance the Indigenous procurement process and Indigenous recruitment. These recommendations will be implemented during the 2017 fiscal year and assist OPG in enterprise-wide alignment on these issues.

## **3.3 COMMUNITY RELATIONS & PUBLIC INFORMATION PROGRAM**

PWF is required to have in place a public information and disclosure program in accordance with CNSC RD-99.3 *Public Information and Disclosure*, and to comply with the *Nuclear Safety and Control Act* and associated Regulations.

OPG's key document for Public Information and Disclosure is listed in the table presented below.

Document Title	Document Number
Nuclear Public Information Disclosure	N-STD-AS-0013

### 3.3.1 Community Consultation Program

OPG ensures timely, open and transparent communication to maintain positive and supportive relationships and confidence of key stakeholders. OPG develops, maintains and implements an annual public information and disclosure program that takes into consideration:

- The type of facility and activities being regulated;
- The risks to public health, safety, security, and the environment posed by the facility or activity, and
- The level of public interest or concern.

Annual engagement activities are directed towards community stakeholders, including government, media, business leaders, educational institutions, interest groups, and community organizations. OPG ensures transparent disclosure of operations and potential impacts, both positive and negative that may occur.

### 3.3.2 Current Operations

During the reporting period, OPG regularly and proactively provided information to the public on its facility activities. For operational status changes or unscheduled operations that may cause public concern or media interest, OPG follows a protocol to notify key community stakeholders in a timely manner. To support this protocol, OPG maintains a duty on-call position 24 hours a day, seven days a week, to manage this requirement.

Increased efforts over the past four years have resulted in expanded outreach with key stakeholders, government officials and the broader public. This is in response to growing interest by the public and community in OPG's waste operations and OPG's proposed Deep Geologic Repository.

On a quarterly basis, OPG publicly posts performance reports on nuclear waste operations at [www.opg.com](http://www.opg.com) and shares this document electronically with key stakeholders. Additionally, starting in 2014 OPG developed and began issuing a quarterly Environment report in an easy to read and understandable format. Annually, OPG posts the Environmental Monitoring Program report on [www.opg.com](http://www.opg.com) for both Pickering and Darlington.

In 2015, OPG initiated the quarterly posting of Waste Facilities Reportable Events, aligned with OPG's nuclear station disclosure activities.

#### Disclosure Protocol

In 2013, OPG implemented a managed system to carry out the requirements of CNSC RD-99.3 *Public Information and Disclosure*. This included the development and issuance of OPG's Nuclear Public Information and Disclosure Standard and the

development and public posting of an OPG *Nuclear Information Disclosure and Transparency Protocol*. While the guidance is directed at Class IA facilities, all of OPG's nuclear waste operations at the nuclear stations and operations at the PWMF adhere to OPG Nuclear's Nuclear Public Information and Disclosure Standard and the *Nuclear Information Disclosure and Transparency Protocol*.

### **Community Outreach and Programming**

Through community outreach, OPG has established strong working relations within the community. Regular briefings are provided to elected officials and council, key community organizations, interested groups and the general public on waste operations and the Deep Geologic Repository. OPG continues to respond to and support requests for information or briefings.

Two-way dialogue with the public was facilitated through personal contact, community newsletters, speaking engagements, educational outreach, and robust websites, with email response options, and many other products and programs.

To increase the understanding of nuclear waste operations, tours are provided to key stakeholder groups, media and interested groups. At the PWMF, a total of 48 tours were conducted from 2008 to the end of 2015.

OPG received, documented, and responded to concerns, complaints and inquiries raised by the public. A managed process is in place to track actions through to closure.

During the current licence period, communications in support of waste operations generated the following:

- Five newsletters to a combined audience of 130,000 households;
- Over 17,000 visitors in 2015 to OPG's waste and Deep Geologic Repository websites;
- One update at the Pickering Nuclear Community Advisory Council (in 2015), and
- Two Community Information Sessions (one in 2014 and one in 2015). The Community Information Sessions are organized in a way to provide an opportunity for the public to ask questions, obtain clarification, and identify or raise any concerns or issues they may have pertaining to current operations or the continued operations.

