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Commission Request for Information

Demande d'information de la  
Commission

**Ontario Power  
Generation**

**Ontario Power  
Generation**

**Darlington Nuclear  
Generating Station:  
CNSC Staff Update on  
Alpha Contamination  
Event – Action from  
November 8, 2018  
Commission Meeting**

**Centrale nucléaire de  
Darlington: Mise à jour  
par le personnel de la  
CCSN sur l'événement de  
contamination alpha –  
mesure de suivi de la  
réunion de la Commission  
du 8 novembre 2018**

Public Meeting	Réunion publique
Scheduled for: 20 February 2019	Prévue pour : 20 février 2019
Submitted by: CNSC Staff	Soumise par : Le personnel de la CCSN

**Summary**

- During the Commission Meeting held on November 8, 2018, Commission Members directed Ontario Power Generation (OPG) to respond to questions listed in an e-mail sent to the CNSC President; and directed CNSC staff to assess the OPG responses.
- The email raised fourteen (14) questions related to the February 2018 alpha contamination event that occurred in the Darlington Retube Waste Processing Building (RWPB).
- This Commission Member Document (CMD) is to provide Commission Members an update on the CNSC staff technical assessment of the OPG responses, and their position regarding the safety significance of the fourteen (14) questions.

There are no actions requested of the Commission. This CMD is for information only

**Résumé**

- Pendant la réunion de la Commission tenue le 8 novembre 2018, les commissaires ont demandé à Ontario Power Generation (OPG) de répondre aux questions envoyées dans un courriel à la présidente et ont demandé au personnel de la CCSN d'examiner les réponses d'OPG.
- Dans le courriel, quatorze (14) questions ont été soulevées concernant l'incident de contamination alpha survenu en février 2018 dans le bâtiment de traitement des déchets de retubage à la centrale de Darlington.
- L'objectif de ce document à l'intention des commissaires (CMD) est de leur présenter une mise à jour de l'évaluation technique des réponses d'OPG par le personnel de la CCSN et de préciser le point de vue du personnel concernant l'importance des 14 questions sur le plan de la sûreté.

Aucune mesure n'est requise de la Commission. Ce CMD est fourni à titre d'information seulement.

**Signed/signé le**

05-February 2019



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Gerry Frappier P. Eng.

**Director General**

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## EXECUTIVE SUMMARY

During the Commission public hearing held on November 8, 2018, Canadian Nuclear Safety Commission (CNSC) Commission Members provided direction to Ontario Power Generation (OPG) and CNSC staff regarding an October 30, 2018 email received by the CNSC President from Dr. F. R. Greening. The email raised fourteen (14) questions related to the February 6, 2018 alpha contamination event that occurred in the Darlington Retube Waste Processing Building (RWPB).

In response to the Commission direction, OPG submitted to CNSC staff responses to each of the fourteen (14) questions. CNSC staff completed technical reviews of OPG responses to assess the safety significance of the issues, and confirm whether immediate or additional regulatory actions are needed based on new information presented.

The CNSC staff technical assessment of OPG's responses to the (14) questions raised is presented in this Commission Member Document (CMD), as directed by the Commission. This CMD is not intended as a status update on the regulatory actions or the implementation of corrective measures in response to the February 2018 alpha event at the Darlington Nuclear Generation Station (DNFS).

The CNSC staff have already completed reactive inspection and compliance oversight activities as per the established compliance program, and had placed enforcement actions that in some instances already addressed related questions in the email. CNSC will continue to conduct follow-up compliance activities and detailed reviews to ensure that corrective actions are fully implemented by OPG.

Based on CNSC staff assessment of the responses and technical reviews of supporting information submitted by OPG, CNSC staff conclude that OPG has adequately addressed the fourteen (14) questions, and recommend to the Commission that the matter as presented in this CMD be closed.

Referenced documents in this CMD are available to the public upon request.

# 1 OVERVIEW

## 1.1 Background

In the Commission public hearing held on November 8, 2018, Canadian Nuclear Safety Commission (CNSC) Commission Members provided direction to Ontario Power Generation (OPG) and CNSC staff regarding an October 30, 2018 email received by the CNSC President from Dr. F. R. Greening [1], which raised questions related to the February 6, 2018 alpha contamination event in the Darlington Retube Waste Processing Building (RWPB).

This event was initially reported to the Commission in March 2018 as an Event Initial Report (EIR), documented in Commission Member Document (CMD) 18-M14 [2].

The CNSC Commission directed that [3]:

*“...OPG is to address the safety concerns that are listed -- they are numbered I through XIV -- at the end of Dr. Greening's email of October 30th. OPG is to provide its information addressing these safety concerns to the CNSC staff in a timely manner for staff's consideration, and staff is to review this information with a view to updating the Commission on its assessment....”*

This Commission Member Document (CMD) provides CNSC staff updates to the Commission on their assessment of the OPG responses to these fourteen (14) questions, as directed.

## 1.2 Highlights

In response to the Commission directions at the November 8, 2018 public meeting, CNSC staff sent a letter to OPG on November 28, 2018 [4] requesting that OPG respond, in a timely manner, to the fourteen questions listed as (i) through (xiv) in the email [1] to the CNSC President.

In their letter [4], CNSC staff requested that OPG provide a complete response for each question that includes:

- the additional information or clarifications requested;
- the measures in place to protect the health and safety of persons as required by subsection 12(1) of the *General Nuclear Safety and Control Regulations*, as applicable; and
- OPG's conclusion whether there is a need to enhance current processes on the basis of dispositioning the question.

On December 19, 2018, OPG submitted to CNSC staff responses to each of the fourteen (14) questions. In support of the responses, OPG included four (4) technical Enclosures in this submission, CMD 19-M7.1[5].



