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In the Matter of the

À l'égard du

Regulatory Oversight Report for 2010–2014 Ontario Power Generation Inc.'s Darlington, Pickering and Western Waste Management Facilities

Rapport de surveillance réglementaire des installations de gestion des déchets Darlington, Pickering et Western d'Ontario Power Generation Inc. pour la période 2010-2014

Commission Meeting

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ONTARIO POWER GENERATION

Report

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2015 Interim Status Report on Darlington, Pickering and Western Waste Management Facilities

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Table of Contents

Page

List of Tables

Page

List of Graphs

Page

List of Figures

Page

Revision Summary

Revision Number	Date	Comments
R000	May 2015	Initial issue

Executive Summary

The purpose of this report is to present the Canadian Nuclear Safety Commission (CNSC) with OPG's status update on the performance of the Darlington Waste Management Facility (DWMF), Pickering Waste Management Facility (PWMF), and Western Waste Management Facility (WWMF).

The DWMF, PWMF, and WWMF were developed for the management and interim storage of radioactive waste generated from the Darlington Nuclear Generating Station (DNGS), the Pickering Nuclear Generating Station (PNGS), and the Bruce Nuclear Generating Stations (BNGS).

OPG is the licensee for the DWMF, PWMF, and WWMF, and has been granted a ten year *Waste Facility Operating Licences* for each facility. As the licence period of each facility varies based on the date of issuance, this report presents a consolidated, interim status update between licence renewals. This report presents the second, consolidated interim status report presented to the Commission, with the previous report provided in December 2010. This report covers the operational performance period from July 1, 2010, to December 31, 2014. OPG's performance results are presented for each of the CNSC's 14 Safety and Control Areas (SCAs) and Other Matters of Regulatory Interest.

During this reporting period, DWMF, PWMF, and WWMF have operated safely and reliably to protect the public, the workers, and the environment. OPG is proud of its excellent record in conventional and radiological worker safety, and is well positioned for the continued safe operation of its Nuclear Waste Management Facilities.

OPG is committed to innovative and responsible solutions for managing radioactive materials safely, efficiently and cost effectively, making investments for this continued safe operation, and improved performance.

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

Improvement Initiatives and Accomplishments

Continued investments and improvements in OPG's Nuclear Waste Management Facilities demonstrate OPG's commitment to operate safely and reliably now, and through the decommissioning of these facilities.

Worker Safety has improved during the last reporting period. At the end of 2014, OPG's Nuclear Waste Management Facilities had completed over one and a half million hours worked without a lost time accident. To reflect OPG's commitment to continuously improving and challenging performance, Accident Severity Rate and All Injury Rate targets have made more challenging throughout the reporting period, as performance continues to better the targets.

Worker Radiological Safety has also improved. Improvements in the way *As Low As Reasonably Achievable* (ALARA) targets were generated and reported have been implemented. There were no recordable doses at any Nuclear Waste Management Facility that exceeded legal limit.

Human Performance has improved. The overall effectiveness of the human performance program is measured through the Event Free Day (EFD) Reset Target. The target EFDR has been reduced from 8 to 2 per annum over the reporting period. For the majority of years, the actual EFDRs were less then target, and in 2012 and 2014 the actual EFDR was 0.

Lessons learned from the Fukushima event have been reviewed and included in the emergency management preparedness and response program. No significant gaps or compensatory actions were identified during the review process; however, improvements and enhancements were implemented, including development of an emergency preparedness procedure and procurement of satellite phone capability for emergency management.

Waste minimization efforts at both the generating stations and at the Western Waste Management Facility have increased resulting in reduced radioactive waste generation rates for the fleet. Several waste pilots have been conducted identifying opportunities for further reprocessing of stored low level wastes. A waste sorting and segregation pilot is underway at the WWMF which has led to initial successes in diversion of metal wastes from the radioactive waste stream, as well as further volume reduction opportunities through incineration and compaction.

1.0 INTRODUCTION

OPG's owned and operated three Nuclear Waste Facilities, DWMF, PWMF, and WWMF were developed for the management and interim storage of radioactive waste generated from the OPG owned nuclear generating station operations. WWMF includes the Used Fuel Dry Storage (UFDS) facility which receives used fuel from BNGS, and the Low and Intermediate-Level Waste (L&ILW) operations which receives wastes from all of the OPG owned Nuclear Generating Stations.

The three Nuclear Waste Management Facilities are regulated by the Canadian Nuclear Safety Commission (CNSC), and are licensed as Class 1B nuclear facilities, in accordance with the *Nuclear Safety and Control Act,* and the *Class I Nuclear Facilities Regulations*.

OPG is the licensee for the DWMF, PWMF, and WWMF, and has been granted ten year *Waste Facility Operating Licences* (WFOLs) by the CNSC. The current WFOLs and renewal dates are shown below:

- *Darlington Waste Management Facility Operating Licence,* WFOL-W4-355.00/2023 – April 30, 2023;
- *Pickering Waste Management Facility Operating Licence,* WFOL-W4-350.02/2018 – March 31, 2018; and,
- *Western Waste Management Facility Operating Licence,* WFOL-W4-314.03/2017 – May 31, 2017.

1.1 Purpose

This report presents a consolidated, interim status update of OPG's Nuclear Waste Management Facilities between the licence renewal applications. This report documents the safe and reliable performance of the DWMF, PWMF, and WWMF from July 1, 2010, to December 31, 2014. For some of the Safety and Control Areas, the full year of data for 2010 is provided to support complete understanding of data trends.

This Interim Status Report provides a consolidated overview on the performance of OPG's three operational Nuclear Waste Management Facilities, and demonstrates that:

1. OPG remains qualified to operate the DWMF, PWMF, and WWMF; 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.

Safe and reliable operations during the reporting period are also demonstrated in the OPG quarterly reports to the CNSC.

1.2 Structure of Report

In order to summarize OPG's performance and present the results during the reporting period, the report is organized into fourteen (14) Safety and Control Areas (SCAs), and Other Matters of Regulatory Interest, as defined by the CNSC [R-1]. The fourteen SCAs and Other Matters of Regulatory Interest and the associated sections of the report are presented in Table 1.

Table 1: Report Sections Associated with Safety & Control Areas and Other Matters of Regulatory Interest

Functional Area	Report Section & Safety and Control Area
Management	3.1 Management System
	3.2 Human Performance Management
	3.3 Operating Performance
Facility and Equipment	3.4 Safety Analysis
	3.5 Physical Design
Core Control Processes	3.6 Fitness for Service
	3.7 Radiation Protection
	3.8 Conventional Health and Safety
	3.9 Environmental Protection
	3.10 Emergency Management and Fire Protection
	3.11 Waste Management
	3.12 Security
	3.13 Safeguards
	3.14 Packaging and Transport
Other Matters of Regulatory Interest	4.1 Licensee's Community Relations and Public Information Program

Functional Area	Report Section & Safety and Control Area
	4.2 First Nations and Métis Community Relations
	4.3 Other Regulatory Notifications
	4.4 Cost Recovery
	4.5 Nuclear Liability Insurance
	4.6 CNSC Financial Guarantees

To present the performance review in a structured and organized manner, the above sections are generally organized under three sub-headings:

1. *Objectives:* This sub-section describes the main programmatic or project objectives of the particular SCA.

2. *Results:* This sub-section describes information related to the facilities results or implementation of programs over the reporting period from the start of the third quarter of 2010 (Q3 2010) to the end of the fourth quarter of 2014 (Q4 2014).

3. *Future Improvements:* Future plans for continuous improvement are included in this section, where applicable.

Additional sub-sections have been included to provide further details of specific SCAs, as required.

2.0 BACKGROUND ON OPG NUCLEAR WASTE MANAGEMENT FACILITIES

*OP*G strives to be recognized as achieving the highest standard in the safe management of nuclear waste with centres of excellence in:

- Interim management of low and intermediate level radioactive waste and dry used fuel;

- Transportation of radioactive waste and non-waste radioactive material; and

- Long term management of low and intermediate level waste.

OPG's vision for nuclear waste management is to manage radioactive materials with innovative and responsible solutions to protect the public, workers and the environment.

OPG's Nuclear Waste Management Facilities have, and will continue to improve, a strong safety culture that permeates the organization, and demonstrates respect for the safety of all workers, the environment, and nuclear material management.

The following sub-sections describe the organization, business plan, overview of Nuclear Waste Management Facilities, and operations including decommissioning plans of OPG Nuclear Waste Management Facilities.

2.1 Decommissioning and Nuclear Waste Management Organization

The Senior Vice President, Decommissioning and Nuclear Waste Management (DNWM) reports to the OPG Nuclear (OPGN) Chief Nuclear Officer (CNO) and has overall responsibility for the safe and reliable operation of the DWMF, PWMF, and WWMF as described in the licensing basis for each facility. The organization is shown in Figure 1.

Day-to-day operations and management of the OPG Nuclear Waste Management Facilities is the responsibility of facility Operations Managers at each of the DWMF, PWMF, and WWMF who report to the Directors of Used Fuel Operations, and Low and Intermediate Level Waste Operations. Only those persons authorized by the facility Operations Manager supervise operations at the Nuclear Waste Management Facilities. There are sufficient qualified personnel in attendance at these facilities to ensure safe operations within the requirements of the CNSC operating licences, and all applicable federal and provincial *Acts and Regulations*.

In addition to the safe operation of these three facilities, DNWM is responsible for the safe transportation of radioactive waste and non-waste radioactive material, decommissioning planning for OPG's nuclear facilities, oversight of long term disposal and storage options, as well as strategic planning for PNGS's end of commercial operations.

2.2 Business Plan

Prepared annually, OPG's Nuclear Waste Management Facilities' Business Plan is a three year comprehensive plan that outlines the divisional business objectives and the associated financial activity to meet those objectives. The first year of the plan is more specific and represents the detailed budget that is reported and monitored against on a monthly basis.

The development of the annual Business Plan is based on the updated OPG Nuclear Waste Management Facilities' System Plan which provides a summary of current planning assumptions, projected waste volumes, and system Reference Plans. DNWM's Business Plan is also aligned with OPG's corporate strategic direction and financial/staffing targets. As part of the OPG business planning process, DNWM's Business Plan is challenged by the CNO/Senior Vice President, endorsed by the Chief Executive Officer / Chief Financial Officer, and ultimately approved by the OPG Board of Directors.

OPG Business Transformation

On May 3, 2012, OPG initiated the transition to a centre-led matrix organization structure as part of a business transformation. Centre-led organizations may be either OPG company-wide, or reside within the Nuclear organization. These organization changes have been made to consolidate departments, eliminate duplication, and streamline support functions while maintaining OPG's primary focus on safe and reliable operations. This new structure allows OPG to continue to operate safely and reliably and will provide strong functional support through effective, efficient service delivery that will meet changing demands.

Business transformation was a multi-phased, managed process continuing into 2015. The work that was done drove efficiencies in practices, processes and governance, and transformed the way functional groups support the business units. Transitioning Nuclear Waste Engineering, Finance, Conventional and Radiation Safety, and Environmental groups to a centre-led model allows for consistent functional practices to be leveraged across OPG. These centre-led functions have reporting lines to either a corporate OPG Vice President or another OPGN Vice President with a dotted reporting relation to the OPG DNWM Senior Vice President.

2.3 Nuclear Waste Management Operations Overview

2.3.1 Low and Intermediate-Level Waste Operations

The L&ILW storage area at the WWMF provides interim storage for radioactive waste produced by the operation of the PNGS, DNGS, and BNGS, including refurbishment wastes from the Bruce Nuclear Generating Stations. Incoming waste must meet the waste acceptance criteria or receive approval prior to being shipped, via a New Waste Form review process. All low level wastes are separated into processible (via incineration or compaction) wastes and non-processible wastes when received. Processed and non-processible wastes are stored in specific designated storage structures.

The waste consists of materials which are contaminated with fission and/or activation products, or have become radioactive as a result of neutron activation, or may contain natural radionuclides and/or actinides. This waste contains an activity concentration or total activity above unconditional clearance levels as established by the CNSC, but does not meet the criteria for high-level waste (e.g., used fuel waste).

Previously stored wastes may also be retrieved, reclassified and/or further processed, then subsequently stored in a different type of storage structure. For intermediate-level waste this may occur following radioactive decay as necessary. These processes, as illustrated in Figure 2, are flexible and determined by WWMF Operations.

2.3.2 Used Fuel Dry Storage Operations

The UFDS process encompasses the facilities, systems, structures, equipment, components, and the operations necessary to transfer used fuel from the DNGS,

PNGS, and BNGS wet fuel bays, to dry storage at the DWMF, PWMF, and WWMF, respectively. Once the fuel has resided in the bays for a minimum of 10 years, the residual decay heat is sufficiently low to allow this fuel to be moved to "dry" storage. Each Dry Storage Container (DSC) is designed to safely store up to 384 used fuel bundles as shown in Figure 3.

The general process for the UFDS waste facilities operations is illustrated in Figure 4, and the UFDS process can be divided into seven parts:

- Receipt of empty DSCs at the DWMF, PWMF and WWMF;
- Preparation of empty DSCs for loading;
- DSC transfer operations from the site used fuel facilities to the nuclear generating stations;
- Loading operations of DSCs with used fuel at the wet irradiated fuel bay areas;
- DSC transfer operations from the nuclear generating station back to the site used fuel facility;
- DSC processing operations at the DWMF, PWMF, and WWMF; and
- Storage of DSCs in storage building.

2.4 Darlington Waste Management Facility

The DWMF is located within its own security-protected area, east of the DNGS, and within the Darlington property site as shown in Figure 5. Presently, the DWMF encompasses a DSC Processing Building and one DSC Storage Building. The DWMF provides safe interim storage for the ten-year cooled used fuel discharged from the DNGS. Figure 6 shows a photograph of DSCs stored in a DSC Storage Building at DWMF.

The DSC Transporter, as shown in Figure 7, is a specially designed multi-wheeled vehicle utilized for the transfer of DWMF DSCs between the fuelling facility auxiliary areas at the DNGS and the DSC Processing Building at the DWMF, and between the DWMF DSC Processing Building and Storage Building. The DWMF received its first *WFOL* in November 2007, and the first DSC loaded with used fuel from DNGS in April 2008. A ten year *WFOL* was granted by the CNSC, and the current operating licence is valid from March 13, 2013, to April 30, 2023.

2.5 Pickering Waste Management Facility

The PWMF is located within the PNGS property site, shown in Figure 8. A ten year *WFOL* was granted in 2008, and the current operating licence is valid from April 1, 2008, to March 31, 2018. The objective of the PWMF is to provide safe interim storage for the ten-year cooled used fuel discharged from the PNGS Units 1-8. In

addition, PWMF provides safe storage for retube components received from the PNGS Units 1-4 refurbishment operations from 1984 to 1992.

The PWMF has been planned in two phases. PWMF Phase I, located within the PNGS protected area, consists of UFDS for the interim storage of the used fuel from PNGS reactors in DSCs, and the Retube Component Storage (RCS) area for the interim storage of irradiated reactor components in Dry Storage Modules (DSM). This phase was constructed in two stages.

- Stage 1 became operational in 1996, and contains a DSC Processing Building and DSC Storage Building 1. DSC Storage Building 1 has a nominal design capacity of up to 185 DSCs (71,040 bundles).

- Stage 2 became operational in 2001, and consists of DSC Storage Building 2, which has a nominal design capacity of up to 469 DSCs (179,712 bundles).

Phase I also contains the RCS area. The RCS area has retube components (i.e. pressure tubes, severed end fittings, garter springs, shield plugs, and miscellaneous identified components) which have been loaded into specifically designed and shielded DSMs for interim storage at the PWMF.

The DSMs are large cylindrical casks as shown in Figure 9, made of reinforced high-density concrete and thick carbon steel inner and outer liners. A bolted gasketed shield door is used to seal the fill port on each DSM. Saddle supports are used to hold each DSM in a horizontal position.

The DSMs are stored outdoors in the fenced and access controlled RCS area. The RCS area is located immediately south of DSC Storage Building 1 within the PNGS protected area. The RCS area contains 34 loaded and two empty DSMs.

PWMF Phase II is located within its own security-protected area, east of the PNGS powerhouse within the Pickering property site. It is located approximately 1 km northeast of PWMF Phase I. PWMF Phase II consists of DSC Storage Building 3 with a nominal design capacity of 500 DSCs (192,000 bundles), which was placed into service in 2009.

The DSC Transporter is used to transfer DSCs between the PNGS wet irradiated fuel bays and the PWMF DSC processing building. The Transporter also transfers DSCs between the Phase I and Phase II sites, and for placement and retrieval for the seal-welded DSCs inside the DSC Storage Buildings.