OPG relies heavily on websites to provide up-to-date information that is easily accessible by the public and offers opportunities for further contact. In this period, a number of newsletters, reports, media releases, updated stories and links to other agencies and regulatory proceedings were kept current on a number of nuclear-related websites.

Social media continues to increase in popularity and use. OPG actively monitors and responds to activity through Tweets, Facebook, and other social media platforms. OPG maintains a Twitter account with 7,527 followers, an Instagram account with 652 followers, and Tweets on relevant nuclear activities and information.

During the licence renewal process, OPG will develop and undertake a public community engagement program. The program will:

- Communicate and inform public and Indigenous communities of the future site operations and expansion to determine level of interest and concern;
- Document findings and address concerns;
- Take appropriate steps for public and Indigenous engagement and consultation to help inform the environmental review work as part of OPG's licence submission, and
- Address and manage concerns as appropriate.

### **3.3.3 Future Plans for Improvement**

OPG plans to:

- Continue to develop and implement a yearly public information program;
- Continue to maintain strong community relationships;
- Continue with website improvements and migration of all relevant PWWF information to OPG websites, and
- Continue to expand public environmental reporting and engagement including environmental follow up programs.

## **3.4 PWWF's RESPONSE TO THE FUKUSHIMA INCIDENT IN 2011**

As noted in Section 2.4, in response to the Fukushima Daiichi nuclear power plant incident, the CNSC established the Fukushima Task Force to evaluate operational, technical and regulatory implications for Canadian nuclear power plants and requested actions to be completed by major nuclear facilities in Canada.

CNSC requested that OPG review initial lessons learned from the earthquake in Japan and re-examine the safety cases in particular the underlying defence-in-depth concept, with the focus on external hazards such as seismic, flooding, fire and extreme weather events; measures for prevention and mitigation of severe accidents; and emergency preparedness. The CNSC also requested that OPG re-examine the assessments from a consequential event sequences perspective and report on implementation plans for short-term, medium-term and long-term measures to address any potential gaps.

Due to the broad scope of the reviews performed by OPG, the DNWM nominated an executive team lead and a supporting work force to manage the extensive work load and tight time lines.

In the review of the safety cases, OPG took on a number of actions with the objective of improving defences and mitigating the consequences for both design basis and beyond design basis events, should they occur at its waste management facilities.

### **A. Safety Cases for Design Basis Events**

OPG performed a systematic review of the impact of the events described above on the following systems:

- Fire detection, protection and water supply;

- Dry storage systems and structures;
- Line communication and Public Address; and
- Transportation packages.

The potential consequential failure modes of the above systems, structures, and equipment following the external initiating event were determined and the potential impact to the workers, the public, and the environment from these extreme events was assessed, as well as the need for any prevention or mitigating measures.

## **B. Safety Cases for Beyond Design Basis Events**

For beyond design basis events, the actions applicable to PWMF fell into two broad categories as discussed below:

### **a. Emergency Response Capability**

This category of actions includes the revision of internal programs and procedures to improve the post-event response, a review of the need for additional contracts for external emergency services, and the purchase of additional emergency equipment.

No significant gaps were identified during the emergency preparedness review. However, some possible enhancements were identified (Table 9). OPG has completed the implementation.

### **b. Technical Studies**

A dose rate assessment was conducted in order to determine the magnitude of the potential public dose at the site boundaries, if all the waste storage buildings at the PWMF were to collapse as a result of a beyond design basis seismic event. Conservatively, rubble was not credited with providing any radiation shielding.

The dose over the course of a year to a member of the public located at the site boundaries of the PWMF was found to be well below the CNSC annual dose limit of 1 mSv for a member of the public. This value is also used by OPG as the acceptance criterion for abnormal operating events at the PWMF.