## 2 CNSC REGULATORY ACTIONS IN RESPONSE TO THE FEBRUARY 2018 ALPHA EVENT AT DARLINGTON

The fourteen (14) questions are related to the February 6, 2018 alpha contamination event that occurred in the Darlington Retube Waste Processing Building (RWPB). The contamination was detected on two workers who were performing lidding operations (bolting) on Darlington Storage Over-packs (DSO) in the Waste Tooling System (WTS) of the RWPB. CNSC staff reported the event to the Commission at the March 15, 2018 public meeting in the form of an Event Initial Report (EIR), under CMD 18-M14 [2].

To provide context for the enforcement actions that CNSC staff placed on OPG in response to the February 2018 alpha event at Darlington, a brief summary of the regulatory actions completed by CNSC staff follows. However, this is not intended as a status update on these actions or on the implementation of the corrective measures in response to this event.

Following the alpha event in the RWPB, CNSC staff conducted a reactive inspection, during the weeks of March 6 to 9 and March 19 to 23, 2018 to verify that OPG was compliant with its Radiation Protection (RP) program requirements for alpha monitoring and control of work performed in the RWPB.

As a result of the inspection, CNSC staff placed enforcement actions on OPG to address deficiencies in the implementation of its RP program. The identified areas of non-compliances were mainly related to:

- Documenting and performing classification of alpha hazards in the RWPB
- Maintaining records of the survey results for work conducted in the RWPB
- Consistently performing reviews and verification of radiation survey results for the RWPB
- Implementing adequate radiological monitoring.

As part of the CNSC graduated enforcement, CNSC staff issued a formal request to OPG pursuant to subsection 12(2) of the *General Nuclear Safety and Control Regulations* on June 29, 2018 [6] in consideration of OPG's lack of progress in dispositioning the identified compliance issues. OPG was advised to complete a radiological hazard characterization and classification of alpha hazard in the RWPB.

CNSC staff provided subsequent updates to the Commission under CMD 18-M41 in August 2018 [7], and another status update under CMD 18-M39.A - supplemental CMD to the annual 2017 Nuclear Power Generating Station Regulatory Oversight Report (ROR) in November 2018 [8]. In the latter CMD, CNSC staff presented the enhanced oversight of alpha monitoring and control as part of their presentation to the Commission.

### 3 CNSC STAFF ASSESSMENTS OF OPG RESPONSES

CNSC staff undertook technical reviews of OPG responses to assess the safety significance of the issues, and to formulate the CNSC staff position regarding the fourteen questions. The objectives of the CNSC staff review of the responses were to determine whether:

- OPG has provided the additional information or clarifications requested by the CNSC staff [4], and whether all questions have been dispositioned appropriately;
- there is a need for immediate/additional regulatory action(s) based on the safety significance of the issues;
- the issue raised can be closed based on the information provided, or whether the same issue is already being tracked under existing regulatory actions taken in response to the February alpha event; and
- additional corrective or further follow-up regulatory action(s) are necessary.

A summary of the CNSC staff technical assessment of OPG responses is tabulated in an Appendix attached to this CMD. The table comprises four (4) columns:

- **Column 1:** numbering of the fourteen (14) questions, items (i) through (xiv)
- **Column 2:** the 14 questions taken verbatim from CMD 18-M39.7 [1].
- **Column 3:** OPG's responses (verbatim) to each question, as outlined in the OPG submission, CMD 19-M7.1 [5].
- **Column 4:** CNSC staff assessment of OPG responses, and recommendations for closure of the issues or need for follow-up actions.

**Note:** Citations and references that support CNSC staff technical assessments are found in the Appendix Table (Column 4) corresponding to the item being addressed.

In general, the subject of the questions centered on requests for further clarification to confirm OPG's consideration of hazards from specific radionuclides (e.g.; C-14, H-3 and Cm-244) in ascertaining doses to refurbishment workers from the February 6, 2018 alpha event. As indicated in the Appendix, CNSC staff concluded that OPG has adequately dispositioned the questions related to the assigned total doses to the workers. In addition, CNSC staff independently completed a calculation that confirmed the assigned doses and verified the level of conservatism in the assumptions that OPG used.

Other questions raised were associated with the characterization of the radiological hazard and the waste generated (pressure tubes) in the RWPB, as well as the adequacy of the OPG radiological monitoring/surveying. Regarding questions (items vi, vii and viii) about characterization of the pressure tube waste, CNSC staff recommended that OPG proactively seek, during refurbishment activities, opportunities where smear samples of pressure tubes could be obtained to verify and validate radiological assumptions. CNSC staff acknowledge that

such activities will require and must be held to the ALARA principle, and recognize the high variability in activity concentration among pressure tubes.

As indicated in the Appendix, CNSC staff initiated compliance activities and verifications in response to the February 2018 alpha contamination event; and in some cases had placed enforcement actions related to questions being discussed in this CMD. Specifically, for questions (vi) and (vii), CNSC staff had already placed an enforcement action requesting OPG to complete a characterization of radiation hazards (not only Cm-244) associated with refurbishment work in the RWPB. The CNSC enforcement action was raised during the reactive inspection in March 2018, and is also an element of the 12(2) request to OPG in June 2018 [6]. CNSC staff are tracking the completion of these actions and regular updates on their status will continue to be given to the Commission as part of the *Status Report on Power Reactors* and the ROR.

CNSC staff assessment of the fourteen (14) questions and the responses provided did not identify the need for additional enforcement actions on OPG. Nonetheless, CNSC will continue the regulatory oversight of the OPG Radiation Protection Program to ensure OPG has appropriately addressed the open enforcement actions and implemented corrective measures to enhance alpha monitoring.

#### **4 OVERALL CONCLUSIONS**

In conclusion, CNSC staff are satisfied that OPG has addressed the fourteen (14) questions, and recommend the matter be closed.

CNSC staff assessment and OPG responses to the questions revealed no need for additional regulatory actions. While this assessment did not raise any need for new enforcement actions, CNSC staff had identified areas for improvement in the execution of OPG's Radiation Protection Program as a result of the reactive inspection completed in response to the event along with the issuance of the 12(2) request, and issued enforcement actions related to some of the questions asked.