2.6 Western Waste Management Facility

The WWMF as shown in Figure 10 is located at OPG's Bruce site. The WWMF provides safe storage of the L&ILW produced by the operation of the PNGS, DNGS, and BNGS. It also provides safe interim storage for the ten-year cooled used fuel discharged from the BNGS reactors. The WWMF consists of the L&ILW storage area

and the UFDS area. A ten year *WFOL* was granted in 2007, and the current operating licence is valid from June 1, 2007, to May 31, 2017.

The L&ILW storage area consists of various structures such as the:

- Amenities Building;
- Waste Volume Reduction Building (WVRB);
- Transportation Package Maintenance Building (TPMB);
- Low Level Storage Buildings (LLSBs);
- Steam Generator Storage Building (SGSB);
- Refurbishment Waste Storage Building (RWSB);
- Quadricells; and
- In-ground Container (IC) systems, trenches, and tile holes.

The L&ILW storage area, presently with a design capacity of up to 120,000 m^3 has been receiving radioactive waste since 1974. There are currently 14 LLSBs in service, with the two most recent placed into service in 2013.

The UFDS area is within its own security-protected area located northeast of the L&ILW storage area, and consists of a DSC Processing Building and four DSC Storage Buildings. The four Storage Buildings in the UFDS area are designed to provide storage space for up to 2,000 DSCs (about 768,000 fuel bundles) for the used fuel generated by the BNGS reactors.

The UFDS area was placed in service with a DSC Processing Area and single Storage Building in October 2002 and received the first DSC of used fuel in February 2003. A second DSC Storage Building was placed into service in 2007. Two additional storage buildings were constructed and placed into service in 2012.

The DSC Transfer Vehicle as shown in Figure 11, is used exclusively to transfer DSCs between the Bruce A or Bruce B station Ancillary Service Buildings (ASBs) and the DSC Processing Building. A DSC Transporter is used for the transfer of the DSCs between the station ASBs and the DSC Processing Building in the event that the DSC Transfer Vehicle is not available, and for placement and retrieval for the seal-welded DSCs inside the DSC storage buildings.

3.0 SAFETY AND CONTROL AREAS

The subsequent sub-sections present OPG's Nuclear Waste Management Facility performance in the CNSC defined 14 Safety and Control Areas (SCAs). The results

cover the operational performance during the reporting period from July 1, 2010, to December 31, 2014. For some of the SCAs the full year of data for 2010 is provided to support complete understanding of data trends.

To provide a comprehensive review of performance at OPG's Nuclear Waste Management Facilities, the sub-sections summarize the common elements of OPG's nuclear waste management program and also include the unique features of each facility, as required.

During this reporting period, the DWMF, PWMF, and WWMF have operated safely and reliably to protect the public, the workers, and the environment. OPG has built a strong safety culture that permeates the organization, and demonstrates a focus to improve organizational effectiveness through the use of best practices, enhanced behaviours, and learning. OPG will continue to operate the three facilities safely, through the current operating licences issued by the CNSC.

3.1 Management System

The OPGN Management System defines the organizational structure, roles and responsibilities, applicable program elements, and the interfaces between them. The Management System establishes the processes, and programs required to ensure the OPG Nuclear Waste Management Facilities' organization achieves its safety objectives, continuously monitoring performance against the objectives, and fostering a healthy safety culture. OPG Nuclear Waste Management Facilities' staff understand and manage work and financial liabilities to accurately plan and forecast expenditures, ensuring value for money.

3.1.1 Objective

OPG's N-CHAR-AS-0002, *Nuclear Management System* defines the organization responsibilities, interfaces, and applicable program elements for the management of all OPGN facilities, to fulfill the requirements of:

- *General requirements for Pressure-retaining Systems and Components in CANDU Nuclear Power Plants,* Canadian Standards Association (CSA) Standard N285.0;
- *Material Standards for Reactor Components for CANDU Nuclear Power Plants,* CSA Standard N285.6; and
- *Management System Requirements for Nuclear Power Plants*, CSA Standard N286-05.

Activities are performed in accordance with procedural documents that prescribe controls and responsibilities to ensure activities are carried out in a safe and effective manner by qualified personnel.

Implementation for the Nuclear Waste Management Facilities is assessed on an on-going basis, consistent with the requirements and practices for the fleet of nuclear

facilities. This process relies on a multi-tiered system of planned reviews and audit activities. These include independent and management self-assessment processes, which provides assurance that Programs are effectively implemented.

Fleet-view Program Health and Performance Reporting is an OPG functional review and reporting process to monitor and routinely report on overall Program effectiveness in support of the Nuclear Management System. Analysis of performance gaps is completed and areas for improving performance are identified, and actions are developed and implemented.

3.1.2 Results

During this reporting period, OPG's Nuclear Waste Management Facilities achieved safety objectives, performance and value for money cornerstones. The results from the Governance Simplification and Fleet-view Program Health and Performance Reporting are described in details below.

Governance Simplification

In 2008, OPG's Nuclear Waste Management Facilities began a transition into the OPGN line of business, and created a team to ensure a smooth transition with the OPGN 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. As part of the project, OPGN governance was adopted where appropriate, and nuclear waste governance eliminated where possible.

Fleet-view Program Health and Performance Reporting

Fleet-view Program Health and Performance Reporting continues to improve the performance of OPG's Nuclear Waste Management Facilities. Example areas of improvement are:

- Through the Nuclear Corrective Action Program identification of lower level conditions has improved, with more Station Condition Records (SCRs) raised for evaluation and analysis of trends as identified through the Corrective Action Program;
- In L&ILW Operations Work Management has improved with the implementation of facility specific outage procedures and weekly work execution metrics to measure adherence to planned work;
- Training processes have improved resulting in a 25% improvement in staff capability as measured by staff qualification indices; and
- OPG's Nuclear Waste Management Facilities have implemented the OPGN Human Performance Program to reduce human error in facilities' operation. Human Performance improvement initiatives are focussed on improvements in

individual risk based perception, supervisory effectiveness, and low level reporting of adverse conditions.

3.1.3 Future Improvements

OPG's Nuclear Waste Management Facilities will continue to make improvements in work processes and program implementation through:

- Continued adoption of OPGN governance as appropriate;
- Ongoing use of Fleet-view Program Health and Performance Reporting to assist with overall program effectiveness;
- Manage the business to ensure a focus on long-term sustainable performance excellence; and
- OPG's Nuclear Waste Management Facilities will develop leadership and management capability at all levels of the organization with a bias toward teaching and learning moments.

3.2 Human Performance Management

The Human Performance Program at OPG's Nuclear Waste Management Facilities is defined by the program document, N-PROG-AS-0002, *Human Performance*. OPG's goal for nuclear waste management is to manage defenses, focus on staff and processes to strive for safe and reliable event-free operation. By systematically identifying and addressing error-likely situations, reducing organizational vulnerability to errors and events, and by questioning or enhancing the integrity of defenses, OPG's Nuclear Waste Management Facilities are positioned to continually improve organizational effectiveness through the use of best practices, enhanced behaviours and learning.

3.2.1 Objectives

The objective of OPG's Human Performance improvement plan for DNWM is to promote, reward, and improve behaviours throughout the organization that support safe and reliable facility operation. Activities to accomplish these objectives include the following:

- Provide human performance oversight;
- Establish human performance indicators and targets;
- Use of the corrective action program to drive improvement;
- Develop action plans for improving human performance through training;
- Refine and improve human performance tools and their application; and

- Communicate human performance activities, issues, and accomplishments.

3.2.2 Results

During this reporting period, OPG's Nuclear Waste Management Facilities enabled effective human performance through the development and implementation of OPGN processes, which include: tracking human performance events, reinforcing procedural use and adherence, observation and coaching, training, pre and post-job briefing, and undertaking gap analysis of human performance standards.

Event Free Day Resets

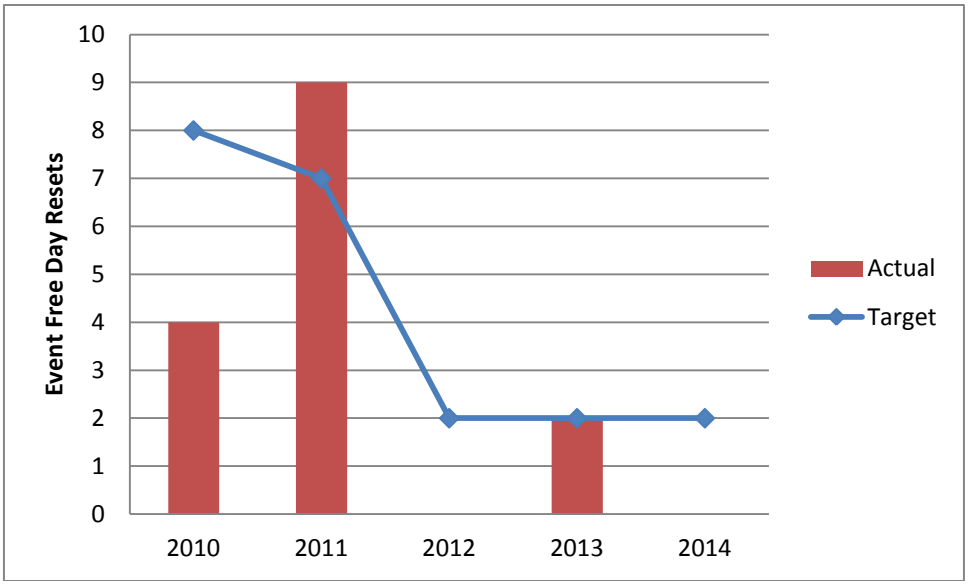
Human performance events are tracked at the divisional level, to identify precursor events to identify and eliminate issues before they escalate to more serious human performance events. OPG's Nuclear Waste Management Facilities perform analysis of the events, as part of the quarterly trend analysis for the Corrective Action Program. SCRs are initiated for the evaluation and correction of adverse trends.

When an event occurs related to human performance, the responsible line organization expeditiously investigates, documents the findings, and develops corrective actions. The investigation includes identifying what event free tools could have prevented the event from occurring. OPG's Nuclear Waste Management Facilities have introduced the OPGN "Anatomy of an Event Analysis" tool to help identify flawed defences contributing to these events, such as:

- Worker behaviours;
- Organizational processes;
- Values;
- Job site conditions; and
- Organizational weaknesses.

This also ensures lessons learned are shared in a timely manner in order to prevent recurrence.

The overall effectiveness of the Human Performance Program is measured through the Event Free Day Reset (EFDR) target. For the reporting period, OPG's performance on nuclear waste management was better than the target for the majority of years.



Graph 1: Event Free Day Reset Target vs. Actual Event Free Day Results

Procedure Use and Adherence

Staff is expected to follow procedures as written; requiring employees to stop and consult their supervisor where procedures cannot be followed as written.

Procedure use and adherence is further reinforced through the following activities:

- Observation and coaching by managers in the field;
- Training activities – error free lab workshops and the *Leadership Academy*;
- Pre and post-job briefing process; and
- Staff communication meetings.

Observation and Coaching

Manager coaching in the field reinforces expectations of procedure use and adherence through observation during pre-job briefings and 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. Gaps to excellence are documented for the development of targeted improvements.

Training

Operations and support staff are trained and qualified under OPGN's 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, identifying 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.

In an effort to improve safety and reduce errors in OPG's Nuclear Waste Management Facilities, three new programs were introduced and delivered to all staff. The first was a course on Safety Culture that focused on creating an awareness of the attitudes and beliefs of workers regarding safety in the workplace and how every member should make a conscious decision to work safely each day. The second Human Performance Program delivered to staff introduced the Event Free Tools for workers to use, including an opportunity to practice with the tools during the training session. The third was an annual workshop in nuclear safety with a focus on Institute of Nuclear Power Operators Significant Operating Experience Report (SOER) 10-2, *Engaged Thinking Organisations*. In this workshop, relevant internal and external case studies were reviewed for learnings that apply to waste operations.

Pre-Job Briefing

The pre 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 interactions.

Gap Analysis of Human Performance Standards

In order to identify the gaps relating to the implementation of N-PROG-AS-0002, *Human Performance,* owners within the organization are required to perform self-assessments with respect to associated standards, procedures, instructions or focus areas. These findings are used to close any identified gaps.

3.2.3 Future Improvements

The 2014 Site Integrated Human Performance Strategic Plan has three focus areas with initiatives to identify the gaps between present practice and OPGN governance. The three focus areas are:

1) Improving individual risk based perception/decision making;

2) Supervisory effectiveness improvements; and

3) Fostering a work environment that embraces all the Traits of a Healthy Nuclear Safety Culture.

These focus areas and initiatives will improve DNWM's capability to manage defenses, with an emphasis on the staff and processes to strive for safe and reliable event-free operations. They will also allow the OPG Nuclear Waste Management Facilities to constantly seek to improve organizational effectiveness through the use of best practices, enhanced behaviours and learning.

3.3 Operating Performance

3.3.1 Used Fuel Processing and Storage Facilities

3.3.1(a) Objectives

In order to ensure adequate wet fuel bay space for operation of the nuclear facilities, the used fuel portions at OPG's Nuclear Waste Management Facilities safely and reliably load, transfer, process, and store DSCs from the DNGS, PNGS, and BNGS until a long-term management facility becomes available.

OPG's waste management facilities are operated safely to protect the public, the workers and the environment, and will continue to operate safely under each operating licence issued by the CNSC.

3.3.1(b) Results

In this reporting period, the safety performance of the three OPG used fuel processing and storage facilities has been excellent while meeting all production targets. This included overcoming the technical challenges of weld wire quality and DSC base flange laminations. Used fuel also met the commitment to demonstrate reverse loading of a DSC.

DSC Transportation

Empty DSCs, and those loaded with used fuel, are transported on OPG site property roads between the DNGS, PNGS, BNGS and the corresponding waste management facilities. Since the inception of the three OPG waste management facilities, there have been over 2,000 on-site transfers of loaded DSCs without incident.

DSC Reverse Loading

OPG has demonstrated that they can perform all of the required DSC reverse loading steps to safely return fuel to a wet fuel bay 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 spent fuel from a DSC was performed where a partially loaded DSC was submerged in the wet fuel bay and one of the spent 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 transportation of

the DSC which are routine operations performed regularly at PWMF, DWMF and WWMF.

DSC Weld Wire Operational Impact

In 2013, 63 DSCs had issues with the quality of the completed welds. These were discovered by our post welding testing using Phased Array Ultrasonic Testing (PAUT). The root cause was discovered to be a change in the quality of coating used by the weld wire manufacturer on the weld wire. The specifications of 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.

All 62 DSC that demonstrated porosity in the welds in PAUT were identified for repair. By the end of the reporting period, all but 4 had been repaired, processed and placed in storage. The remaining 4 DSCs will be completed in 2015.

DSC Base Flange Laminations

OPG first identified a used fuel DSC base flange apparent lamination issue in 2010. The laminations were initially attributed to original manufacturing defects, and OPG implemented repairs for the affected DSCs. However, during subsequent investigations the base material was analyzed, and it was found that the PAUT results had been overly conservative in identifying the material as having laminations to the degree originally indicated. An additional, more precise, PAUT procedure has been developed for use should apparent laminations be identified in the base flange during future inspections of the closure weld. Actions taken by OPG to address this issue were found to be acceptable by CNSC staff.

Production History

The production history of the DWMF, PWMF, and the UFDS area at WWMF during the current review period is summarized in Table 2.

Table 2: DSCs Loaded at DWMF, PWMF, and WWMF

Year	Number of DSCs Loaded Per Year		
	DWMF	PWMF	WWMF
2010	42	20	98
2011	44	35	120
2012	60	50	130
2013	60	51	130
2014	60	51	110

Note: Data is from January 2010, to December 2014.

3.3.1(c) Future Improvements

Going forward, the annual rates of DSCs being placed into storage at the facilities are expected to be:

- DWMF: approximately 60 DSCs per year;
- PWMF: approximately 50 DSCs per year; and
- WWMF: approximately 130 DSCs per year.

At all three facilities, the following future improvements are planned:

- Facility configuration is being reviewed and improved to increase equipment reliability and ensure employee safety; and
- A new generation DSC Transporter vehicle (the Gen IV) has been designed. The new Transporter was tested in 2013, and following modifications and completion of a second vehicle, will be put in service in 2015.

A work management processes effectiveness initiative is in progress, to ensure a high availability target for equipment required for facility operations.

DWMF

Construction of one additional DSC Storage Building is in progress, and is expected to be completed in 2015. The DWMF will provide storage capacity for up to 1000 DSCs (with 384,000 bundles) when both DSC Storage Buildings are in operation. In addition, DNGS retubing waste generated from refurbishment will be stored in an above-ground storage Retube Waste Storage Building (RWSB) at DWMF.