**Table 9: Possible Improvements and Enhancements with OPG's Actions Taken**

Item	Possible Improvements and Enhancements	Actions Taken
1	Purchase satellite phones and associated contracts for all facilities, to ensure DNWM has a means of communication if regular phone lines are down, and cell phones cannot be charged due to loss of power. This could be required as a result of a severe weather emergency that results in DNWM employees being stranded at work for up to seven days.	Three satellite phones were purchased. These phones can be charged by a computer, an electrical outlet, or a car, which provides flexibility in keeping the phones charged in the event that some of these power sources are impacted by a severe weather event.  Also, a contract has been established for access to a satellite and usage.  The phone number for the PWWF was provided to the CNSC.
2	Develop a procedure for the safe shutdown of the nuclear waste management facilities in the event of a beyond design basis event.	A DNWM Emergency Preparedness and Response procedure was developed and issued. It includes actions to be taken by staff during and after a beyond design basis event. The procedure includes facility specific checklists for all sites, which comprises the list of components that need to be checked, to ensure the facility is in a safe state.
3	Assess whether undertaking additional measures to provide food, water etc. is required in the event of a severe weather emergency.	Results of the assessment concluded that additional food, water, and other provisions would be required for this event. OPG procured the required additional items.
4	Investigate the adequacy of the existing Mutual Aid Agreements, and whether additional mutual aid contracts would be required in the event of a severe weather emergency.	Results of the assessment concluded that no additional mutual aid agreements would be needed.



## **3.5 FINANCIAL GUARANTEE**

PWMF is included in OPG's consolidated financial guarantee for all the costs of implementing proposed decommissioning plans for all its Class I licensed facilities.

### **3.5.1 Cost Estimates**

Cost estimates are prepared based on the PWMF Preliminary Decommissioning Plan to determine the liability to be incurred during decommissioning. In 2011, OPG completed a comprehensive review and update of the Ontario Nuclear Funds Agreement Reference Plan and associated lifecycle cost estimate for nuclear waste management, stations and waste facilities decommissioning as part of the five-year update cycle as required by Ontario Nuclear Funds Agreement. The updated Ontario Nuclear Funds Agreement Reference Plan was approved by Ontario Minister of Finance effective January 1, 2012. The updated and approved cost estimates form the basis of OPG's proposed 2013-2017 CNSC Consolidated Financial Guarantee requirement submission which was accepted by the CNSC Commission in December 2012. OPG is currently working on an update to the Ontario Nuclear Funds Agreement Reference Plan which is expected to be approved by the Ontario Minister of Finance effective January 1, 2017. The updated and approved cost estimates will form the basis of OPG's 2018-2022 CNSC Consolidated Financial Guarantee submission in 2017.

### **3.5.2 Financial Guarantee**

In December 2012, CNSC accepted OPG's proposed 2013-2017 Consolidated Financial Guarantee. The sources to satisfy the consolidated financial guarantee requirement are the *Ontario Nuclear Funds Agreement* segregated funds augmented by a Provincial Guarantee. CNSC access to these funds is provided by the *CNSC Financial Security* and *Ontario Nuclear Funds Agreement Access Agreement* between the CNSC, OPG and the Province of Ontario, and the *Provincial Guarantee Agreement* between the CNSC and the Province of Ontario. The PWMF is included within this consolidated financial guarantee scope. The consolidated financial guarantee is normally updated on a five-year cycle using the guidance set out in CNSC Regulatory Guidance documents G-219 and G-206. Specific to PWMF, this requirement is embedded in PWMF operating licence Licence Condition 10.2 which requires OPG to maintain a financial guarantee acceptable to the Commission, and references the accepted documentation supporting the financial guarantee.