CNSC staff will continue the regulatory oversight of OPG's Radiation Protection Program to ensure OPG has appropriately addressed the open enforcement actions and implemented corrective measures to enhance alpha monitoring. Specifically, CNSC staff will continue to apply regulatory oversight to the OPG characterization of radiological work to ensure hazards are being identified and appropriate protective measures are implemented, as per inspection findings and as stated in the 12(2) request.

The CNSC staff satisfaction with OPG's responses in dispositioning all questions is no indication of a lack of concern by CNSC staff about other matters related to the execution of OPG's Radiation Protection Program or the consideration of additional enforcement actions (unrelated to the 14 questions), where necessary, to enhance the effectiveness of the program.

## 5 RECOMMENDATIONS

CNSC staff recommend to the Commission Members that the matter before them and as presented in this CMD be closed. This recommendation is founded on CNSC staff assessment of the responses to the fourteen (14) questions and technical reviews of supporting information provided by OPG.

As per the established regulatory oversight taken in response to the February 2018 alpha contamination event at Darlington, CNSC staff will continue to conduct follow-up compliance activities and detailed reviews to ensure that corrective measures are implemented by OPG, and provide regular updates to the Commission on the implementation of these measures.

## REFERENCES

1. Email from Frank Greening, CMD 18-M39.7, November 8, 2018.
2. Event Initial Report, Darlington Refurbishment – Retube Waste Processing Building – Internal Contamination Event, CMD 18-M14, March 15, 2018, e-Doc [5477243](#).
3. Transcripts, Commission Meeting, November 8, 2018, e-Doc [5714022](#).
4. Letter N. Riendeau to B. Duncan, S. Gregoris and D. Reiner, Darlington NGS: Darlington Retube Waste Processing Building - February 2018 Internal Contamination Event – Directions of the Commission, November 28, 2018, e-Doc [5719278](#).
5. Darlington Nuclear Generation station: Update on Alpha Contamination Event, Action Item from November 8, 2018 Commission Meeting, CMD 19-M7.1, January 28, 2019.
6. Letter G. Frappier to B. Duncan and D. Reiner, Request pursuant to Subsection 12(2) of the General Nuclear Safety and Control Regulations: Issues Relating to Radiation Risk Assessments and Measures Taken to Protect Workers from Potential Alpha Exposures in the Retube Waste Processing Building and Darlington NGS Unit 2 Vault, June 29, 2018, e-Doc [5574215](#).
7. Status Report on Power Reactors, Commission Meeting, August 22, 2018, CMD 18-M41, e-Doc [5611060](#)
8. Supplemental: Regulatory Oversight Report for Canadian Nuclear Power Generating Sites: 2017, CMD 18-M39.A, e-Doc [5643522](#)

## GLOSSARY

<b>ALARA</b>	As Low as Reasonably Achievable
<b>CMD</b>	Commission Member Document
<b>DGR</b>	Deep Geologic Repository
<b>DNGS</b>	Darlington Nuclear Generation Station
<b>DSO</b>	Darlington Storage Over-packs
<b>EFPY</b>	Effective Full Power Year
<b>EIR</b>	Event Initial Report
<b>HP</b>	Health Physics
<b>ICRP</b>	International Commission on Radiological Protection
<b>IEMP</b>	Independent Environmental Monitoring Program
<b>IVP</b>	Inventory Verification Plan
<b>JRP</b>	Joint Review Panel
<b>MDA</b>	Minimum Detectable Activity
<b>OPEX</b>	Operating Experience/ Operational Experience
<b>OPG</b>	Ontario Power Generation
<b>PHT</b>	Primary Heat Transport
<b>PT</b>	Pressure Tube
<b>ROR</b>	Regulatory Oversight Report
<b>RP</b>	Radiation Protection
<b>RPC</b>	Radiation Protection Coordinator
<b>RPEGs</b>	Radiation Protection Execution Guides
<b>RWC</b>	Retube Waste Container
<b>RWPB</b>	Retube Waste Processing Building
<b>SAT</b>	Systematic Approach to Training
<b>VRS</b>	Volume Reduction System
<b>WIVP</b>	Waste Inventory Verification Plan
<b>WTS</b>	Waste Tooling System

## A. APPENDIX: CNSC Staff Assessments of OPG Responses to the Fourteen Questions

Item	Question	OPG Response	CNSC Staff Assessment
i.	Why has the C-14 contribution to the refurbishment workers' inhalation dose from the Feb 2018 lidding event been ignored when OPG considers it to be <i>the major contributor</i> to the dose from a hypothetical retube waste container accident?	<p>OPG had considered the contribution of carbon-14 while ascertaining total assignable dose to the refurbishment workers involved in the February 2018 event.</p> <p>The contribution to dose from C-14 was different in the February 2018 situation compared to the hypothetical situation referenced in OPG's <i>Western Waste Management Facility Safety Assessment Report (W-REP-01320-00008-R000)</i> due to the two unique scenarios. Although both situations are retube waste container events, they involve different radionuclide exposure pathways.</p> <p>Section 3.2.5 of the safety report, entitled <i>Accident Scenario: Dropped Retube Waste Container</i>, describes a specific accident scenario in which a container is dropped and all gaseous radionuclides (including carbon dioxide and carbon particulate) within the container are assumed to be released. This does not apply to the February 2018 alpha uptake event as the container was not dropped.</p> <p>The February 2018 uptake was a contamination event, a result of loose contamination on the outside of the container. A more relevant report for dose predictions is NK38-REP-09701-0515372 <i>Radiological Source Term Characterization Strategy applicable to DNGS Refurbishment</i> report by AMEC NSS (Enclosure 1), which attributes most of the dose from loose contamination for pressure tube activities to Cm-243/244 based off smear sample data. All annulus gas systems of OPG stations now employ carbon dioxide as the annulus gas, the particulate form of C-14 is much reduced. The potential contribution of particulate C-14 to loose contamination dose was estimated to be essentially 0% for pressure</p>	<p><b>CNSC staff are satisfied with the OPG response.</b></p> <p>CNSC staff do not consider C-14 to be a significant safety concern in this event, and that as indicated in OPG's response to item (ii) below, both affected workers were on a routine urine bioassay program for tritium, which includes screening for C-14. Therefore, in the event there had been an exposure, it would have been identified during analysis of the workers routine bioassays.</p> <p><b>CNSC staff recommend that this item can be closed; no further regulatory follow-up is required.</b></p>