PWMF

Studies are currently ongoing to optimize facility configuration of storage buildings to accommodate the storage of all the used fuel from the wet fuel bays until the end of life of PNGS.

In the interim, OPG plans to submit a licence amendment later in 2015 to construct a new Processing Building, and construction approval for DSC Storage Building #4 to store 648 DSCs on the PWMF Phase II site. The new Processing Building will replace the existing processing facility, and will have an increased nominal production capacity of 100 loaded DSCs annually, starting in 2018.

WWMF

Facility improvements have been made at the WWMF during this review period, to support the upgraded processing and storage rate of approximately 130 DSCs per year. At the UFDS area at WWMF, the conceptual layout for future amenities is being

developed to address current gaps with respect to the provision of additional services such as maintenance shops, offices, and showers.

3.3.1.1 Retube Component Storage Area at the PWMF

3.3.1.1 (a) Objectives

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

3.3.1.1 (b) Results

During this reporting period, radionuclide inventories inside the DSMs have been steadily decreasing due to radioactive decay. Operational activities at the RCS area have been limited to periodic inspection, monitoring, maintenance, and refurbishment of the DSMs and the RCS area since 1993.

Thirty-six DSMs are located in the RCS area; two of these are empty, and used for DSM aging management and monitoring purposes. Results of this program are discussed in Section 3.6. The remaining 34 DSMs contain irradiated reactor components for interim storage.

3.3.1.1 (c) Future Improvements

The current plan is to monitor recent improvements to the RCS area, with the goal of maintaining DSM integrity. Radiological monitoring and access control to the area remains in effect.

3.3.2 Low and Intermediate-Level Waste Processing and Storage Facilities

3.3.2(a) Objectives

The Western L&ILW storage facility supports the continued operation of PNGS, DNGS, and BNGS by providing processing and storage facilities for the L&ILW, in accordance with established acceptance criteria. The Western L&ILW facility maintains storage space to safely track, process, and store station radioactive waste.

3.3.2(b) Results

Table 3 shows the approximate total volume of L&ILW received each year, the net stored volume, and stored activity at the Western L&ILW storage facility since 2010.

Table 3: Low and Intermediate-Level Radioactive Waste Received and Stored at WWMF

Year	Waste Processed m^3/yr		Waste Stored m^3/yr	Stored Activity TBq/yr
	Incinerated	Compacted		
2010	1,332	527	1,999	38
2011	1,437	1,727	3,719	157
2012	530	963	2,639	39
2013	600	657	2,455	99
2014	397	950	2,402	65

Note: Data is from January 2010 to December 2014.

The following results were achieved over the period from 2010 to 2014:

- LLSBs 12, 13 and 14 were constructed and placed in service;
- 54 new IC18's were constructed and placed in service;
- The roof was replaced on LLSBs 1, 2, 3, 4 and 5;
- Improvement of plant configuration management through implementation of electronic flowsheets that are used to establish safe work areas for maintenance personnel thereby improving employee safety;
- Planned incinerator outages were completed in accordance with an outage improvement strategy;
- The 600 V switchgear was replaced in the Waste Volume Reduction Building (WVRB) addressing aging management concerns with the original building electrical equipment;
- Lighting upgrades were completed throughout the WVRB and yard areas; and
- Fire Hazard Assessments were completed for all L&ILW facilities and recommendations implemented, or planned for execution.

Incinerator Performance

Throughout the reporting period, the incinerator met all emissions requirements including successful completion of stack testing as required by the Ministry of Environment and Climate Change (MOECC) Environment Compliance Approval (ECA). The incinerator continued to perform very well in the environmental area, well below limits set for parameters such as dioxins/furans, metals and particulate.

Non-routine Facility Operations

With respect to non-routine facility operations there were two events, in 2013 and 2014, involving overheating of an air duct that is designed to provide combustion air to the incinerator's primary chamber for waste incineration. In response to these events, all incineration of solid waste has been stopped until the system is modified to prevent the potential for recurrence. Additional details are provided in Sub-section 3.10.2.

3.3.2(c) Future Improvements

Future improvements at L&ILW Processing and Storage facilities are summarized below with respect to planned projects; operational initiatives; and facility structures and storage containers.

Projects

Projects planned for the next five years which will increase waste storage capacity could include the following. These are being assessed with respect to need given future waste volume assumptions:

- Construction and operation of up to 54 additional in-ground storage containers, each having a capacity of 18 m^3, similar to the existing in-ground storage containers at the facility; and

- Construction and operation of up to three additional low-level waste storage buildings, each having a capacity of approximately 7,050 m^3, similar to the existing LLSBs at the facility.

Operating Initiatives

Operating initiatives planned for the next five years to sustain and improve on the current operating processes include the following:

- Reduction in maintenance backlogs, to ensure a high availability for equipment required to process L&ILW; and

- Execution of incinerator and auxiliary system modifications to return solid waste to the incinerator feed, and improve facility performance and reliability.

Improving Structures and Storage Containers

Initiatives aimed at improving structures and storage containers in the next five years include the following:

- Re-packaging of L&ILW containers from the trenches. This re-packaging is based on the results of on-going aging management investigations to verify the material conditions of waste containers. This is to ensure that the waste containers can be easily and safely handled in the future;

- Upgrading of the fire detector systems in the LLSBs by installing more reliable linear heat detector systems; and,

- Continued sorting and segregating of stored wastes in LLSBs to identify opportunities for further processing and volume reduction.

3.4 Safety Analysis

3.4.1 Objectives

Safety analysis and assessment of a structure, system, component or facility is carried out to determine the impact on workers and/or the public. Safety assessments are presented in each Nuclear Waste Management Facility *Safety Report*, which also provides an overview of the facility design and operations. The facility Safety Report demonstrates that the facility can be constructed, operated or continue to be operated, without undue risk to the health and safety of the workers, the public, and the environment.

OPG's Safety Report update process encompasses the systematic identification of safety issues, their prioritization, their resolution, and the physical updates of the safety report.

3.4.2 Results

The DWMF, PWMF, and WWMF Safety Reports address the health and safety of workers and the public, and the protection of the environment.

<u>DWMF Safety Report</u>

The DWMF Safety Report contains information on the facility, and the DWMF Safety Report Annex contains information on the proposed Retube Waste Storage Building. The Safety Report and the Annex demonstrate that dose rates and emissions from the DWMF under normal and postulated accident conditions are within allowable limits, and pose a negligible risk for the public, the workers, and the environment. The current update of the DWMF Safety Report, and the DWMF Safety Report Annex were both accepted by CNSC staff in March 2013.

<u>PWMF Safety Report</u>

The PWMF Safety Report contains information on the UFDS facility and RCS area. The Safety Report demonstrates that dose rates and emissions from the PWMF under normal and postulated accident conditions are within allowable limits, and pose a negligible risk for the public, the workers, and the environment. The current update of OPG's PWMF Safety Report was accepted by CNSC in August 2014.

WWMF Safety Report

The WWMF Safety Report contains information on UFDS facility and L&ILW storage area. The Safety Report demonstrates that dose rates and emissions from the WWMF under normal and postulated accident conditions are within allowable limits, and pose a negligible risk for the public, the workers, and the environment. The current update of the WWMF Safety Report was accepted by the CNSC in April 2013.

3.4.3 Future Improvements

Safety Reports are reviewed every five years for clarity of the content and updated as required to reflect changes in operational experience and information supporting the assumptions made in the assessments. The work planning for Safety Reports updates is prepared approximately two years in advance.

Self assessments are performed after every Safety Report update to identify issues and continually improve the update process. A roll-out of the changes to the Safety Reports is conducted for the waste facility staff and engineering support personnel.

A periodic due diligence review is performed of revised Safety Reports to confirm no instances of non-compliance in the OPG procedures and operational practices, to identify any potential required changes. Potential changes are documented for inclusion in the next update cycle of the Safety Reports

3.5 Physical Design

3.5.1 Objectives

All new designs or design changes are prepared and executed in accordance with the OPGN *Conduct of Engineering Program* document, N-PROG-MP-0007 and the *Engineering Change Control* (ECC) program document, N-PROG-MP-0001. This governance has been written to ensure the ECC process complies with the CAN/CSA N286 series of standards, *Quality Assurance for Nuclear Power Plants*, and regulatory requirements in accordance with OPG's Nuclear Waste Management Facilities' licences.

The OPGN *Conduct of Engineering Program* and its associated procedures ensure that all design changes are controlled such that facility configuration is maintained in accordance with the design and licensing basis.

3.5.2 Results

During this reporting period, OPG's Nuclear Waste Management Facilities transitioned to the OPGN *Pressure Boundary Program* document, N-PROG-MP-0004, effective December 31, 2012. This change was made to comply with amendments to OPG's Nuclear Waste Management Facilities' licences and to align with a proven program for simplification and consistency across the fleet. These amendments required OPG's Nuclear Waste Management Facilities to implement a pressure boundary program

compliant with *General Requirements for Pressure-Retaining Systems and Components in CANDU Nuclear Power Plants,* CSA standard N285.0*.*

To facilitate this transition, OPG's Nuclear Waste Management Facilities also adopted applicable elements of the OPGN *Conduct of Engineering Program* and associated governance, as the OPGN *Pressure Boundary Program* interfaces significantly with the OPGN *Conduct of Engineering Program*. OPG's Nuclear Waste Management Facilities fully adopted the applicable elements of the OPGN *Conduct of Engineering Program* effective December 31, 2012.

Previous Nuclear Waste Management Facilities' initiatives addressing design status and quality, such as the *Beyond Code Requirements* document and the *Design Status Assessment* report, have been replaced with equivalent OPGN fleet-wide metrics and initiatives. The results and operating experience are discussed with OPGN design peers to promote organizational learning and continuous improvement.

Engineering support staff has also incorporated fleet-wide design quality initiatives, such as *Design Review Boards* and the use of *Design Verification Checklists*, again promoting organizational learning and continuous improvement. Self-assessments are conducted annually to evaluate compliance with *Conduct of Engineering* governance and *Pressure Boundary* governance, identify areas for improvement, and to put in place actions to improve procedures and engineering practice. These are ongoing practices to identify and address issues which result in actions for improvement.

The SCR system is used to identify problem areas and to implement the required corrective actions to improve governance, engineering and operational activities. The SCR database is an integral input to the aforementioned design status and quality metrics and initiatives.

Physical design is continually improving based on operating experience. For example, there were five reportable events with a basis in physical design over the reporting period. Three of the events were identified by OPG staff demonstrating a questioning attitude.

- In June 2012, staff identified that wooden framing surrounding the WVRF incinerator stack did not meet the minimum clearance requirements per the applicable National Fire Protection Association (NFPA) 82 standard. A modification to replace the wood with a non-combustible material was completed in the third quarter of 2013.

- In June 2012, staff identified that fire alarms in certain locations of the WVRF did not meet audibility requirements per the applicable *National Building Code of Canada*. A modification to install appropriate audible and visual alarms that comply with code was completed in the fourth quarter of 2013.

- In July 2013 and February 2014, there were events involving overheating of an air duct that is designed to provide combustion air to the incinerator's primary

chamber for waste incineration at WWMF, as mentioned in section 3.3.2. The design of the incinerator allowed waste residue to drip down from the primary chamber into the underfire air duct during incineration, leading to elevated temperatures in the duct. Installation of modifications is planned for the third quarter 2015. More detail on these events is provided in section 3.10.2.

- In November 2014, staff identified that a relief valve on the CO_2 fire suppression system for Low Level Storage Buildings 11-14 was not sized in accordance with ASME B31.1 code requirements. A modification to install a properly sized relief valve in the system is scheduled for installation in the second quarter 2015.

In all cases, the conditions resulted from the original design of the system or structure. The conditions were identified by OPG staff using a questioning attitude and looking critically at the field situation. As a result, modifications have been, or are in the process of being, implemented to resolve the legacy physical design of the system or structure.

3.5.3 Future Improvements

OPG's Nuclear Waste Management Facilities will continue to participate in OPGN fleet-wide quality improvement initiatives. Lessons learned within the organization and from the broader design engineering organization will be continuously applied to all design activities.

Continued participation in recently initiated *Design Workshops* is planned. In these workshops design engineers from specific engineering disciplines, representing design departments across the fleet, meet to network and share operating experience. The workshops are intended to leverage expertise and resources from across all of OPG, which includes the Nuclear and Hydroelectric/Thermal assets.

3.6 Fitness for Service

3.6.1 Objectives

The objective of OPG's aging management program for Nuclear Waste Management Facilities is to ensure the availability of required safety functions throughout the service life of the facility, considering changes that occur with time and use. This requires addressing both physical aging of Structures, Systems and Components (SSCs) that may result in degradation of their performance characteristics, and obsolescence of SSCs, i.e. their becoming out of date in comparison with current knowledge, standards and regulations, and technology.

Effective aging management is in practice accomplished by coordinating existing programs, including maintenance, in-service inspection and surveillance, as well as operations, and operating experience.

Effective aging management throughout the service life of a SSC requires the use of a systematic approach to managing aging that provides a framework for coordinating all

programs and activities relating to the understanding, control, monitoring and mitigating aging effects of the SSC.

3.6.2 Results

Aging Management

Aging management plans have been developed for the critical safety credited SSCs for the transportation of radioactive material, storage of intermediate and low-level waste, and the storage of dry used fuel.

Procedures exist for all major maintenance activities, and contain adequate information or direction for the maintainer to understand and perform the work effectively. The preparation, control, and revision of maintenance procedures takes into account human performance considerations, the assurance of technical accuracy, critical task analysis, and classification according to complexity.

Preventative maintenance is based on vendor recommendations, reliability analysis, operating experience, cost benefit analysis, service condition, and expected radiation fields. Qualified parts are procured as required to adequately support the preventative maintenance program. A system exists to track and schedule all planned maintenance activities.

Maintenance to correct component malfunctions is reviewed and evaluated to determine the cause of malfunctions, and whether other components of the same type can be expected to perform their function reliably. Corrective measures are planned prior to replacement, repair or modification of common components in equipment and systems that have performed unsatisfactorily.

System Health Reports are completed twice per year in accordance with OPG procedure, N-PROC-MA-0024, *System Performance Monitoring*. These System Health Reports summarize the status of key parameters, and assess the overall condition of the systems, based on input from system performance monitoring. Detailed action plans are created to drive system improvements such as major component replacements and preventive maintenance plans. Monitoring and trending of aging effects is included in this aspect of the program. System Health Reports also provide inputs into the business planning cycle, to ensure long-term facility reliability.

Critical parts reviews are also conducted on critical systems. The components in the system are assessed against established criteria and a criticality rating is assigned. Mitigating actions are then developed and documented for those components that are assessed as critical. The mitigating actions may include, but are not limited to, assurance of adequate inventory in stock, procurement of critical spare parts, and identification of alternate strategies such as increased maintenance or inspection.

Critical equipment failure reviews are assessed on a routine basis to determine failure mechanisms and effective means to prevent failure recurrence. Evaluations with structured corrective actions are completed when a component fails unexpectedly.

Detailed inspections on critical components are completed periodically on components (e.g. spray cooler, incinerator exhaust stack) depending on service conditions, expected degradation zones, and aging mechanisms.

Used Fuel Dry Storage Containers

During this reporting period, DSC aging management activities focused on the condition of the weld coating, base plate inspections and investigating for internal corrosion.

The condition of the protective coating on the DSC containment welds (i.e. the Lid-to-Base structural or seal weld, the vent seal weld, and the drain seal weld), and the DSCs themselves, remain in good to excellent condition. To date, very few areas on the containment welds (<1% frequency) have required re-coating.

Periodic re-inspection of a baseline population of DSC base plates was conducted by lifting them off the ground approximately six inches and examining the base plate with a high resolution digital camera. The DSC base is inspected using a defined path for the camera to travel to confirm accurate re-inspections of the base plates. Overall the results of these re-inspected DSC base plates indicate that the DSCs remain in good condition.

A Corrosion Monitoring System was established in July 2012 at the DWMF to investigate the behavior of the internal metallic components of a DSC in a concrete environment. The critical metallic components include the carbon steel inner liner, reinforcing steel, and the stainless steel drain assembly. The DSC is loaded with used fuel and 12 corrosion sensing probes (four in the Lid and eight in the Base) have been strategically located and embedded in the high density concrete. The key measurements are potential, corrosion rate, electrical resistance of the concrete, and temperature. These quantities will help determine the rate and type of corrosion in the DSC concrete. Preliminary analyses of the results indicate acceptably low corrosion rates. The potentials recorded on austenitic stainless steel to date indicate absence of oxygen in the concrete environment, and thus immunity to localized corrosion and stress corrosion cracking.