### **3.5.3 Financial Guarantee Reporting**

In addition to the five year update cycle, OPG provides an annual financial guarantee report to CNSC detailing the status of the guarantee including the amounts accumulated in segregated funds and the value of the Provincial Guarantee required. The report compares the amount of the liabilities and the financial resources available to discharge the obligations. The guarantee remains valid and in effect, and is sufficient. The 2016 Annual Report for the 2013-2017 CNSC Financial Guarantee was submitted to the CNSC in February 2016.

### **3.5.4 Financial Guarantee Hearing**

The next financial guarantee public hearing before the CNSC Commission is expected to occur towards the end of 2017 where OPG will request that the Commission accept a revision to OPG's consolidated financial guarantee for the 2018-2022 review period.

### **3.6 NUCLEAR LIABILITY INSURANCE**

OPG continues to maintain Nuclear Liability Insurance for PWMF consistent with the requirements of the *Nuclear Liability Act (1976)*, and will make any required changes to comply with *Nuclear Liability and Compensation Act* when its associated regulations take effect. A copy of the most current certificate is attached as Appendix A, confirming that the appropriate insurance is in place. Insurance inspections are conducted at PWMF at the request of the nuclear property or conventional insurers.

### **3.7 COST RECOVERY**

OPG has provided timely payments during the current licensing period, to the CNSC on a quarterly basis upon receipt of invoices. OPG will continue to make timely payments as required. There is no special request or inquiry about cost recovery at this time.

### **3.8 LONG-TERM WASTE MANAGEMENT**

The long term management or permanent disposal of intermediate level waste and used fuel is outside the scope of the PWMF licence renewal application. It is included here to demonstrate OPG's commitment to managing its waste from cradle to grave.

#### **3.8.1 OPG's Low & Intermediate Level Waste Deep Geologic Repository**

OPG assumes that the Low and Intermediate Level Waste Deep Geologic Repository which is currently undergoing the environmental assessment and licensing process will be constructed and become operational near the end of the requested licensing period. The availability of the Low and Intermediate Level Waste Deep Geologic Repository will not result in a need to change the programs for the ongoing monitoring and maintenance of the Dry Storage Modules during the requested licensing period.

OPG's commitment to safely managing its nuclear waste includes the long-term disposal of Low and Intermediate Level Waste. An environmental assessment for a project to prepare, construct and operate the Low and Intermediate Level Waste Deep Geologic Repository on the Bruce Nuclear Site within the Municipality of Kincardine, Ontario, has been conducted. The Low and Intermediate Level Waste Deep Geologic Repository would be designed to manage the Low and Intermediate Level Waste produced from the continued operation of the Bruce, Pickering and Darlington NGSs.

### **3.8.2 Adaptive Phase Management for Used Fuel Deep Geological Repository**

In November 2002, the Canadian Parliament passed the *Nuclear Fuel Waste Act* which provides the legal framework for the Government of Canada to make a decision on the long-term management of Canada's used nuclear fuel. The *Nuclear Fuel Waste Act* required the majority owners of nuclear fuel waste to form a Nuclear Waste Management Organization to study approaches for managing Canada's used nuclear fuel. Nuclear Waste Management Organization is responsible for the long-term management of Canada's used nuclear fuel waste that currently exists and that which will be produced in the future. The Nuclear Waste Management Organization is now implementing the Adaptive Phase Management which involves the siting and development of a deep geological repository for used nuclear fuel. OPG assumes that the Adaptive Phase Management process will not result in a need to change operations at the PwMF in the requested licensing period.

### **3.9 PICKERING NGS END OF COMMERCIAL OPERATION**

During the next PwMF licensing period (2017 – 2028), Pickering NGS will end its commercial operation by shutting down and entering the Stabilization Phase. The Stabilization Phase refers to the period in time following the permanent shutdown of the Pickering NGS where stabilization activities will be carried out in order to transition the station from its current (operational) state, to its Safe Storage State.

During the Stabilization Phase, the reactors will be defueled and the fuel will continue to be stored in the irradiated fuel bays before transfer to the PwMF. The Stabilization Phase is expected to last approximately three years.