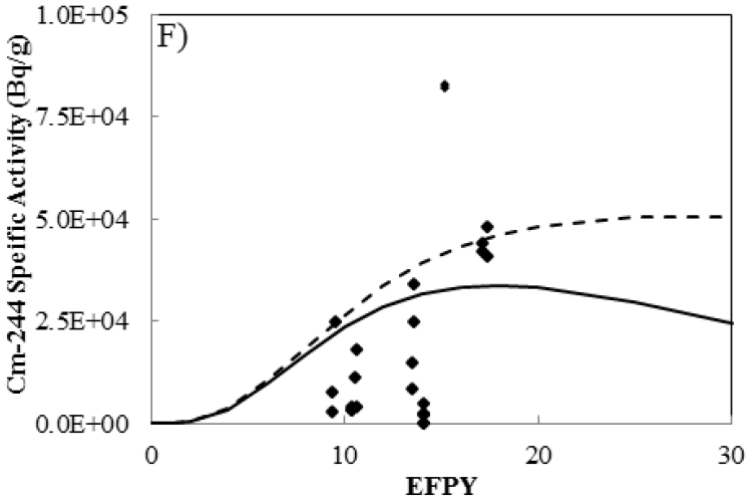
Item	Question	OPG Response	CNSC Staff Assessment
		<p>tube removal activities. Therefore our assessment is that C-14 particulate personal monitoring was not required. No C-14 dose has been assigned.</p> <p>Workplace smear samples were taken in the RWPB and analyzed for C-14 (Enclosure 2). Results were less than 0.42 Bq/smear. These results support the assessment that C-14 monitoring was not required.</p> <p>Based on the above, OPG believes that no enhancements to current processes related to monitoring workers for particulate C-14 exposure in the RWPB are required.</p>	
ii.	<p>Has <b>OPG</b> considered the contribution of <i>tritium</i> to the refurbishment workers' inhalation dose from the Feb 2018 event?</p>	<p>OPG always considers the contribution of tritium to radiation exposures of workers at our nuclear plants, and we have a robust tritium dosimetry program.</p> <p>OPG had considered the contribution of tritium while ascertaining total assignable dose to the refurbishment workers involved in the February 2018 event. As part of the follow up, both workers submitted urine bioassays for analysis. Results for both workers indicated tritium concentrations below the derived recording level of 18.5 kBq/L (0.5 µCi/L); thus no tritium committed dose was assigned. Routine bioassay samples submitted as part of the bioassay program were also well below the derived recording level.</p> <p>Primary Heat Transport System (PHTS) components such as the pressure tubes and calandria tubes are dried prior to removal, hence the liquid D2O and tritium vapour hazard is significantly minimized. Airborne tritium surveys in the Retube Waste Processing Building (RWPB) are performed as part of the radiation hazard survey program, and routinely results are 0 MPCa, and none above 0.1 MPCa.</p>	<p><b>CNSC staff are satisfied with the OPG response.</b></p> <p>Specifically, the monitoring of tritium was confirmed, and that Primary Heat Transport (PHT) components were dried prior to removal and RWPB processing should have mitigated the tritium risk. OPG's airborne monitoring within the RWPB did not identify elevated readings. Routine bioassay monitoring of the RWPB workers revealed no recordable tritium exposure. Follow-up bioassays collected from the affected workers were below recording levels.</p> <p><b>CNSC staff recommend that this item can be closed; no regulatory follow-up is required.</b></p>



Item	Question	OPG Response	CNSC Staff Assessment
		<p>In conclusion, there was no appreciable tritium source term to cause an exposure, the workers were monitored for tritium, and no recordable tritium exposure occurred, therefore no tritium dose was assigned. OPG believes that additional enhancements to current processes related to monitoring workers for tritium exposure in the RWPB are not required.</p>	
iii.	<p>The contradictory claims by <b>OPG</b> as to whether or not the pressure tube waste container being processed in the RWPB at the time of the exposure incident was <u>the first</u> such container, <u>needs to be resolved</u>.</p>	<p>OPG appreciates that the wording used to verbally describe the sequence of events may have been unclear at times.</p> <p>OPG would like to clarify the following points:</p> <ul style="list-style-type: none"> <li>• The RWPB tooling involves two independent and duplicate Processing Lines (Line #1 and Line #2).</li> <li>• The Darlington Storage Overpack (DSO) containing pressure tube coupons which was the source for the February event was the first one for Line #2, and the second processed in the RWPB.</li> <li>• The first DSO processed in the RWPB was processed on Line #1, and no adverse contamination levels were measured.</li> <li>• The second DSO processed in the RWPB was processed on Line #2. The event occurred during the lidding operations of this DSO.</li> </ul> <p>The investigation did not identify any need to enhance the engineering barriers or controls. However, the radiation protection monitoring that was performed was not to expectations, and corrective actions were established through the corrective action process, to improve monitoring and oversight.</p>	<p><b>CNSC staff are satisfied with the OPG response.</b></p> <p>Specifically, OPG’s confirmation that the affected Dry Storage Overpack/Retube Waste Container (DSO/RWC) was the first Pressure Tube (PT) container processed on line #2, and the second PT container processed in the Waste Tooling System (WTS) aligns with CNSC reactive inspection findings (March 2018).</p> <p>During the conduct of the reactive inspection, CNSC inspectors have confirmed that:</p> <ul style="list-style-type: none"> <li>• The first DSO processed in the RWPB was processed on Line #1, and no adverse contamination levels were measured.</li> <li>• The second DSO processed in the RWPB was processed on Line #2. The event occurred during the lidding operations of this DSO.</li> </ul> <p><b>CNSC staff recommend that the issue be closed; regulatory follow-up was completed in the form of a reactive inspection.</b></p>