DWMF Weld Bay Walls

The DWMF has developed a weld bay wall inspection program to confirm the structural integrity of the weld bay walls. The inspection program has been submitted to and accepted by the CNSC. Weld bay wall inspections were performed in 2014 in accordance with the plan and has confirmed that the condition of the weld bay walls is in good condition.

PWMF Floor Slabs

The PWMF underwent an assessment to determine the structural condition of the Stage 1 and Stage 2 floor slabs. The conclusion of the report indicated that the floor condition was acceptable for continued operation, however recommendations are

being implemented to ensure the slabs are available for continued operations for the projected end of facility service.

Dry Storage Modules in the RCS

Annual visual inspections of the DSMs were performed in 2010-2014, and recommendations were identified for future improvements.

Twice annually, dose rates at the DSMs are recorded, and surfaces checked for contamination, to confirm DSM integrity. No loose contamination has been recorded from 2010-2014. Dose rate measurements taken at the east and south fences of the RCS area between 2010 to present show no significant change.

As part of the on-going aging management plan, individual DSMs with known elevated contact dose rates are monitored to confirm DSM integrity has not changed and contents remain in design configuration.

Low and Intermediate Level Waste

A detailed Continued Operations Improvement Plan has been prepared for the Incinerator and Auxiliary Systems. Major component replacements have been identified and are being executed prior to failure or obsolescence (e.g. Switchgear, Motor Control Centers, Air Compressor, and Control System).

For low-level waste storage, there is an on-going effort to over-pack deteriorated containers on an as-required basis. In 2013, a monitoring program was set up for low-level waste containers which were identified as having a higher possibility of failure through corrosion. Container wall thickness was measured and a small section of the container wall cut-out underwent metallographic analysis. Results were analyzed and no issues were identified.

Monitoring of the intermediate-level waste storage structures' integrity continued as part of the ongoing L&ILW storage structures' aging management plan. The integrity of these storage structures was assured by a program of preventive maintenance tasks and operator rounds. These included routine structure water checks, pressure tests, drainage water monitoring, surface-level radiation monitoring and visual inspections. During this reporting period the monitoring program confirmed the integrity of the structures. The condition of the sample caps and the paving around some of the IC-18s needs improvement, which is to be addressed.

3.6.3 Future Improvements

There are a number of future improvements to be undertaken by DNWM with respect to aging management at the facilities and radioactive materials transportation. Some examples follow.

- In an effort to improve the fire detection system reliability, the LLSBs at the WWMF will undergo beam detector replacements with linear heat detection to improve the overall fire protection system reliability.

- Implementation of PWMF Stage 1 and Stage 2 floor slab recommendations to ensure the slabs are available for 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.

- Trench remediation and inspection at WWMF is scheduled for 2016.

3.7 Radiation Protection

3.7.1 Objectives

The Radiation Protection Program is based on the *OPG Nuclear Radiation Protection Policies and Principles* and the *Radiation Protection Requirements* and is documented in N-PROG-RA-0013, *Radiation Protection*. All personnel including contractors and visitors whose work at these facilities involves the potential for exposure to ionizing radiation are required to comply with OPG's Radiation Protection Program.

3.7.2 Results

During the current reporting period, there were no recordable doses at any Nuclear Waste Management Facility that exceeded legal limits or that were in excess of OPG administrative limits.

Improvements in the way ALARA targets are generated and reported have been implemented. Proposed ALARA targets involve line management input and acceptance by the Directors of Used Fuel Operations, and Low and Intermediate Level Waste. Performance metrics are documented and provided to the Senior Vice President, DNWM and discussed through the Joint Committee on Radiation Protection (JCRP) which involves OPG management and worker representation (Power Workers Union and Society of Energy Professionals).

Key indicators used to measure the effectiveness of the radiation protection program at OPG's Nuclear Waste Facilities include:

- Collective dose and maximum individual dose per year;

- Contamination control; and

- Use of Fleet Wide Report Card.

Collective Dose and Maximum Individual Dose per Year

OPG Nuclear Waste Management Facilities' exposure control program continues to be in full compliance with regulatory requirements. 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) per year, and the five-year regulatory limit of 100 mSv (10 rem) averaged over five years. ALARA targets are generated on a yearly basis and are based on outages, normal operations, and waste to be received on a volume basis along with special projects (such as movement of waste to accommodate fire detection upgrades).

The table below outlines key dose statistics for OPG's Nuclear Waste Management Facilities.

Table 4: Key Dose Statistics for OPG's Nuclear Waste Management Facilities

Facility	Calendar 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
	Unit:	#	#	Person-mSv	mSv	mSv	mSv
DWMF	2010	48	45	4.2	0.1	0.2	0.6
	2011	38	37	4.0	0.1	0.2	0.5
	2012	42	41	8.5	0.2	0.4	0.9
	2013	47	44	12.9	0.3	0.5	1.6
	2014	45	44	14.9	0.3	0.5	1.7
PWMF	2010	47	45	7.3	0.1	0.4	0.9
	2011	51	49	6.0	0.1	0.3	0.9
	2012	45	42	10.6	0.2	0.5	1.3
	2013	38	37	9.4	0.2	0.4	1.3
	2014	40	38	8.8	0.2	0.4	1.2
WWMF	2010	246	227	33.8	0.1	0.7	1.7
	2011	241	225	15.6	0.1	0.3	0.9
	2012	242	229	17.7	0.1	0.3	1.8
	2013	207	197	18.8	0.1	0.4	1.2
	2014	220	205	13.5	0.1	0.2	1.7

There have been slight increases in both Collective Dose and Maximum Individual Effective Dose in subsequent years at each of OPG's PWMF and DWMF over the reporting period. This is largely attributable to increase in weld repairs for used fuel dry storage processing activities, resulting from the operational issues previously discussed.

Contamination Control

During the reporting period, no contamination events in excess of regulatory limits have occurred. Radioactive contamination controls are in place to reduce occupational and public exposure, and to ameliorate 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.

3.7.3 Future Improvements

Enhanced radiological contamination monitoring equipment has been procured at OPG's Nuclear Waste Management Facilities to increase OPG's capability and reliability to detect low levels of radioactive contamination and is being phased into operations. This consists of personal whole body contamination monitors and gamma sensitive portal monitors, as well as, large object monitors to detect extremely low levels of radioactivity. Similarly, based on industry best practices, OPG's Nuclear Waste Management Facilities will also be evaluating revised alarm set-points and Radon rejection software to reduce spurious alarms.

3.8 Conventional Health and Safety

3.8.1 Objectives

The goal of OPGN's Conventional Safety Program is to ensure that safety is the number one priority by managing conventional risks in the workplace associated with OPG's Nuclear Waste Facilities' operations. The Conventional Safety Program is designed to be an integrated system with OPGN business managed processes, where appropriate, and considers the current organizational structure.

The *OPG Health and Safety Policy,* OPG-POL-0001 commits:

- 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.
- 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 *OPG 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.

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

- All Injury Rate (AIR);
- Accident Severity Rate (ASR); and
- High Maximum Reasonable Potential for Harm (MRPH) Events.

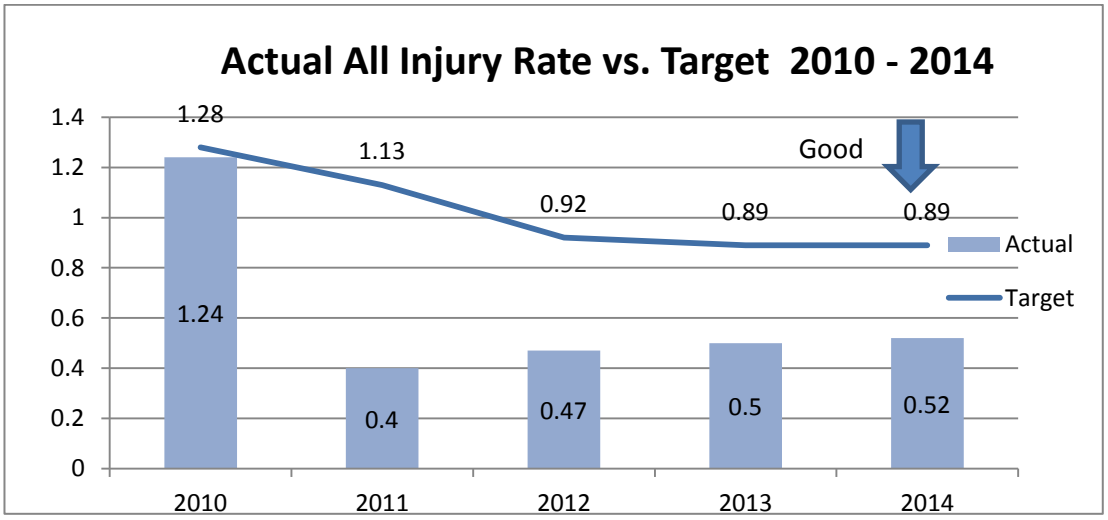
3.8.2 Results

The following section provides the results on All Injury Rate (AIR), Accident Severity Rate (ASR), and high Maximum Reasonable Potential for Harm (MRPH) events for the reporting period.

All Injury Rate (AIR)

The AIR is the number of incidents, including fatality, lost time injuries and, medical attention injuries per 200,000 hours worked, divided by the total exposure hours worked.

OPG's Nuclear Waste Management Facilities AIR performance was better than target from 2010 through 2014 as shown in Graph 2. There were three medically treated injuries in 2010 (rolled ankle, back strain, and back pain); one lost time accident in 2011 due to arc flash; and one medically treated injury in each of 2012 (arc flash), 2013 (slip in a parking lot) and 2014 (elbow pain while working at computer workstation).

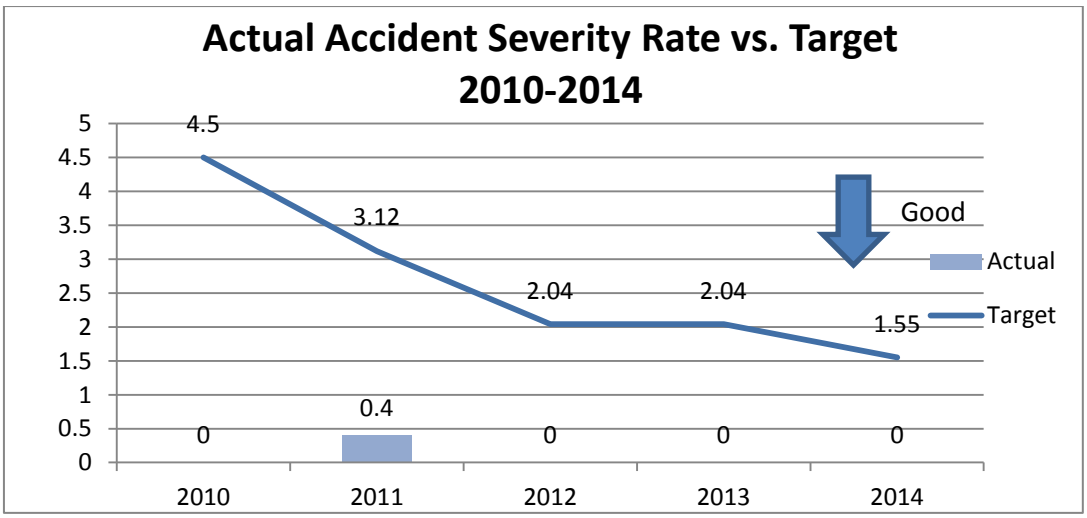


Graph 2: DNWM All Injury Rate vs. Target

Accident Severity Rate (ASR)

The ASR is the number of calendar days lost due to injury per 200,000 hours worked, divided by total facility hours worked.

The ASR was better than target from 2010 through 2014. There was one Lost Time Injury in 2011, where a worker was exposed to a weld arc flash which resulted in one missed day of work. A root-cause investigation was conducted and corrective actions were implemented including training and procedural requirements for welding of DCSs.



Graph 3: DNWM Accident Severity Rate vs. Target

High "Maximum Reasonable Potential for Harm" Events (MRPH)

The MRPH is a 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 MRPH incident investigations offer learning opportunities for continued improvement in safety performance.

During this reporting period there were four high MRPH events that occurred at OPG's Nuclear Waste Management Facilities.

Material Handling

In June 2011 an employee attempted to assist a fork lift operator with a stuck oil pallet when a steel frame suddenly moved and made contact with the individual's shoulder. Operating Experience (OPEX) of this event was communicated to staff to ensure alignment with management expectations with regard to safe production at all time. A procedure was developed for the task being performed, and a roll out of the Internal Responsibility System was completed to L&ILW staff in November 2012.

Mobile Crane

In October 2013 a mobile crane contacted live overhead power lines while an employee was driving the mobile crane from a lay down area to the L&ILW Facility. While exiting the lay down area, the boom of the mobile crane came in contact with live overhead power lines (4.16kV). The event was reviewed with staff and a copy of the Ministry of Labour (MOL) Order was posted on the approved Occupational Health and Safety Notice Boards on site. The overhead power lines were replaced/repaired and power was restored by Hydro One. Warning flags were applied to the over head power lines by Hydro One.

Falling Object

In January 2014 two employees were moving a single person Genie lift from the Bruce Power Central Maintenance Facility garage to the OPG Transportation Package Maintenance Building (TPMB) using a pick-up truck fitted with a power tailgate. During the move the swivel casters caught against an uneven surface, and the lift inadvertently came into contact with the TPMB garage door and landed on the ground. Lessons learned from this event were communicated to Low & Intermediate Level Waste staff, a safe work plan was developed for moving single person Genie lifts, and Supervisors conducted Observations and Coaching activities focused on Pre-Job Briefs.

Working at Heights

In November 2014 a recycling truck operator working for an external company was at the WWMF site to pick up recycling material. An OPG employee observed the recycling truck operator climb to the top of the truck and into the back of the truck exposing the operator to a potential fall from height. The contractor confirmed the company has a policy on workers accessing the top of the vehicle. The contractor also confirmed they have discussed the incident with the worker, outlined their expectations, and changed their policy for work at the Bruce/Western site no longer allowing their workers to access the top of the vehicle while on site.

3.8.3 Future Improvements

A number of health and safety improvement initiatives have been identified for the Nuclear Waste Management Facilities as part of the continuous improvement cycle of the health and safety management system. These include further implementation of the OPGN *Human Performance* program tools and processes and an increased focus on Situational Awareness as well as continued focus on improvements to the Internal Responsibility System (IRS).

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.

Internal Responsibility System (IRS)

The IRS is a system within an organization, 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 (H&S) issues, work to solve problems, and make improvements on an on-going basis. The IRS is based on the principle that employees themselves are in the best position to identify H&S problems and identify solutions. The IRS outlines the appropriate resolution level for timely corrections.

In addition, to reflect DWMF's commitment to continuously improving and challenging performance, targets of AIR and ASR have been decreasing, as shown in Table 5.

Table 5: Target for All Injury Rate (AIR) and Accident Severity Rate (ASR)

Years	AIR Target	ASR Target
2010	1.28	4.5
2011	1.13	3.12
2012	0.92	2.04
2013	0.89	2.04
2014	0.89	1.55

3.9 Environmental Protection

3.9.1 Objectives

The corporate-wide OPG-PROG-0005 *Environmental Management System* has been implemented at the DWMF, PWMF and WWMF sites. This is further defined through the framework specified in N-PROG-OP-0006, Environmental Management.

OPG's Environment Policy states that "OPG shall meet all legal requirements and any environmental commitments that it makes, with the objective of exceeding these legal requirements where it makes business sense."

Specifically OPG will establish an environmental management system and maintain registration for this system to the International Standards Organization (ISO) 14001 *Environmental Management System* standard.

3.9.2 Results

ISO 14001: 2004

The corporate-wide *Environmental Management System* is based on the ISO 14001:2004 *Environmental Management System – Requirements with Guidance for Use*. The CNSC Regulatory Document REGDOC-2.9.1, *Environmental Protection: Policies, Programs and Procedures,* dated September 2013 are fully incorporated into the nuclear line of business within OPG's *Environmental Management System*.

As part of OPG's Environmental Management System, environmental performance targets are reviewed annually to ensure that opportunities for continuous improvement are identified and implemented. Spill management programming is in place to ensure that facility spill risks are identified/reviewed, and that appropriate controls are in place to prevent spills from occurring or mitigate the severity of a potential spill through appropriate spill controls and response procedures.

Over the past 10 years the PWMF, DWMF and WWMF have consistently achieved or surpassed internal environmental and spill performance targets.