Following the Stabilization Phase is the Storage with Surveillance Phase where Pickering NGS will exist in its Safe Storage State until dismantling and demolition activities commence. The Storage with Surveillance period is expected to last approximately 30 years. The fuel will be transferred into dry storage at PwMF during both the Stabilization Phase and Storage with Surveillance Phase.

Throughout the phases of Pickering NGS end of commercial operation, a systematic review of the programs and services which support the Safety and Control Areas will be undertaken. Changes are documented in the Stabilization Activity Plan and other documents which are routinely submitted to the CNSC. The continued operation of PwMF will be taken into account to ensure its safe operation when programs are being revised for Pickering NGS.

### 3.10 ADDITIONAL INFORMATION REQUESTED BY THE CNSC

#### 3.10.1 Other Relevant Regulations, Obligations and Permits

At the time of writing, Table 10 provides the list of other regulations, obligations that PWMF must abide by, and permits, certificates and licences issued by authorities other than the CNSC.

**Table 10: Other Legislation (Non-CNSC) that PWMF Abides By**

Regulatory Agencies	Legislation	Legislative Instrument	Reporting Requirements
<b>FEDERAL</b>			
Environment and Climate Change Canada	Canadian Environmental Protection Act	Federal Halocarbon Regulations SOR/2003-289	Semi-annual report on halocarbon releases in excess of 10 kg but less than 100 kg
Environment and Climate Change Canada	Canadian Environmental Protection Act	Canadian Environmental Protection Act	Annual National Pollutant Release Inventory Report
<b>PROVINCIAL</b>			
Ministry of Environment and Climate Change	Environmental Protection Act	Not Applicable	Annual Written Summary report for Air and Noise under Environmental Compliance Approval 9090-6SBGEH
Ministry of Environment and Climate Change	Environmental Protection Act	Not Applicable	Annual Update of the Emission Summary and Dispersion modelling for Environmental Compliance Approval 9090-6SBGEH
Ministry of Environment and Climate Change	Environmental Protection Act	Not Applicable	Source Test Report associated with Environmental Compliance Approval 9090-6SBGEH
Ministry of Environment and Climate Change	Environmental Protection Act	Not Applicable	Annual Industrial Sewage Works Performance Report under Environmental Compliance Approval 4881-5MHQ9F

Regulatory Agencies	Legislation	Legislative Instrument	Reporting Requirements
<b>MUNICIPAL</b>			
Toronto and Region Conservation Authority	Not Applicable	Not Applicable	Toronto and Region Conservation Authority Permit #C-110875 expired in October 2013, as all construction was completed.
<b>OTHER</b>			
Technical Standards and Safety Authority	Ontario Technical Standards and Safety Act	Boilers and Pressure Vessels Regulation	Certificate of Authorization P-CERT-01913-0497064 (expires April 15, 2017)
Technical Standards and Safety Authority	Ontario Technical Standards and Safety Act	Elevating Devices Regulation (O.Reg 209/01)	Licence Number EDLIC-069578 (expires April 15, 2017)

### 3.10.2 Open Action Items Discussed in CNSC Hearings and Meetings

There are no open action items remaining from the 2008 CNSC Hearing on PWWF licence renewal, nor from the interim status consolidated meetings held in 2010 and 2015.

#### 4.0 ACRONYMS

CANDU	CANada Deuterium Uranium
CNSC	Canadian Nuclear Safety Commission
CSA	Canadian Standards Association
DNWM	Decommissioning and Nuclear Waste Management Division
DSC	Dry Storage Container
IAEA	International Atomic Energy Agency
ISO	International Organization for Standardization
NBCC	National Building Code of Canada
NFCC	National Fire Code of Canada
NGS	Nuclear Generating Station
NRCC	National Research Council of Canada
OPG	Ontario Power Generation
PWMF	Pickering Waste Management Facility