Item	Question	OPG Response	CNSC Staff Assessment
iv.	<p>Could <b>OPG</b> justify the claim that it was <i>not anticipated</i> that high levels of contamination existed in the RWPB near the VRS and that it did not expect the motion of the lids would result in high levels of contamination being introduced to the lidding area?</p>	<p>On the contrary, in the planning for the Refurbishment Project, elevated contamination levels were anticipated by OPG during the lidding process, which is the primary reason that dedicated robust enclosures were constructed around the hardware stations for containing and controlling the spread of contamination.</p> <p>In addition to the engineered barriers, an administrative barrier was implemented in anticipation of potential contamination level changes. The procedure required a Radiation Protection Coordinator to perform a survey for loose contamination between the fastening of the inner and outer lids.</p> <p>The OPG radiation protection program elements for monitoring and controlling the hazards to protect workers is sound. As part of the OPG investigation, opportunities were identified to enhance the application of the process to ensure staff recognized good pre-job briefing techniques and what types of surveys would be required.</p>	<p><b>CNSC staff are satisfied with the OPG response.</b></p> <p>Unanticipated high levels of loose contamination would have been a concern to CNSC staff; however, OPG did provide evidence to demonstrate that it did anticipate such a hazard, and that the program and procedures were developed to manage the hazard.</p> <p>According to OPG’s Radiation Protection Execution Guide for Unit 2 Pressure Tube Processing, it was anticipated that the processing of pressure tubes in the RWPB will generate high levels of contamination, and loose contamination will yield Alpha Level III conditions.</p> <p>During the conduct of the reactive inspection, OPG demonstrated to CNSC’s inspectors that elevated contamination levels were anticipated. OPG stated that radiation hazard surveys conducted in the RWPB conducted prior to the Pressure Tube processing had indicated that it would be safe to proceed with lidding activities without respiratory protection. The first DSO processed on Line #1 was conducted in plastic suits; with the surveys performed ‘validating’ that it would be safe to continue the work without respiratory protection.</p> <p><b>CNSC staff recommend that this item be closed; regulatory follow-up was completed through the conduct of the reactive inspection.</b> In addition, CNSC staff will perform focused oversight of the WTS once the RWPB operations resume with the next Unit 3 refurbishment.</p>
v.	<p>Was <b>OPG</b> not aware of the valuable OPEX from Point</p>	<p>OPG was fully aware of the OPEX from Point Lepreau’s contamination event in 2009. Additionally, OPG performed benchmarking at Bruce Power in 2013 with a focus on refurbishment OPEX, including tooling performance.</p>	<p><b>CNSC staff are satisfied with OPG’s response.</b></p> <p>Failure of OPG to consult OPEX and implement lessons-learned would be a concern to CNSC staff; however, OPG has provided sufficient evidence to demonstrate that this was</p>

Item	Question	OPG Response	CNSC Staff Assessment
	Lepreau's 2009 discovery of high levels of alpha contamination associated with the operation of a pressure tube waste VRS?	<p>Elevated contamination (both beta/gamma and alpha) was anticipated and OPEX from Point Lepreau and Bruce Power was incorporated into the design of the DNGS Volume Reduction System (VRS). The Darlington system features a higher degree of remote and automated operations along with a more robust containment system and shielding around the VRS Press itself (where volume reduction takes place). The primary design target was to control contamination at the source and this was largely successful, as is evident from surveys conducted around the VRS itself (on the Waste Tooling Platform) and on the flasks.</p> <p>Although OPG believes that no additional enhancements to the engineering processes are required, OPG has revised the Radiation Exposure Permit for this work to incorporate the OPEX from our February 2018 event.</p>	<p>not the case with respect to the construction and operation of the WTS (or VRS).</p> <p>In addition to OPG's response, it is noted that the RWPB's WTS are located within an enclosure in order to contain contamination. As well, the WTS design includes enclosures over the lidding stations to further assist with contamination control. Discussions with OPG Health Physics (HP) staff during the CNSC reactive inspection (March 2018) revealed that these lidding station enclosures were added to the WTS design by the equipment manufacturer at the express request of OPG HP based on review of OPEX pertaining to operation of Point Lepreau and Bruce Power VRS systems.</p> <p>As well, during the CNSC Reactive Inspection (March 2018), CNSC staff verified that for significant radiological work activities within the RWPB, the OPG HPs had written Radiation Protection Execution Guides (RPEGs). For the WTS processing activities, these incorporated OPEX from the refurbishments conducted at the Point Lepreau, Bruce, Wolsong (Republic of Korea) and Embalse (Argentina) CANDU-type nuclear power plants.</p> <p><b>CNSC staff recommend that this item can be closed; no regulatory follow-up is required.</b></p>
vi.	Does <b>OPG</b> have reliable measurements of <i>the inventory of Cm-244</i> in its pressure tube wastes?	<p>OPG has an active waste characterization program, including pressure tube measurements and Darlington End Fitting and Liner Tube data. A partial summary of the CANDU pressure tube data analysis was published (3rd Canadian Conference on Nuclear Waste Management, Decommissioning and Environmental Restoration Ottawa Marriott Hotel, Ottawa, ON, Canada, September 11-14, 2016. Measurements, from several CANDU units, indicate that Cm-244 is present in significant amounts in pressure tube material).</p>	<p>While OPG has provided some amount of assurance that it has in the past and continues in the present to characterize the CANDU pressure tubes (PTs), and that these activities have included Cm-244, <b>OPG's response has not fully addressed the question.</b></p> <p>CNSC staff provide the following additional details:</p> <p>CNSC staff note that OPG's response references published literature and not an internal report. Cm-244 can be released from the fuel into the Primary Heat Transport (PHT) system when a fuel defects. The non-volatile radionuclides quickly plate out on the first</p>