Derived Release Limits

OPG's Nuclear Waste Facilities are 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 (ALARA). *Derived Release Limits* (DRLs), as approved by the CNSC, are used to establish controls on the releases of radioactive materials. DRLs are calculated for radionuclides of potential dose significance in effluent streams, to facilitate the control, reporting, and regulation of radionuclide emissions. The emissions from OPG's Nuclear Waste Management Facilities have been consistently less than 1% of the DRLs.

Radiological Monitoring

The radiological monitoring program is designed to monitor any release of radionuclides by:

- Sampling and analyzing the liquid effluent discharged from the waste facilities;
- Monitoring the airborne emissions;
- Measuring the average ambient radiation dose rates at the perimeter of the facilities; and

- Sampling and analyzing the groundwater at the WWMF.

Radiological Waterborne Emissions

Waterborne radioactivity is monitored via the storm water runoff at PWMF, DWMF and WWMF and via the sub-surface drainage systems at the PWMF and WWMF.

During the reporting period waterborne emissions were below Action Levels, with the exception of six reported exceedances of the Action Level for gross beta waterborne emissions at the WWMF between the third quarter of 2010 and fourth quarter of 2012. As a result of the exceedances, an investigation was performed, which identified the need to revise the Action Levels to be more representative of loss of integrity events. In 2013, the DRLs and Action Levels were updated to better reflect site boundaries and conditions in accordance with the CSA standard. Since updating the Action Levels, there have been no exceedances.

The results of the radiological waterborne emission monitoring programs are reported in the Waste Management Facilities' quarterly operations reports submitted to the CNSC. A summary of WWMF's annual radiological waterborne emissions is provided in Table 6 which shows the radiological waterborne emissions were consistently less than 1% of the DRL.

Table 6: Waterborne Radiological Emissions Released Annually from the WWMF, 2010-2014

Parameter	Units	2010	2011	2012	2013	2014	Derived Release Limits	
							2010 - 2012	2012 - 2014
Tritium	Bq/yr	1.60E+11	1.54E+11	1.00E+11	1.42E+11	2.50E+11	2.10E+15	7.70 E+15
Gross Beta	Bq/yr	5.11E+07	9.55E+07	6.79E+07	1.26E+08	1.39E+08	1.16E+11	4.56 E+11

Note: Derived Released Limit has been converted to Bq/yr from Bq/month for comparison purposes.

The waterborne DRLs for the DWMF and the PWMF are encompassed under the waterborne DRLs for DNGS and PNGS respectively. At DWMF and PWMF, the waterborne emissions were consistently below 1% of the DRLs and in most cases below the minimum detectable activity.

Radiological Airborne Emissions

At the WWMF, the WVRB radioactive waste incinerator stack and ventilation exhaust stack are monitored for tritium, particulate and iodine 131 emissions while Carbon 14 emissions are monitored on the incinerator stack only. The TPMB ventilation stack is monitored for tritium and particulate emissions.

PWMF, DWMF and the UFDS facility at WWMF each have a ventilation exhaust stack that is monitored for particulate emissions.

The results of the radiological airborne emission monitoring programs are reported in the Waste Management Facilities' quarterly operations reports which are submitted to the CNSC. A summary of the annual radiological airborne emissions for WWMF is provided in Table 7 which shows the radiological airborne emissions were consistently less than 1% of the DRLs.

Table 7: Airborne Radiological Emissions Released Annually from the WWMF, 2010-2014

Parameter	Units	2010	2011	2012	2013	2014	Derived Release Limit	
							2010 - 2012	2013 - 2014
Tritium	Bq/yr	2.90E+13	1.99E+13	1.04E+13	1.43E+13	7.17E+12	1.39E+17	2.96E+17
Carbon-14	Bq/yr	6.00E+09	3.99E+09	1.88E+09	1.96E+09	1.56E+09	4.64E+15	1.09E+15
Particulate	Bq/yr	5.61E+05	4.36E+05	1.26E+05	3.78E+05	5.12E+04	2.93E+12	2.34E+12
Iodine-131	Bq/yr	9.76E+04	8.86E+04	6.06E+04	6.38E+04	1.22E+05	7.16E+12	1.90E+12

Notes: - Derived Released Limit has been converted to Bq/yr from Bq/week for comparison purposes.
- The increase in 2014 iodine emissions is due to the change from using ½ Minimum Detection Limit (MDL) in calculating emissions to using the MDL value.

The airborne DRLs for the DWMF and the PWMF are encompassed under the airborne DRLs for DNGS and PNGS respectively. The stack sampler particulate results for PWMF and DWMF were consistently orders of magnitude below the DRLs.

Perimeter Dose Monitoring Program

Environmental TLDs mounted on the perimeter fences of PWMF, DWMF and WWMF were changed and analyzed quarterly. Annual performance is reported as the average of all dose rates.

A dose rate of 0.0005 mSv/h for 2000 hours of exposure would result in a dose to the public of 1 mSv, the regulatory limit. The actual perimeter dose rate averages at the three facilities has consistently been less than the 0.0005 mSv/h with an average of approximately 0.00007 mSv/h.

Groundwater Monitoring Programs

The WWMF has an established groundwater monitoring program that has been in place for over two decades. The current groundwater monitoring program consists of 20 groundwater wells (i.e. 19 wells at WWMF, and one well by the Bruce Power Learning Centre for reporting purposes) that sample the middle sand and carbonate bedrock in the vicinity of the WWMF for radiological parameters. The results of the

groundwater monitoring program are included in the quarterly operations reports submitted to the CNSC.

In 2014, twenty-two new additional wells were installed as part of a groundwater study to increase the distribution of the groundwater quality data over a two-year period. The groundwater study will incorporate eight sampling intervals completed quarterly to monitor seasonal variations in groundwater conditions (flow and geochemistry).

Groundwater samples are analysed for various conventional parameters (e.g., metals, inorganics, hydrocarbons, etc.) as well as radiological (tritium, carbon-14, caesium, etc.).

Elevated concentrations of tritium are present onsite in the Middle Sand Aquifer at well WSH231 and immediate area (located directly down gradient of LLSBs 1-10). The source of the elevated tritium is well understood and mitigation measures have been implemented.

The results of the groundwater study to date are generally consistent with previous groundwater distribution of parameters and the overall groundwater flow in the various hydrogeologic units (Middle Sand Aquifer, bedrock aquifer and till). Based on the results of the groundwater study to date and the effluent monitoring program, there is no evidence of adverse offsite impacts to groundwater.

Non-radiological Emissions

OPG's Nuclear Waste Management Facilities have Ministry of Environment and Climate Change conventional environmental compliance approvals (ECAs) for the incinerator and storm water management system.

In the event of a non-compliance with an ECA requirement and/or condition, OPG's Nuclear Waste Management Facilities complete all required notifications and corrective actions to prevent re-occurrence. Waste management facility non-compliance events are reported in the quarterly operations reports that are submitted to the CNSC.

Biodiversity Management

OPG has transitioned to a centre-led Biodiversity Program, which is being implemented in 2015. The major initiatives implemented to date for the WWMF under the Biodiversity Program are as follows:

- A partnership with Laurentian University to study Endangered Species at the Bruce Site;
- Invasive species monitoring and control to maintain and enhance the ecological resilience of wildlife habitat;

- Landfill cap and WWMF Laydown Area Berm naturalization to promote local wildflower and grass biodiversity;
- Completion of a Natural Heritage Study to identify species and features of ecological significance;
- Donations to Conservation, Non Government Organizations and interested parties to support habitat protection and stewardship through the corporate charity program; and
- Employee and Community Education Program to increase Biodiversity awareness.

WWMF also successfully re-certified to the Wildlife Habitat Council's Corporate Wildlife Habitat certification in 2012, which was initially certified in 2007. The Wildlife Habitat Council's *Corporate Wildlife Habitat Certification and International Accreditation Program* recognizes commendable wildlife habitat management and environmental education programs at individual sites. The Wildlife Habitat Council certification adds value to programs by providing third-party credibility and an objective evaluation of projects.

3.9.3 Future Improvements

OPG Nuclear Waste Management Facilities have a program of improvement initiatives aimed at reducing the environmental and radiological risk associated with the handling, processing, and/or storage of used fuel and L&ILW. Initiatives planned to improve environmental impact over the next five years include the following:

- Completion of the WWMF groundwater monitoring program enhancement and well network assessment project;
- Execution of implementation plans for compliance to CSA standards 288.4 *Environmental Monitoring Programs at Class 1 Nuclear Facilities and Uranium Mines and Mills* and N288.5 *Effluent Monitoring Programs at Class 1 Nuclear Facilities and Uranium Mines and Mills*; and
- Work with Wildlife Habitat Council staff in order to examine future certification options for OPG.

3.10 Emergency Management and Fire Protection

3.10.1 Objectives

<u>Emergency Preparedness</u>

OPG's Consolidated Nuclear Emergency Plan (CNEP) documents the emergency response capability to a nuclear emergency at OPG's nuclear stations. Although event scenarios at the DWMF, PWMF and WWMF would not result in a radiological danger to the public or any required protective actions as defined in the Provincial Nuclear

Emergency Plan (PNERP), the procedures developed under the CNEP could be implemented to support a DWMF or PWMF event if it resulted in a Station Emergency being declared, or at the nuclear station Shift Manager's discretion. Staff on-site at the DWMF and PWMF participate in site wide emergency drills that involve assembly and accounting or site evacuation.

In accordance with the existing Bruce Power notification protocol, OPG staff at the WWMF would follow the emergency response instructions from Bruce Power for a station emergency at either BNGS A or B.

Fire Protection

DNWM's goals for Fire Protection are to protect the building and its staff from the hazards of fires; minimize work interruption due to fires; and, minimize economic loss resulting from fire damage. The fire protection provisions are required to conform to:

- The *National Fire Code of Canada* (NFCC);
- The *National Building Code of Canada* (NBCC); and
- The *Occupational Health and Safety Act* (OHSA).

DNWM's fire protection procedure has been incorporated into OPG's fire protection program, N-PROG-RA-0012, to ensure a consistent approach to fire protection across all the nuclear sites, ensuring adequate fire protection by minimizing both the probability of occurrence and the consequences of fire at the facilities.

Memoranda of Understanding and Fire Response Planning

A *Memorandum of Understanding* (MOU) between the Municipality of Clarington and OPG, as well as, a MOU between the Municipality of Pickering and OPG, applies to the provision of fire protection services, including coordinated emergency response. In the event of an on-site incident, both Clarington's Emergency and Fire Services for DNGS, and Pickering Fire Services for PNGS, will be called for assistance.

The initial fire response for DWMF rests with the Municipality of Clarington with support from the DNGS Emergency Response Team. Clarington Emergency and Fire Services is familiar with the DWMF. The DNGS Emergency Response Team will respond with Shift Manager concurrence and approval.

The initial response for the PWMF portion outside the protected area rests with Pickering Fire Service with support from the PNGS Emergency Response Team. The PNGS Emergency Response Team will respond with Shift Manager concurrence and approval. The initial response for the PWMF portion inside the protected area rests with PNGS Emergency Response Team with support from Pickering Fire Service. Pickering Fire Service is familiar with PWMF.

A service level agreement at WWMF exists for Bruce Power Emergency & Protective Services to provide the initial response to the facility.

Fire Safety Plans

The Fire Safety Plans at each of the facilities meet the requirements of the *National Fire Code of Canada (NFCC)*. The Fire Safety Plan describes the methods used for Fire Prevention, Fire Protection, Emergency Procedures, and Training and drills. The Fire Safety Plan is reviewed on an annual basis for any required updates.

Independent Third Party Reviews

In accordance with the OPG's Nuclear Waste Management Facilities' licences, inspection and testing of the fire detection and protection system is performed at the required frequency as stipulated in the *NFCC*. A third party performs the annual safety inspections of the fire detection and protection system. Emergency Fire Drills are also performed in accordance with the *NFCC.*

On biennial basis, a third party review of compliance with requirements of the *NFCC* is undertaken at the WWMF. A triennial independent third party review of compliance is performed at the DWMF and PWMF.

3.10.2 Results

As summarized below, during the reporting period, OPG's Nuclear Waste Management Facilities completed Emergency Management & Fire Protection drills, applied improvements resulting from the lessons learned from the Fukushima earthquake, and undertook independent analysis of fire protection at the OPG's Nuclear Waste Management Facilities.

Emergency Management

Hazardous Material (HAZMAT) spill drills were conducted annually for each Waste Management Facility during the reporting period. Upon completion of each drill, a report was issued which captured lessons learned, corrective actions and valuable operating experience. This is part of spill response improvement and organizational learning.

Response to Fukushima Event

OPG reviewed the initial lessons learned from the Fukushima event in Japan, and re-examined the safety case for the Waste Management Facilities. 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.

No significant gaps and no compensatory actions were identified during these reviews, however, some possible opportunities for improvement were identified. These improvements and enhancements include the development of an emergency preparedness procedure to improve the post-event worker response, the identification of technical studies to evaluate the consequences of a beyond design basis

earthquake at the waste sites, and the completion of a flood hazard assessment for the WWMF. In the review of the safety cases, OPG identified actions with the objective of improving defences and mitigating the consequences for both design basis events and beyond design basis events, should they occur.

For design basis events, a number of areas for improvement were identified during the safety case review process, and have been addressed with the development of post-event worker response procedures.

For beyond design basis events, the completed actions included technical studies as well as improvements to emergency response capability. Response capability, internal programs and procedures were revised to improve the post-event response (e.g. manual activation of the LLSB fire suppression system); a mutual aid agreement was created between Bruce Power, OPG, Hydro Quebec, New Brunswick Power and AECL; and OPG purchased additional emergency equipment such as emergency provisions and satellite phones.

Fire Protection

Fire protection and detection systems at OPG's Nuclear Waste Management Facilities are designed and constructed to comply with applicable fire protection and building codes (e.g. *NFCC* and *NBCC*). During the reporting period, these systems were required to comply with updated pressure boundary code requirements, such as CSA Standard N285.0-08, Update No. 2, *General Requirements for Pressure-Retaining Systems and Components in CANDU Nuclear Power Plants*; CSA B51-2009 and Update No. 1, *Boiler, Pressure Vessel, and Pressure Piping Code*; and ASME B31.1, *Power Piping Code*, 2010 Edition. OPG is complying with the updated pressure boundary code requirements, applying the additional rigour warranted for the maintenance of these non-nuclear / Class 6 pressure boundary systems.

During the review period, organizational realignment resulted in the DNWM Fire Protection program being re-integration into OPGN's Fire Protection. This realignment will ensure programmatic consistency and implement actions to address past challenges regarding managed system controls. Program ownership now falls within a single programmatic document within Nuclear to facilitate a unified approach across OPGN.

Annual emergency fire drills were performed at OPG's Nuclear Waste Management Facilities, in accordance with the NFCC. In addition, fire protection and detection systems were independently evaluated on a periodic basis.

During the reporting period, and as summarized in Table 8, OPG provided 5 reviews to CNSC staff of the fire protection program at DWMF, PWMF and WWMF undertaken by independent third party organizations.

Table 8: Summary of Independent Third Party Reviews of Fire Protection Programs at OPG's Nuclear Waste Management Facilities

Review Period	DWMF (Triennial)	PWMF (Triennial)	WWMF (Biennial)
2010	-	-	June 30
2011	-	-	-
2012	March 28	March 13	August 28
2013	-	-	-
2014			October 27

The above reviews concluded that the Fire Protection Program at the DWMF, PWMF and WWMF 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 NFCC. Corrective actions have been completed on any items resulting from the reviews.

Non-routine Operations Response

The fire protection program and systems are capable of responding to emergency and non-routine situations. For example, on July 11, 2013, the excess air duct located beneath the primary chamber of the incinerator at the WWMF experienced localized heating. Smoke was observed to be emanating from the surface. Operators appropriately responded by misting the excess air duct with water to cool the air duct, and turned off the blower to restrict air flow inside the duct to decrease the temperature. The temperature of the duct continued to be monitored to ensure it did not increase again. The solid and liquid waste feeds were suspended by operations staff, and the incinerator was placed in a safe state. The Bruce Power Emergency Response Team (ERT) was called to the scene to check the piping and surrounding area, and found no concerns.

Following a second localized heating event in February, 2014, OPG initiated a root-cause investigation. OPG has taken the following measures to prevent re-occurrence of the localized heating event of the incinerator air duct.

- Solid wastes are not being combusted in the incinerator at the WWMF.
- An expert, third party consultant's assessment was obtained regarding the legacy design of primary incinerator chamber excess air duct.
- The recommendations from the expert assessment to remove the incinerator air tubes have been incorporated into an engineered modification to the system.
- The modification to upgrade the incinerator design has been progressing through OPG's Engineering Change Control process. Upon completion of the modification, the fuel path out of the incinerator will be removed, preventing any localized heating.