#### 5.0 REFERENCES

- [R1] OPG Letter, K.E. Nash to M. Ben Belfadhel, "Pickering Waste Management Facility Phase II Project - Submission of Final Environmental Assessment Study Report," December 19, 2003, CD# 92896-CORR-00531-00205.
- [R2] CNSC Letter, S. Locatelli to K. Nash, "Record of Proceedings – Ontario Power Generation," May 28, 2004, CD# 92896-CORR-00531-00233.
- [R3] OPG Letter, N. Mihalic to P. Jones, "Pickering Waste Management Facility Phase II – Environmental Assessment Follow-up Report 2010 – Submission of Enclosures," July 30, 2010, E-Doc 3589043, CD# 92896-CORR-00531-00532.
- [R4] OPG Letter, D.P. McNeil to T.E. Schaubel, CNSC, "Pickering B Environmental Assessment (EA) for Proposed Refurbishment and Continued Operation – Submission of Final EA Study Report," December 17, 2007, CD# NK30-CORR-00531-04644.
- [R5] CNSC Letter, L. Levert to D.P. McNeil, OPG, "Record of Proceedings – Ontario Power Generation Inc.," January 26, 2009, e-Doc 3330500, CD# NK30-CORR-00531-05083.

## APPENDIX A

### INSURANCE CERTIFICATE



### Certificate of Insurance

No.: 2016-46

Dated: September 16, 2016

This document supersedes any certificate previously issued under this number

<p>This is to certify that the Policy(ies) of insurance listed below ("Policy" or "Policies") have been issued to the Named Insured identified below for the policy period(s) indicated. This certificate is issued as a matter of information only and confers no rights upon the Certificate Holder named below other than those provided by the Policy(ies).</p> <p>Notwithstanding any requirement, term, or condition of any contract or any other document with respect to which this certificate may be issued or may pertain, the insurance afforded by the Policy(ies) is subject to all the terms, conditions, and exclusions of such Policy(ies). This certificate does not amend, extend, or alter the coverage afforded by the Policy(ies). Limits shown are intended to address contractual obligations of the Named Insured.</p> <p>Limits may have been reduced since Policy effective date(s) as a result of a claim or claims.</p>	
<p><b>Certificate Holder:</b>                  Canadian Nuclear Safety Commission                  Headquarters                  280 Slater Street P.O. Box 1046                  Station B                  Ottawa, ON K1P 5S9</p>	<p><b>Named Insured and Address:</b>                  Ontario Power Generation Inc.                  700 University Avenue, H18-J18                  Toronto, ON M5G 1X6</p>

**This certificate is issued regarding:**  
 Pickering Waste Management Facility

Type(s) of Insurance	Insurer(s)	Policy Number(s)	Effective/ Expiry Dates	Sums Insured Or Limits of Liability	
NUCLEAR LIABILITY • Pickering Nuclear Generating Station	Euro Liab. Ins for the Nuc. Ind. (ELINI)	EL032CA16	Jan 01, 2016 to Jan 01, 2017	Limit of Liability	\$ 25,000,000 as part of \$50,000,000
NUCLEAR LIABILITY • Pickering Nuclear Generating Station	Nuclear Insurance Association of Canada	OF002	Jan 01, 2016 to Jan 01, 2017	Limit of Liability	\$ 50,000,000 as part of \$75,000,000

**Notice of cancellation:**

The insurer(s) affording coverage under the policies described herein will not notify the certificate holder named herein of the cancellation of such coverage.

<p><b>Marsh Canada Limited</b>                  120 Bremner Boulevard                  Suite 800                  Toronto, ON M5J 0A8                  Telephone: 416-868-2143                  Fax: 416-868-2526                  certificaterequestscanada@marsh.com</p>	<p style="text-align: right;">Marsh Canada Limited</p> <div style="text-align: center; margin-top: 20px;"> </div> <p style="text-align: right;">By: _____                  Diane Flynn</p>
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