Item	Question	OPG Response	CNSC Staff Assessment
		<p>OPG continues to conduct measurements to increase the extent of its waste characterization database. The included graphic shows a general distribution of Cm-244 specific activity vs Equivalent Full Power Years for various CANDU units.</p>  <p>The figure is a scatter plot labeled 'F)'. The vertical axis is labeled 'Cm-244 Specific Activity (Bq/g)' and has major tick marks at 0.0E+00, 2.5E+04, 5.0E+04, 7.5E+04, and 1.0E+05. The horizontal axis is labeled 'EFPY' and has major tick marks at 0, 10, 20, and 30. There are approximately 15 data points represented by small black diamonds. A dashed line represents a trend, starting at (0,0), rising to a peak of about 5.0E+04 Bq/g at 20 EFPY, and then slightly declining. Another solid line shows a similar trend but lower, peaking at about 3.5E+04 Bq/g. The data points are widely scattered, with one notable outlier at approximately (15, 8.5E+04).</p>	<p>cold surface they interact with, specifically in this case the pressure tubes. The quantities are very specific to the fuel defect, the length of time the defect stays in core and the size of the defect. A correlation between Effective Full Power Year (EFPY) and Cm-244 would at best be a very rough correlation and not necessarily a good fit for all CANDU plants given that fuel performance/defect rates differ among them. In these situations direct measurements are the most reliable data source - see also Item vii regarding the application of the ALARA principle.</p> <p>In their review of Enclosure 2 (while not cited in OPG’s response to this question), CNSC staff note that 10 samples were collected specifically within or adjacent to the two RWPB Hardware Stations; these samples were collected on February 20, 2018, shortly after the alpha-event (February 6, 2018). With respect to alpha-emitting nuclides analyzed for (Pu-238, Pu-239/240, Am-241, Cm-242 and Cm-243/244), Cm-243/244 is consistently the most prevalent in these 10 samples. OPG has not referenced these results in their answer to this question, despite having included them in the overall response.</p> <p>CNSC staff also note that Enclosure 1 contains considerable analysis, albeit of historical data (2010-2013), of theoretical models, and of sister stations/units, much of which speaks to the radionuclides that may be present and their anticipated relative ratios in various refurbishment work activities. OPG has not referenced this document (or its results) in their answer to this question, despite having included it in the overall response.</p> <p>During the conduct of the reactive inspection (March 2018), CNSC staff raised an enforcement action (DRPD-2018-008-AN02) requesting OPG to produce a radionuclide characterization specific to this new RWPB.</p> <p>During the conduct of the reactive inspection, CNSC staff found that OPG utilized historical plant data in the refurbishment planning of Darlington Unit 2 as well as past</p>

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			<p>analyses to develop its work plans. Conduct of work has relied on use of field instruments to verify safe work conditions. OPG has not implemented a planned/proactive collection of smears to validate the work planning assumptions, or to develop new baseline models in support of Darlington's refurbishment practices.</p> <p>While this matter is not an immediate health and safety concern, and given that CNSC had opened a related enforcement action, <b>CNSC staff recommend that this item can be closed.</b></p> <p>CNSC staff will continue to apply regulatory oversight to OPG's characterization of radiological work to ensure hazards are being identified and appropriate protective measures are being implemented. In addition, CNSC expectations in this regard have been strongly communicated to all licensees and will be enforced for all subsequent refurbishment projects or similar activities.</p>
vii.	Does <b>OPG</b> have any information on <i>the surface concentration of loose or fixed Cm-244</i> on its pressure tube wastes?	<p>Assuming this question is related to the Darlington Unit 2 pressure tubes extracted during Refurbishment, OPG provides the following response: OPG performed workplace monitoring by taking 'smears' (contamination samples) from various work surfaces, and these were analysed. These work place surfaces, that may have come into contact with removed reactor core components (e.g. pressure tubes and end fittings), are the surfaces that workers may be exposed to, not the PT directly. These workplace smears provide a good surrogate for the radionuclide composition of loose contamination on pressure tube wastes and are important for understanding potential worker exposures. It is not ALARA to get the workplace smears of the PT that were processed because of the extremely high dose rates on the pressure tubes themselves.</p> <p>Several smears taken within the Retube Waste Processing Building</p>	<p>As stated above, not all PTs are equally contaminated, and while the radionuclides may be similar from PT-to-PT (within Unit 2) the activity concentrations (e.g., Bq/cm<sup>2</sup>) will be different in each PT and so too will be the magnitude of the hazard posed by each PT.</p> <p>While historic data and workplace smears are suitable surrogates for estimating which radionuclide hazards may be encountered, CNSC staff expect that OPG have performed activities to verify and validate its assumptions and as well to quantify the magnitudes of the hazards, such that appropriate protective measures can be implemented. OPG responses do not demonstrate that they have a proactive approach to this matter, but rather have only taken reactive steps to respond to changing conditions if and when they arise.</p> <p>CNSC staff agree with OPG's statement that it would not be <b>ALARA</b> to smear the surface of the PTs within the calandria/vault; however, CNSC staff recommend that OPG should have sought out opportunities where smear samples of PT surfaces could have been</p>