There were no negative impacts on the health and safety of OPG personnel, members of the public, or the environment as a result of either incident.

3.10.3 Future Improvements

W-MAN-09076-00001, *Nuclear Waste Management Division Fire Impairment Manual* describes how OPG will manage planned and unplanned impairments for OPG's Nuclear Waste Management Facilities. This manual provides resource information to guide trained staff who are directly involved with planned and unplanned outages to the fire protection system in evaluating, establishing, planning, controlling and executing outages on fire systems at PWMF, DWMF and WWMF. 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 impairment 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.

General Emergency Planning, Fire Safety Plan and Emergency Fire Drills will continue to be performed in accordance with the NFCC, specifically as follows:

- Annual emergency fire drills conducted by Fire Protection Programs at the DWMF, PWMF and WWMF utilizing OPG Fire Protection staff at PNGS and DNGS or Bruce Power Emergency & Protective Services at the WWMF;
- The annual review of the Fire Safety Plan; and
- Independent biennial or triennial third party compliance review of requirements of the NFCC at the facilities.

3.11 Waste Management

3.11.1(a) Objectives

OPG Nuclear Waste Management Facilities' waste management program is aligned with, and based on N-PROG-OP-0006, *Environmental Management*. The Nuclear Waste Management Facilities work in collaboration with the OPG nuclear stations in order to implement strategies for waste minimization and waste management.

Low and Intermediate Level Radioactive Waste is identified as a significant environmental aspect in OPG's OPG-PROG-0005, *Environmental Management System* (EMS).

3.11.1(b) Results

OPG Nuclear Waste Management Facilities have taken the lead in establishing an OPGN Fleet-wide initiative related to waste minimization. The objective of this initiative is to implement waste strategies across the nuclear fleet, which will improve waste minimization, segregation, sorting and processing of Low Level Waste.

Each year targets are established for low and intermediate-level waste production at each of the generating stations and within the WWMF itself.

Pilot Projects

In 2012 and 2013, OPG explored some external opportunities for waste reprocessing. Pilot projects were completed to confirm opportunities for volume reduction of large metal components such as heat exchangers, and to verify contents of stored non-processible waste and confirm opportunities for further reprocessing. The pilots provided valuable data in terms of validating options available on the external market for large metal components. The pilots also validated that opportunities do exist within currently stored volumes of non-processible wastes.

Waste Segregation

In 2013, the WWMF instituted a “Likely Clean” waste segregation initiative to improve its own performance in the area of waste minimization. Specific waste collection stations were set up at the WWMF facilities. Through enhanced radioactive contamination monitoring and procedures, low-level waste that was once considered radioactive by default, is now thoroughly monitored and released.

Waste Sorting

In 2014, the WWMF began a waste sorting pilot project. Bins of stored non-processible LLSB wastes and new non-processible waste arisings are opened and physically sorted into various streams. Incinerable and compactible materials are segregated for further processing at the WWMF. Metals are segregated and either surveyed, decontaminated and free released or if not able to be decontaminated they are stored for future processing or interim storage.

Through this initiative 254 m^3 of low level waste was sorted resulting in further volume reduction opportunities through incineration and compaction, as well as being able to free release approximately 7.5 m^3 of metals.

3.11.1(c) Future Improvements

OPG Nuclear Waste Management Facilities have identified a strategic initiative to determine options which exist for volume reduction of large metal components, both for waste arising from refurbishment and operations of the nuclear generating stations. This could also provide input into plans for future wastes arising from decommissioning.

In 2014, an indicator was developed for each station to specifically identify waste reduction targets for the non-processible waste stream. This enables focus to occur on waste reduction at the source. Through increased awareness and challenges to waste generators at Pickering station, that particular station was able to reduce its non-processible waste volumes shipped by 120 m^3 in 2014. These indicators continue to be used across the fleet to increase awareness and drive improvement.

Through the OPG Waste Minimization initiative, specific objectives will continue to be brought forward and implemented. These include:

- Ongoing fleet-wide communication campaigns; and
- Reviewing and improving waste sorting practices.

3.11.2 Decommissioning

3.11.2(a) Objectives

The objective of decommissioning planning is to demonstrate the technical and financial feasibility of decommissioning the DWMF, PWMF, and WWMF. The decommissioning plans ensure the health, safety and security of workers, the public and the environment.

Decommissioning plans are developed for all OPG Class 1 facilities to provide a structured outline for establishing and maintaining acceptable financial guarantees.

Planning for the eventual decommissioning of the waste facilities is an ongoing process, taking place throughout each stage of the licensed facility's life-cycle. The proposed plan for the decommissioning is described in each waste facility's decommissioning plan. The decommissioning plans were prepared in accordance with *Decommissioning Planning for Licensed Facilities*, G-219, CNSC Regulatory Guide and *Decommissioning of Facilities Containing Nuclear Substances,* CSA Standard N294-09*,* and the decommissioning plans are updated periodically as required.

The decommissioning plan describes the activities that will be required to decommission and restore the site for other OPG uses. It demonstrates that decommissioning is feasible with existing technology and it provides a basis for estimating the cost of the decommissioning. The decommissioning plan includes schedules and cost estimates based on the assumptions that form the basis for this plan.

Decommissioning of the waste facilities will commence only after the removal and transfer of all the waste (used fuel and low and intermediate-level waste) from the facility to the long-term management facilities.

3.11.2(b) Results

The DWMF, PWMF and WWMF decommissioning plans were revised and submitted to CNSC Staff in June 2012, and accepted by the CNSC in December 2012 [R-2], as part of the 2013 to 2017 CNSC Financial Guarantee submissions. The requirements of CSA Standard N294-09, as well as, any relevant domestic and international experience obtained in the last five years, were incorporated into this revision.

3.11.2(c) Future Improvements

The decommissioning plans are updated once every five years or when required by the Commission. Currently, the next revision of the decommissioning plans is scheduled to be submitted to the CNSC by January 31, 2017, as part of the 2018 to 2022 CNSC Financial Guarantee submission.

3.12 Security

3.12.1 Objectives

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 emergencies 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 and Emergency Services (SES) is accountable to the Senior Vice President, DNWM to provide security support for these facilities. The Vice President, SES is accountable to the Chief Nuclear Officer, for the security of all OPG assets. This accountability includes the security program for the WWMF located on the Bruce site. This program is implemented through contracted security services provided by Bruce Power Security. Under the *Bruce Site Services Agreement*, Bruce Power provides security services to OPG for all retained facilities on the Bruce site, including security at the WWMF.

3.12.2 Results

OPG's program ensures the security of the Nuclear Waste Management Facilities' 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.

- Security measures are evaluated against annual threat and risk assessments to ensure credible threats are mitigated.

- Training programs are in place to enhance and sustain improved performance of both OPG and Bruce Power 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, provide performance testing of the nuclear security program. Lessons learned through drills and exercises are applied to enhance the program at OPG's Nuclear Waste Management Facilities.

- 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 ensure open communication and that evolving security requirements are understood.

- Details of the security program for DNWM's high security sites are contained in their respective Security Reports.

- Security requirements in accordance with the *Nuclear Security Regulations* are in effect at OPG's used fuel dry storage facilities.

DWMF Construction Project

A temporary protected area barrier has been constructed and placed into service at the DWMF to separate the operating facility from the area where Storage Building 2 construction is occurring. The barrier was placed into service in the third quarter of 2014 and will remain in place until the conclusion of the project.

3.12.3 Future Improvements

OPG is upgrading aging security search equipment at all of its high security sites replacing existing weapons, explosive detection and baggage x-ray devices with devices utilizing industry leading technology. The transition is complete at DWMF and planned for PWMF, and the UFDS facility at WWMF, to coincide with facility modifications currently in design.

3.13 Safeguards

3.13.1 Objectives

The objective of OPG's Safeguards Program is to support OPG compliance with the governing agreement made between the Government of Canada and the International Atomic Energy Agency (IAEA). This is done in accordance 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.

3.13.2 Results

Under the integrated safeguards protocol, all safeguards commitments were met at the DWMF, PWMF, and WWMF during the reporting period.

OPG's Nuclear Waste Management Facilities have met all safeguards conditions in the operating licences, and the terms of the agreement between Canada and the IAEA pursuant to the *Treaty on Non-proliferation of Nuclear Weapons*. The OPG's Nuclear Waste Management Facility staff has fully co-operated with the IAEA and facilitated achievement of IAEA safeguards goals.

As of June 28, 2012, OPG's Nuclear Waste Management Facilities have been in full compliance with the CNSC Regulatory Document, RD-336, *Accounting and Reporting of Nuclear* Material; and CNSC Guidance Document, GD-336 , *Guidance for Accounting and Reporting of Nuclear Material* requirements. This includes updating to the *Nuclear Fuel Location and Storage History* (NuFLASH) program to support RD-336 reporting requirements.

OPG 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 address stakeholder issues.

3.13.3 Future Improvements

- OPG's Nuclear Waste Management Facilities have and will continue to perform annual self-assessments to ensure OPG adherence to the safeguards program. Any findings needing attention will be addressed.
- Safeguards personnel will continue to be trained to OPG qualification requirements for safeguards.
- In 2014, the ownership for Safeguards programs in OPGN moved from the Director, Regulatory Affairs and Stakeholder Relations, to the Director, Nuclear Waste Engineering.
- Updates will be completed to documentation, which provide a detailed account of facility design information to the IAEA to facilitate discharging of the facilities' safeguards responsibilities. The *Design Information Questionnaire* (DIQ) updates

will be submitted in 2015 for the surveillance areas installed in the PWMF in 2013, and planned for the DWMF in 2015. The DIQ update has been completed for WWMF and the area is in use.

- OPG continues to work with the CNSC and licensees both to identify exempted materials being submitted to the L&ILW Facility and to track these exempted materials.

3.14 Packaging and Transport

3.14.1 Objectives

The objective of the OPGN Radioactive Materials Transportation (RMT) program is to ensure safe, regulatory-compliant, and efficient transportation of radioactive material. This program is supported by NK38-PLAN-03456.05-0188620, *Emergency Response Plan*. Activities related to Packaging and Transport are performed under the nuclear generating station *Power Reactor Operating Licences* and the WWMF *Operating Licence*.

3.14.2 Results

OPG's RMT program has a fleet of tractors, trailers, packaging, and Transportation of Dangerous Goods Class 7 Carriers (drivers) for the transportation of:

- L&ILW to the WWMF at the Bruce site;
- Non-waste radioactive materials (tools, sources, titrated heavy water); and
- Single bundles of used fuel to Canadian Nuclear Laboratories (previously AECL Chalk River Laboratories) for examination and analysis.

All OPG radioactive materials transportation packaging is compliant with the requirements of the *Packaging and Transport of Nuclear Substances Regulations*. The designs of packaging for the most hazardous radioactive materials (Type B) are certified by the CNSC. OPG's Nuclear Waste Management Facilities track and maintain package certificates and registered user status for all Type B packaging used by OPG.

All DNWM carriers have a documented training and qualification process that exceeds Ontario Ministry of Transportation requirements.

OPG typically performs over 700 radioactive shipments per year. Since 1997 there have been only three minor motor vehicle collisions involving OPG radioactive shipments from which there have been no releases of radioactive material to the environment, and no serious injuries. One of these occurred during the reporting period. In March 2012 an OPG RMT vehicle carrying empty bins (classified as a Class 7 radioactive, excepted empty shipment) was rear-ended on a 400 series highway by a private driver who was then charged.

Program improvements have included:

- Procurement and integration into the RMT fleet of two Type B(U) packages known as the Multi-Purpose Transportation Package (MPTP) for use in transporting tritiated heavy water.
- Procurement and integration into the RMT fleet of one Type B package known as the Multi-Purpose Transportation Package (MPTP-SF) for use in transporting radioactive filters and components.
- Design changes to and retrofitting of the Trillium Transportation Packages (TTP) to upgrade the TTP to Type B(U) package design requirements.
- Conveyances for several RMT packaging have been replaced or refurbished as required.

3.14.3 Future Improvements

A replacement schedule exists for all of the Type A and B transportation packages to ensure that new packages are manufactured and commissioned as required and older packages are then retired and decommissioned.

4.0 OTHER MATTERS OF REGULATORY INTEREST

The subsequent sub-sections present OPG's Nuclear Waste Management Facilities' performance in the CNSC-defined "Other Matters of Regulatory Interest". The results discuss topics such as OPG's Community Relations and Public Information Program, First Nations and Métis Community Relations, Notifications to other Regulatory Bodies, Cost Recovery, Nuclear Liability Insurance, and Financial Guarantees.

4.1 Licensee's Community Relations and Public Information Program

4.1.1 Objectives

OPG's Corporate Relations and Communications, (formally Public Affairs), manages public and First Nations and Métis communication, engagement and relationship building in the host communities of PWMF, DWMF and WWMF.

OPG ensures timely, open and transparent communication to maintain positive and supportive relationships and the 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.

An annual communications engagement plan directs activities towards community stakeholders, including government, media, business leaders, educational institutions, interest groups, and community organizations. OPG ensures transparent disclosure of our operations and potential impacts, both positive and negative that may occur as a result of our operations.

4.1.2 Results

During the reporting period, OPG regularly and proactively provided information to the public on its facility activities. Information was communicated on an ongoing and timely basis, respectful of both the public's views regarding risk and the level of public interest of station operations, activities, and anticipated effects on the environment and the health and safety of the public.

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.

On a quarterly basis, OPG publicly posted performance reports on nuclear waste operations at www.opg.com and this was shared electronically each month 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 (EMP) report on www.opg.com and aspects of our nuclear waste operations are included in Bruce Power's EMP report.

Disclosure Protocol

At the start of 2013, OPG had completed all necessary work to ensure a managed system was in place to carry out the requirements of CNSC Regulatory/Guidance Documents 99.3, *Public Information and Disclosure.* This included the development and issuance of OPG document, N-STD-AS-0013 *Nuclear Public Information and Disclosure* 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 Western Waste Management Facility adhere to N-STD-AS-0013 and the *Nuclear information Disclosure and Transparency Protocol* and have begun to report and post all waste-related reportable events.

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. OPG continues to respond to and support requests for information or briefings. In the past two years these briefings and information sharing have dramatically increased as a result of

interest in the Deep Geologic Repository project. OPG has worked to respond to all of these requests and proactively reach out to communities to share information in both Canada and the United States.

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

Presentations and informal meetings were held with local elected officials and community leaders a number of times each year to provide updates on performance and other activities taking place both at the stations and waste facilities. This included both individual updates with Members of Parliaments and Members of Provincial Parliaments, as well as, periodic attendance at council (municipal/regional) meetings to provide operational updates. These presentations were often televised and widely covered by the media.

To increase the understanding of nuclear waste operations, tours are provided to key stakeholder groups, media and interested groups. Across all three of the waste management facilities, a total of 160 tours were conducted from 2010 to the end of 2014.

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.

OPG's "Radioactive Material Transportation and Emergency Response" communication program was presented to emergency responders in communities across the province where our transportation vehicles travel. In an effort to continue to build community and stakeholder understanding, OPG conducted a number of face-to-face radioactive material transportation and emergency response presentations with provincial/municipal first responders and municipal leaders along the transportation routes. Since the last report, OPG has provided 45 training presentations to over 700 emergency personnel.

Since the past reporting period, communications in support of waste operations at the three sites, generated the following on average:

- Eight newsletters to a combined audience of 260,000 households;
- Over 1000 visitors to the information centres;
- 24 ads (in 2014) in newspapers in Bruce county;
- 144 media inquires (in 2014) responded to on waste and DGR; and
- Over 10,000 visits in the year to OPG's waste and DGR websites.

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 Facebook account, a Twitter account with 5,200 followers, and Tweets on relevant nuclear activities and information.

Through OPG's Corporate Citizenship Program, financial support is provided for community-based programs with a focus on education, environment and community-building events. From 2010 to 2014, WWMF provided support for 393 charitable and non-profit initiatives in our host communities. Employee leadership on local committees and volunteerism helped strengthen the social infrastructure of our host communities.

The sites hosted a variety of environmental education and recreational programs geared for students to demonstrate that OPG shares the values of family, safety and environmental stewardship. Pickering and Darlington hosted, "March Break Madness," a program with close to 6,000 visitors. The Western site supports Science Career Paths sessions, The Bluewater Science Fair, Water Works and the Girls Science Club reaching over 5,200 students.