Item	Question	OPG Response	CNSC Staff Assessment
		<p>(RWPB) were sent for radionuclide analysis (Enclosure 3). The smears were analyzed for the Cm 243/244 as well as other radioisotopes. Each smear was taken over 100 cm<sup>2</sup>. The average Cm-243/244 result was 15.2 Bq/smear; Processing Line #2 results up to 22.4 Bq/smear. These isotopes and the activity quantity were identified in the fecal samples for the workers, and Cm-244 was the isotope of interest used to bound the potential upper dose.</p> <p>The contamination monitoring processes that have been established by OPG, per our program, provide appropriate radionuclide characterization for hazard assessment and worker safety.</p> <p>OPG believes that additional enhancements to current processes are not required in this regard.</p>	<p>obtained in order to verify and validate radiological assumptions.</p> <p>Characterization of the radiation hazards (not only Cm-244) associated with refurbishment work was the subject of a March 2018 CNSC reactive inspection finding (Action Notice: DRPD-2018-008-AN02) as well as an element of the 12(2) Request made to OPG in June 2018.</p> <p>Given that this matter is not an immediate Health and Safety concern, and that CNSC has open enforcement actions related to it, <b>CNSC staff recommend that this item be closed</b>. However, regulatory oversight will continue to be performed until such time as OPG has suitably addressed the open enforcement items.</p> <p>In addition, CNSC staff will perform technical reviews of any direct measurements once available, as planned by either OPG or other licensees.</p>
viii.	<p>Would <b>OPG and/or the CNSC</b> provide an update on the status of its radionuclide inventory verification plan and in particular, report on how it has been applied to the validation of OPG's pressure tube waste inventory</p>	<p>OPG has an ongoing waste characterization program that has been in place for many years and has many years of data for radionuclides produced from CANDU Power Reactors.</p> <p>In response to a 2014 DGR Joint Review Panel information request, OPG provided a Waste Inventory Verification Plan (WIVP). This documented the direction and intent of OPG's waste characterization program. This program is incorporated into OPG's management system for waste characterization:</p> <ul style="list-style-type: none"> <li>• OPG's Nuclear Waste Management Program, W-PROG-WM-0001 provides direction on waste characterization.</li> <li>• OPG's Nuclear Waste Characterization Procedure (W-PROC-WM-0096) ensures OPG is consistent with international guidance and standards on nuclear waste characterization in the production of OPG's integrated and comprehensive L&amp;ILW</li> </ul>	<p><b>CNSC staff agree that this item is unrelated to the February 2018 alpha event at the RWPB.</b></p> <p>CNSC staff confirm that the DGR Joint Review Panel (JRP) requested that OPG provide information on a waste inventory verification plan. The object of this inventory verification plan (IVP) was to determine with reasonable confidence the level of radiation (i.e., radionuclides activities) in the low- and intermediate-level radioactive waste to be placed in the proposed DGR.</p> <p>The plan was put into place by OPG to ensure the information required to reduce uncertainties with the inventory are obtained before a licence to operate is sought, in case the DGR Project goes forward. As part of the JRP process, CNSC staff determined that the plan was sufficient to address CNSC recommendations with respect to inventory characterization.</p>

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		<p>characterization plan.</p> <p>OPG has a Waste Characterization Plan for Low- and Intermediate-Level Waste. This plan is the current implementation of the WIVP. It identifies L&amp;ILW characterization priorities for a nominal five year window, and provides a general schedule to guide the program. The plan is updated periodically taking into account the waste stream safety significance and results of sampling since the previous revision.</p> <p>The OPG waste characterization program has included measurements and analysis of pressure tubes. A partial summary of the data and analysis was published as a conference paper in 2016. Measurements and analysis have continued since then, per the Waste Characterization Plan. As part of our ongoing Waste Characterization program, the database will be re-assessed as additional data is accumulated.</p> <p>As part of our ongoing operations, the Waste Characterization procedure and plans are reviewed and updated on a periodic basis. OPG therefore believes that additional specific enhancement actions are not required as a result of this event.</p> <p>OPG notes that this item is not related to the events of February 2018.</p>	<p>[Ref: <i>CNSC. 2014. Deep Geologic Repository Project Joint Review Panel CNSC Staff Sufficiency Review for Information Package #13 – EIS-13-514. June 6, 2014. <a href="http://www.ceaa.gc.ca/050/documents/p17520/99375E.PDF">http://www.ceaa.gc.ca/050/documents/p17520/99375E.PDF</a>].</i></p> <p>OPG's request was for a licence to Prepare a Site and Construct the DGR; if such a licence were granted, CNSC staff will conduct compliance activities to verify that the results of OPG's waste characterization program, over the construction period, will meet the objectives established in the inventory verification plan (IVP). As part of an application for a licence to operate the DGR, OPG will be required to use all data collected in the safety assessments.</p> <p>In March 2018, CNSC staff conducted a Type II Inspection that focused on waste management at Darlington Nuclear Refurbishment – Unit 2 Construction Island and Retube Waste Processing Building. During this inspection, CNSC staff verified that OPG staff has implemented waste characterization practices in accordance with regulatory requirements.</p> <p>Regulatory oversight of waste characterization practices at OPG's waste management facilities will continue to ensure that all planned activities are acceptable to CNSC staff.</p>
ix.	<p>Could <b>OPG</b> provide data on the particle size of the alpha-contaminated dust inhaled by two refurbishment workers in</p>	<p>OPG did not perform particle sizing measurements.</p> <p>This was not necessary for several reasons. The dose assessment was performed as an inhalation exposure using the most conservative parameters, so performing a particle size measurement would at most confirm the dose, and potentially lower the dose assignment. However, the work involved in doing such measurements is not justified for such low doses, lower than Action Levels and much lower than Administrative Limits much less dose limits.</p>	<p><b>CNSC staff are satisfied with OPG's response.</b></p> <p>Given the low magnitude of the doses, the benefit associated with determining the particle size would not be warranted.</p> <p>Further to OPG's response, during the reactive inspection, CNSC staff confirmed that OPG's assessment followed its approved procedures. These procedures employ a 5 µm particle size, as per industry standards and International Commission on Radiological Protection (ICRP) recommendations.</p>