Both Pickering and Darlington continued to manage local Community Advisory Committees (CAC) in which waste updates were provided by senior leadership from the stations and the waste management organization. On average, 16 meetings are conducted each year, feedback and input was solicited at the meetings, and media attended and reported on outcomes.

Working through the local Medical Officer of Health (MOH), OPG helped support and provide information to the Durham Nuclear Health Committee at least four times per year. The general public, special interest groups and media attended the meetings; all minutes and presentations were posted on the internet. Yearly meetings were also provided to the MOH and staff of Grey-Bruce County.

4.1.3 Future Plans

OPG plans to:

- Continue to develop and implement a yearly public information program;
- Establish a Community Advisory Council in Bruce County;
- Proactively report and post waste-related reportable event;
- Continue website improvements and use of video; and
- Continue to expand of environmental reporting to the public.

4.2 OPG Nuclear First Nations and Métis Community Relations

OPG is committed to discussing with First Nations and Métis communities, our nuclear waste operations and future projects. OPG's demonstration of this commitment is directed by a corporate-wide policy that provides a framework for engaging with Aboriginal peoples and supporting programs, committees and community initiatives.

4.2.1 Objective

OPG is committed to building long-term mutually beneficial working relations with First Nations and Métis communities proximate to its present and future operations. OPG is committed to develop these relationships on a foundation of respect for the languages, customs, political, social and cultural institutions of First Nation and Métis communities.

4.2.2 Results

Annually, a First Nations and Métis relationship work plan is developed and executed.

Since the last reporting period OPG has continued to work with 12 communities and held numerous meetings (approximately 15 per year) on a yearly basis to share information; to consult on issues and concerns; and to work collaboratively on areas of common interest. Participation agreements and memorandums of understanding have also been put in place since 2010 with a number of First Nations and Métis communities to enable the sharing of information on OPG's waste operations and engage in discussions and resolution of concerns. This allows for structured and ongoing opportunities for open and constructive dialogue.

As such, OPG regularly meets with Aboriginal communities who have an interest in current regulatory licensing processes to help inform them of the process, facility operations, opportunities for engagement, and identify interests and concerns.

Over the past reporting period OPG met regularly and engaged with:

- Saugeen Ojibway Nations;
- Williams Treaty First Nations representatives (Chippewa Nations: Georgina Island, Christian Island (Beausoleil), Rama, Mississauga Nations: Scugog, Hiawatha, Curve Lake, Alderville);
- Métis Nation of Ontario -Region 7: including the Métis Councils of Georgian Bay, Moon River and Great Lakes; and
- Historic Saugeen Métis.

Periodically, information meetings/community sessions and briefings were also held with:

- Métis Nation of Ontario – Region 6 and Region 8;
- Mississauga of New Credit First Nation;

- Mohawks of Akwesasne First Nation;
- Mohawks of Bay of Quinte; and
- Six Nations Hereditary Chiefs represented by Haudenosaunee Development Institute (HDI) and communities on Manitoulin Island.

4.2.3 Future Plans

OPG has worked hard to build strong respectful and mutually-beneficial relationships with all First Nations and Métis communities in proximity to our operations. The relationships continue to mature and build trust and understanding. A number of agreements and MOU's are in place to ensure a framework is in place to enable OPG and the communities to continue to remain informed and engaged in the future and that issues are discussed and resolved in the right forum and to allow both parties to continue to work toward common goals.

4.3 Other Regulatory Notification

In addition to reporting requirements under the NSCA, its associated *Regulations*, and CNSC licences, OPG has been reporting on certain activities as required to other regulatory agencies. These agencies include, but are not limited to, the Ontario Ministry of the Environment and Climate Change (MOECC), the Ontario Ministry of Labour (MOL), and Environment Canada.

A summary of all reports made to other regulatory agencies regarding operations at the DWMF, PWMF, and WWMF were provided to the CNSC.

4.4 Cost Recovery

OPG has provided timely payments during the review period, to the CNSC on a quarterly basis based on 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.

4.5 Nuclear Liability Insurance

During the reporting period OPG maintained the required nuclear liability insurance for Nuclear Waste Management Facilities. This was comprised of $6 million dollars of actual insurance and reinsurance from the federal government of $69 million, for a total limit of $75 million which was the maximum liability of an operator under Sections 3 and 15 of the *Nuclear Liability Act*. OPG will continue to be in compliance with nuclear insurance requirements as the new Act is implemented.

4.6 CNSC Financial Guarantees

The *Nuclear Safety and Control Act* and the associated *Regulations* require that OPG, as owner of nuclear generating stations and Nuclear Waste Management Facilities,

make adequate provisions for decommissioning of existing operations. Where decommissioning includes the development of acceptable decommissioning plans, the provision of credible estimates of the costs of implementing such decommissioning plans, and providing assurance in the form of a Financial Guarantee that adequate resources will be available to fund decommissioning activities. The decommissioning plans, the cost estimates, and the Financial Guarantee must be updated and submitted to the CNSC, as established by the *Nuclear Safety and Control Act*, on a five-year cycle for review and acceptance. This is supplemented by an annual report of the status of the cost estimates and Financial Guarantee in the interim years.

The CNSC Financial Guarantee covers the following programs:

- Physical decommissioning of all Class 1 Facilities and facilities with a Waste Nuclear Substance Licence (WNSL);
- Used Fuel Interim Storage;
- Used Fuel Long Term Management;
- Low and Intermediate Level Waste Interim Storage; and
- Low and Intermediate Level Waste Long Term Management.

In December 2012, the CNSC accepted OPG's proposed 2013 – 2017 Consolidated Financial Guarantee [R-2].

5.0 CONCLUSION

This interim status report summarizes the safe and reliable performance of OPG's three nuclear waste management operating facilities: the DWMF, PWMF, and WWMF, for the period from July 1, 2010, to December 31, 2014.

This report has presented a consolidated overview of the common elements and unique aspects of each facility's operation and performance in fourteen Safety and Control Areas, and other matters of regulatory interest to the CNSC.

During the reporting period, OPG's facilities were operated safely to protect the public, the workers, and the environment, in accordance with the *Nuclear Safety and Control Act*, associated *Regulations*, applicable federal and provincial legislation, and *WFOLs*. OPG will continue to operate these facilities safely, through the current operating licences issued by the CNSC.

OPG will continue to:

- Safely manage radioactive waste through mature, refined processes;
- Embrace organizational learning and continuous improvement;

- Focus on human performance as the basis for safe, reliable operation, while achieving value for money;
- Maintain a robust public information and engagement program; and
- Meet regularly with aboriginal communities in or around our three facilities.

In conclusion, the results from the reporting period have demonstrated OPG's commitment to:

- A strong safety culture that permeates through the organization, and visibly demonstrates respect for the safety of workers, the environment, and material management;
- Develop innovative solutions for managing radioactive waste;
- Manage the facilities to ensure a focus on long-term sustainable performance excellence; and
- Constantly seek to improve organizational effectiveness through the use of best practices, enhanced behaviours and learning.

6.0 REFERENCES

[R-1] CNSC Guidance Document, "Guide for Applicants and Intervenors Writing CNSC Commission Member Documents," March 2012, GD-379.

[R-2] CNSC Letter, L. Levert to A. Sweetnam, "Record of Proceedings and Licence – OPG's Financial Guarantee," Dec 20, 2012, CD# N-CORR-00531-06031.

Appendix A: Figures

Figure 1: Decommissioning and Nuclear Waste Management Organization Chart

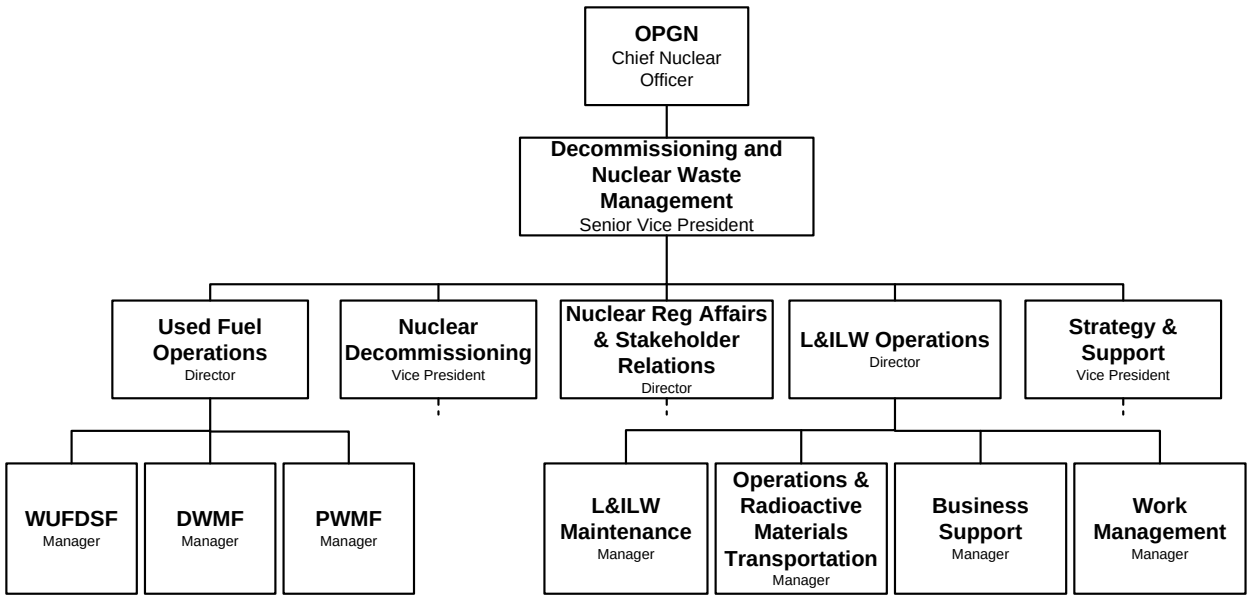


Figure 1 Acronyms

OPGN: Ontario Power Generation Nuclear
L&ILW: Low and Intermediate-level Waste
WUFDSF: Western Used Fuel Dry Storage Facility
DWMF: Darlington Waste Management Facility
PWMF: Pickering Waste Management Facility

Figure 2: Waste Management at the Low and Intermediate-Level Storage Area

The L&ILW storage area provides storage for wastes produced in NGS and other facilities presently or previously operated by OPG. Incoming waste must meet waste acceptance criteria or have special prior approval. Waste characterization studies are performed on waste streams. All wastes are separated into processible wastes and non-processible wastes, when received. Processed and non-processible wastes are stored in a storage structure. After a period of radiological decay, previously stored wastes may be retrieved, reclassified and/or further processed, then subsequently stored in a different type of storage structure (cascading). These processes are flexible and determined by WWMF Operations.

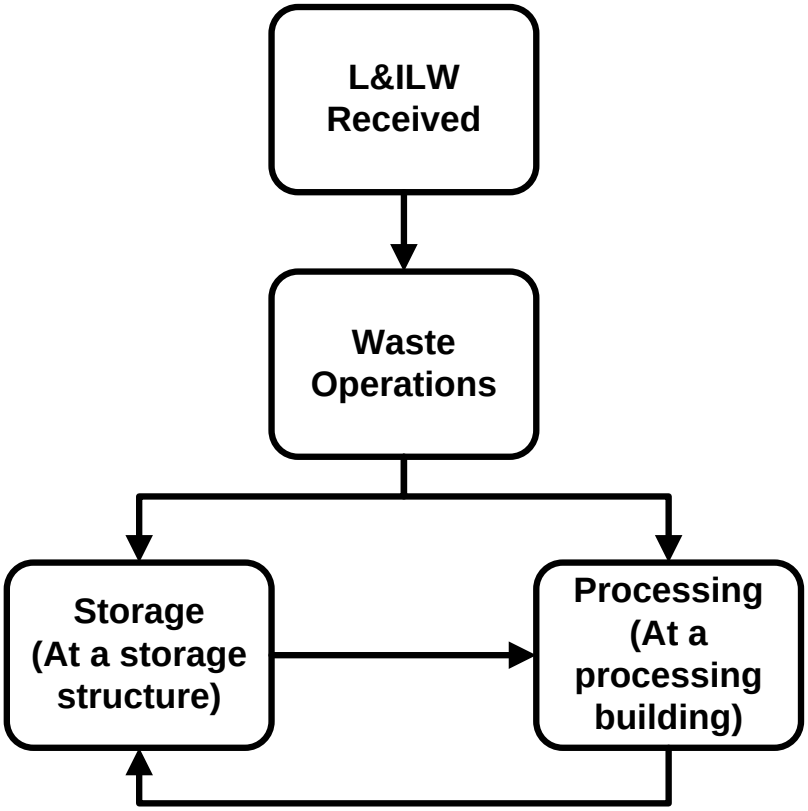


Figure 3: Ontario Power Generation Dry Storage Container

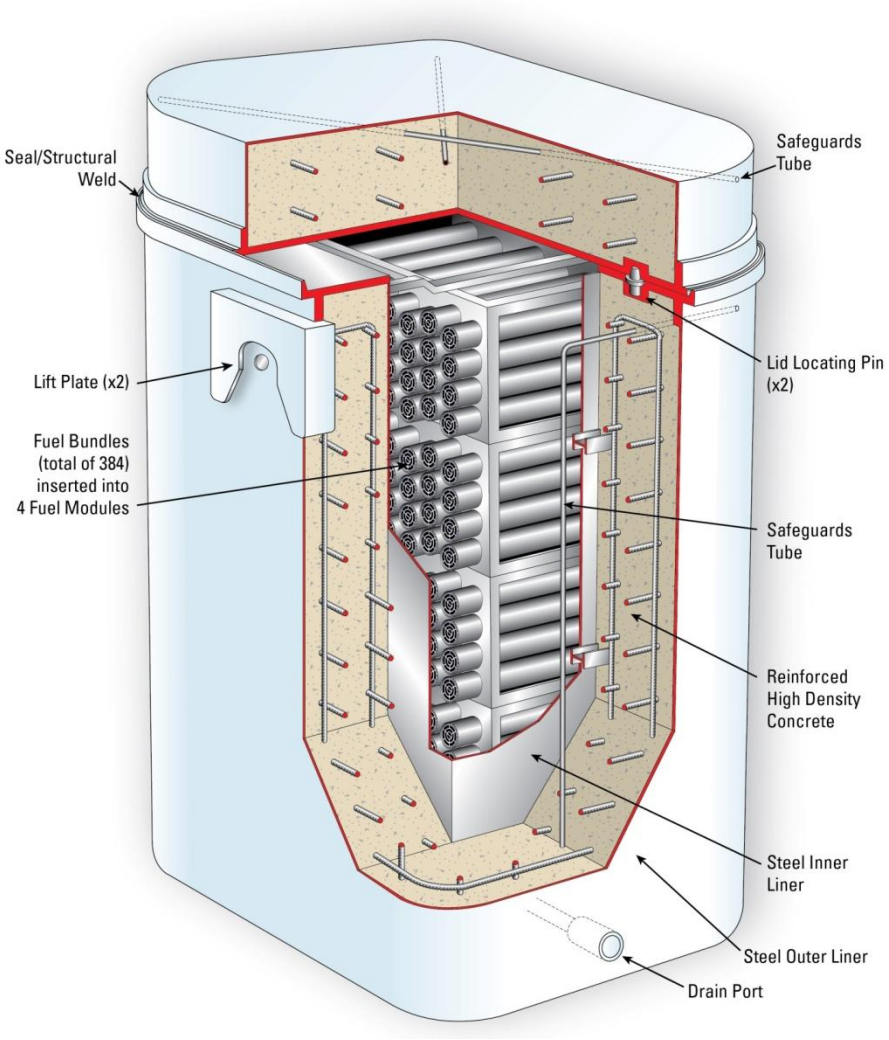


Figure 4: Used Fuel Dry Storage Process

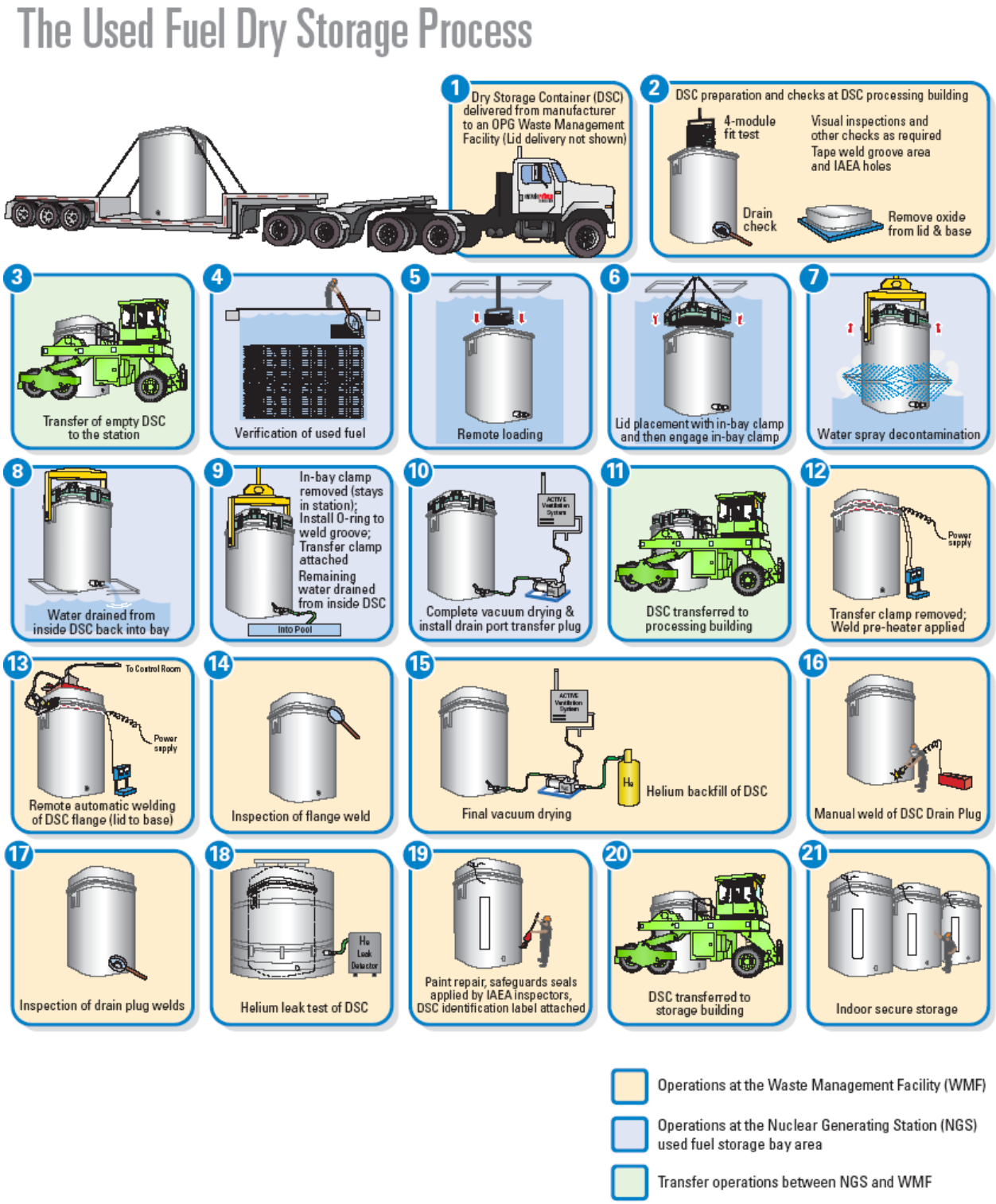


Figure 5: Darlington Waste Management Facility Site

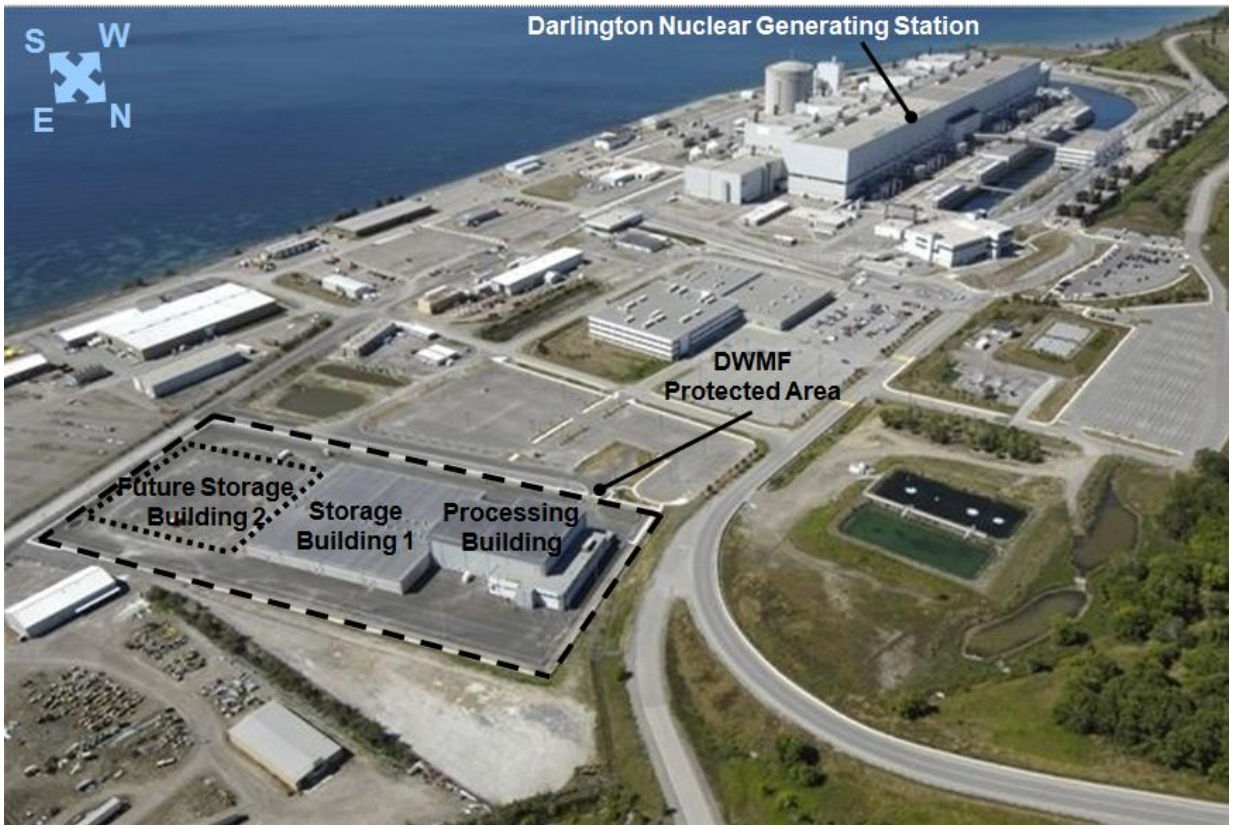


Figure 6: Dry Storage Containers in Storage

Figure 7: DSC Transporter

Figure 8: Pickering Waste Management Facility Site

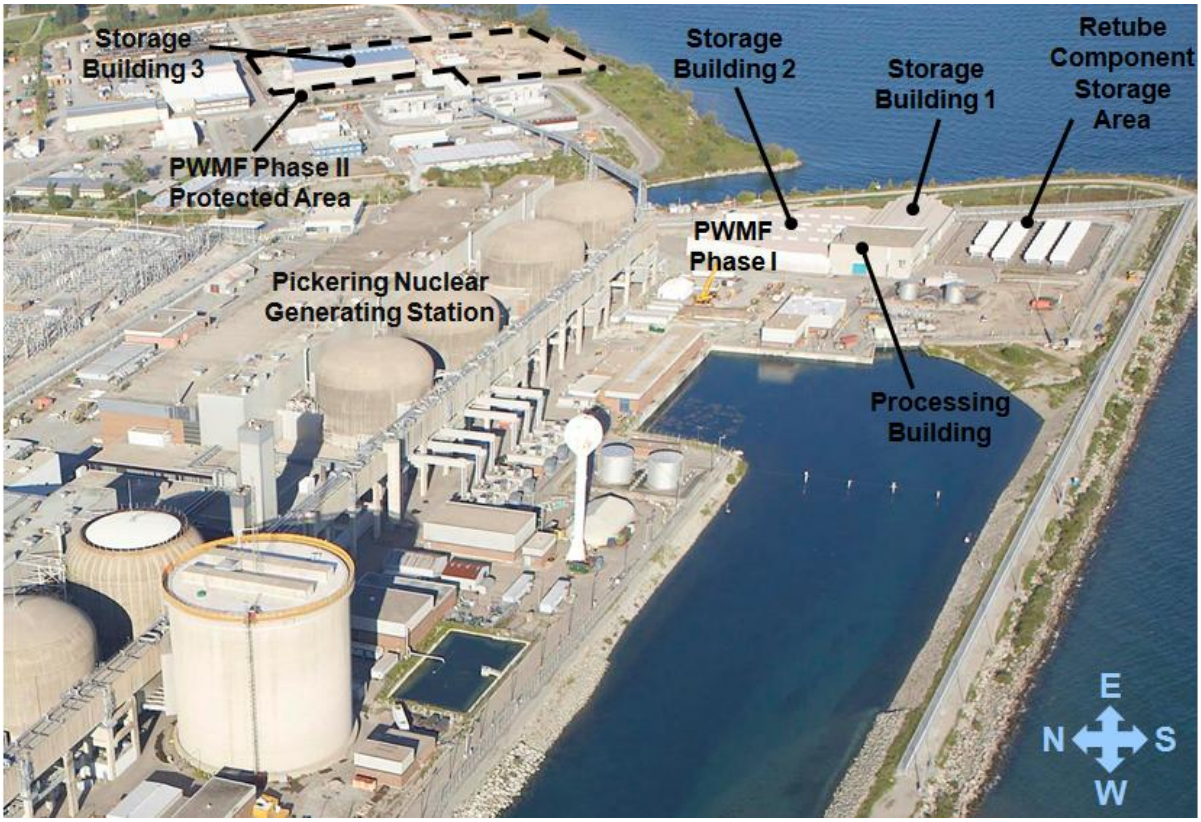


Figure 9: PWMF Retube Component Storage Area

Figure 10: Western Waste Management Facility Site

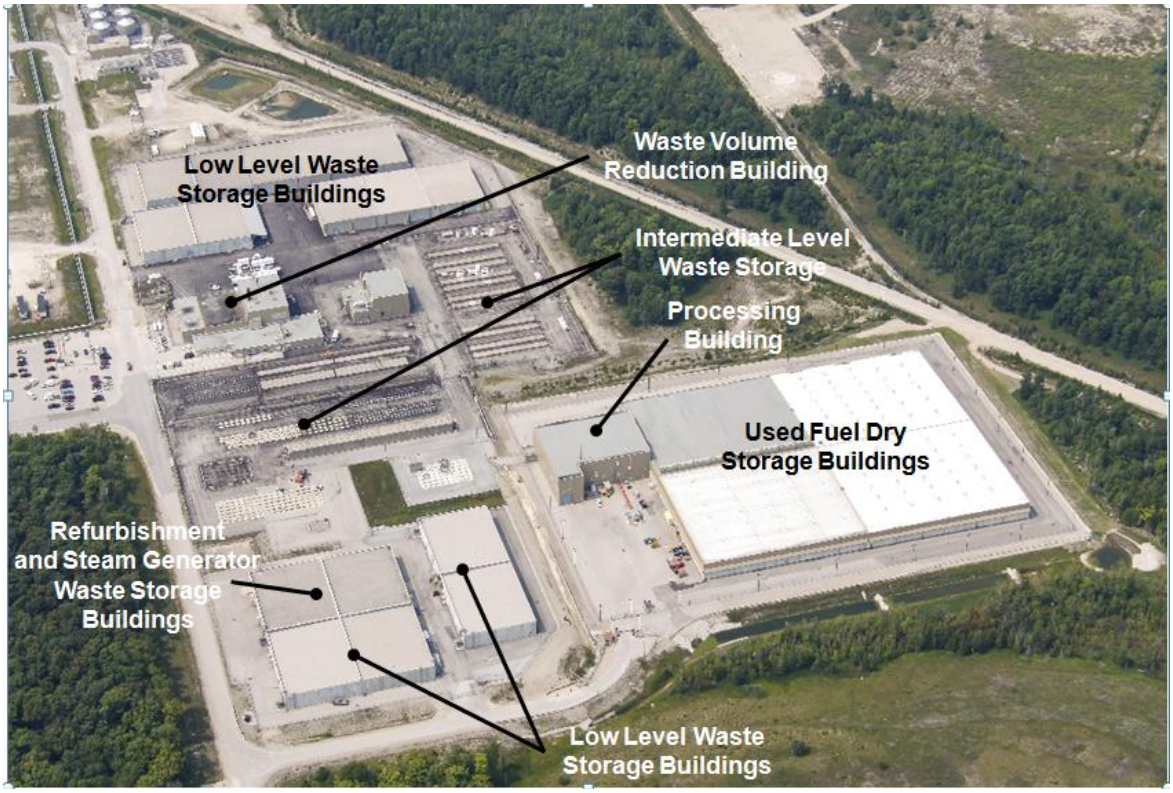


Figure 11: DSC Transfer Vehicle

Appendix B: Glossary

Low-Level Waste (LLW):

This consists of minimally radioactive materials such as mop heads, rags, paper towels, floor sweepings and protective clothing used in the nuclear stations during routine operation and maintenance. These items, which do not require shielding, are packed in plastic bags and shipped to the WWMF in CNSC-licensed steel containers for processing and storage. When possible, these materials are compacted or incinerated to reduce their volume, so that the concrete warehouses used to store them can be designed with smaller environmental footprints.

Intermediate-Level Waste (ILW):

This consists mostly of used reactor components, as well as the resins and filters used to keep reactor water systems clean. These items, which cannot be handled without shielding, are loaded into specially reinforced and shielded transportation packages licensed by the CNSC for shipment to the WWMF. There, the waste is stored in steel-lined in-ground storage structures.

High-Level Waste (Used Fuel):

When a fuel bundle no longer contains enough fissionable uranium to heat water efficiently, it is replaced by a new fuel bundle. The used fuel contains more than 99% of the radioactive by-products of nuclear reactors.

The used fuel bundle, which is still emitting heat and radioactivity, is removed from the reactor by remote control and discharged into a water-filled 'wet fuel bay.' It looks like a swimming pool but is built of reinforced concrete, lined to prevent leaks, and designed to withstand earthquakes.

The water in the bay cools and shields the bundles as the heat and radioactivity gradually declines. Thousands of used fuel bundles are stored in each bay for ten years or more.

After the used fuel bundles become 'cool' enough, they are transferred to CNSC-licensed dry storage containers made of concrete and steel. Then the containers are welded closed, and the International Atomic Energy (IAEA) affixes sophisticated seals to the containers to verify that Canada is in compliance with the International Non-proliferation Treaty.

When loaded, these containers weigh about 70 tonnes and have a minimum design life of 50 years. Studies indicate that, with ongoing maintenance and inspection, they can be safely used for a much longer time.

Appendix C: List of Acronyms

AIR	All Injury Rate
ALARA	As Low As Reasonably Achievable
ASB	Ancillary Service Buildings
ASR	Accident Severity Rate
BNGS	Bruce Nuclear Generating Station
CNO	Chief Nuclear Officer
CNSC	Canadian Nuclear Safety Commission
CSA	Canadian Standards Association
DNGS	Darlington Nuclear Generating Station
DRL	Derived Release Limits
DSC	Dry Storage Containers
DSM	Dry Storage Modules
DWMF	Darlington Waste Management Facility
ECA	Environment Compliance Approval
ECC	Engineering Change Control
EFDR	Event Free Day Reset
EMS	Environmental Management System
HDI	Haudenosaunee Development Institute
H&S	Health and Safety
IAEA	International Atomic Energy Agency
IC	In-ground Container
ISO	International Standards Organization
JCRP	Joint Committee on Radiation Protection

L&ILW	Low and Intermediate-Level Waste
LLSB	Low Level Storage Building
MDL	Minimum Detection Level
MOECC	Ministry of Environment and Climate Change
MOL	Ministry of Labour
MPTP	Multi-Purpose Transportation Package
MRPH	High Maximum Reasonable Potential for Harm
NFPA	National Fire Protection Association
NuFLASH	Nuclear Fuel Location and Storage History
OPEX	Operating Experience
OPG	Ontario Power Generation
OPGN	OPG-Nuclear
PNGS	Pickering Nuclear Generating Station
PWMF	Pickering Waste Management Facility
RCS	Retube Component Storage
REMP	Radiological Environmental Monitoring Program
RMT	Radioactive Materials Transportation
RWSB	Refurbishment Waste Storage Building
SCA	Safety and Control Areas
SCR	Station Condition Records
SES	Security and Emergency Services
SGSB	Steam Generator Storage Building
SSC	Structure Systems and Components
TLD	Thermoluminescent Dosimeter
TTP	Trillium Transportation Packages

UFDS	Used Fuel Dry Storage
WFOL	Waste Facility Operating Licences
WNSL	Waste Nuclear Substance Licence
WWMF	Western Waste Management Facility