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	February 2018	<p>The dose assessment models used the default worst case parameters using ICRP and industry values of 5 µm AMAD. Particle size measurement is only required under industry guidance (and OPG past practice) if non-conservative particle sizes are proposed to be used for dose assessment.</p> <p>OPG therefore believes that no additional enhancements to current dose assessment procedures are required.</p>	<p>[Ref: International Commission on Radiological Protection , <i>Compendium of dose coefficients based on ICRP Publication 60</i>, Publication 119, Volume 41, Supplement 1, 2012]</p> <p>Given the level of conservatism applied in assigning the doses, CNSC staff consider the determination of particle-size for this event to be of no additional benefit.</p> <p><b>CNSC staff recommend that this item be closed; no regulatory follow-up is required.</b></p>
x.	<p>Could <b>OPG</b> provide information on the calculations it used to estimate the radiation dose to the two exposed refurbishment workers – in particular what particle size and lung solubility were assumed in OPG’s dosimetric calculations?</p>	<p>The inhalation dose calculations were performed based on fecal and urine bioassay measurements (actinides, beta emitters and gamma emitters), corroborated with whole body counting measurements for gamma emitters (Enclosure 4).</p> <p>Of actinides, only Cm-242 and 243/244 were detected in the fecal samples for both workers. For actinides the potential intake was derived using two methods:</p> <ul style="list-style-type: none"> <li>a) ICRP excretion functions, and</li> <li>b) WBC measurements for Zr/Nb-95 and the ratio of Zr/Nb-95 to actinides as determined from the fecal samples.</li> </ul> <p>To provide an upper bound on the potential dose, the highest of the two potential intake values was used to calculate the dose from actinides. The highest intake values were obtained from the WBC Zr/Nb-95 measurements along with the fecal sample Zr/Nb-95 ratio to actinides.</p> <p>The default ICRP inhalation parameters for particle size (5 µm AMAD) and lung solubility (type M for Cm-242 and 243/244) were used. The doses were sufficiently small that no additional work to refine dose</p>	<p><b>CNSC staff are satisfied with OPG’s response.</b></p> <p>CNSC staff have completed an independent calculation of the workers’ doses from the raw bioassay data, and obtained results that were in agreement with OPG’s.</p> <p><b>CNSC staff recommend that this item can be closed; no regulatory follow-up is required.</b></p>



Item	Question	OPG Response	CNSC Staff Assessment
		<p>assessment models (e.g. for less conservative parameters than the ICRP default parameters) were warranted for the final dose assignment.</p> <p>The selection of the solubility type for the dosimetry of the Darlington event is compatible with the findings of CNL Report No. 153-121110-REPT-080 Characterization of Alpha Radiation Hazards.</p> <p>OPG therefore believes that no additional enhancements to the current dose assessment processes are required.</p>	
xi.	<p>Is <b>OPG (and the CNSC)</b> aware of the findings of CNL's <i>Characterization of Alpha Radiation Hazards</i>, Report No. 153-121110-REPT-080, issued April 2016? Were these findings applied to the dosimetry of the Darlington event?</p>	<p>OPG is aware of the work presented in CNL Report No. 153-121110-REPT-080 Characterization of Alpha Radiation Hazards.</p> <p>The results of this work was reviewed by OPG.</p> <p>The selection of the solubility type for the dosimetry assessment of the Darlington event is compatible with the findings of this CNL report, specifically CM-244 solubility Type M when from irradiated UO2 fuel.</p> <p>As described in the answer to x) above, application of OPG's dosimetry program in the February 2018 event is compatible with this report.</p> <p>OPG therefore believes that additional enhancements to current alpha dose assessment procedures are not required.</p>	<p><b>CNSC staff are satisfied with OPG's response.</b></p> <p>CNSC staff are aware of the findings of this CNL report.</p> <p><b>CNSC staff recommend that this item can be closed; no regulatory follow-up is required.</b></p>

Item	Question	OPG Response	CNSC Staff Assessment
xii.	<p>Will <b>OPG</b> confirm that, starting in April 2017, alpha particulate was detected for the first time in Darlington's airborne emissions and has continued to be detected to this day, (Oct 2018)? And will OPG acknowledge that the source of these highly radiotoxic emissions is the dispersal of alpha-contaminated dust by refurbishment activities on Darlington Unit 2?</p>	<p>Detection of alpha particulate in airborne emissions is dependent on the laboratory use of very low level counting statistics. As continual improvement in technology occurs, OPG has periodically improved its detection capability for various radionuclide emissions.</p> <p>Prior to April 2, 2017, Darlington chemistry and environment lab analyses typically used 100 mBq (2.8 pCi) as the Minimum Detectable Activity (MDA) for its airborne stack samples. From April 2, 2017 and onwards the MDA of 6.7 mBq (0.183 pCi) was used, which improved identification of very low activity.</p> <p>The detected and reported levels of alpha particulates are orders of magnitude below our Derived Release Limits and were reported with a higher number than previously in April 2017 because of more sensitive detection.</p> <p>OPG makes environmental emission monitoring data publicly available on <a href="http://www.opg.com">www.opg.com</a>. Total weekly alpha airborne emissions average less than <math>2 \times 10^4</math> Bq for 2017 Q2 through 2018 Q1 inclusive, and were fairly constant prior to, during and post volume reduction activities in the RWPB, which ended the first week of March 2018. The airborne particulate emissions were measured and reported for the same time period. The airborne emissions for particulate remained constant or decreased somewhat during the volume reduction activities in the RWPB.</p> <p>Total emissions are a combination of all the activities at Darlington. The alpha airborne emissions cannot be attributed to a specific unit, work activity or to Refurbishment activities.</p>	<p><b>CNSC staff are satisfied with OPG's response</b></p> <p>Based on reviews of the information submitted by OPG as part of CNSC compliance oversight program, CNSC staff confirm that releases remain below the regulatory limits. Regulatory limits are set at a level that is protective of the environment and of human health.</p> <p>OPG has attributed this change to the improvement in their measurement capabilities; i.e., improvement in the Minimum Detectable Activity (MDA). Also, OPG has stated that the alpha releases to air are not attributed to a specific unit or work activity.</p> <p>Notably, CNSC staff have completed an Independent Environmental Monitoring Program (IEMP) campaign in the areas surrounding the Darlington facility in 2017; and particularly, determined that the gross alpha in surface water of all the collected samples were below the CNSC laboratory detection level of 0.1 Bq/L.</p> <p><b>CNSC staff recommend that this item can be closed;</b> and will continue to confirm that releases stay below regulatory limits.</p>

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		OPG therefore believes that additional enhancements to current processes related to release or detection of airborne alpha particulate are not required.	
xiii.	<p><b>OPG</b> has acknowledged that the RP Coordinator in charge of the safety of the two exposed refurbishment workers was “<i>weak in RP fundamentals due to lack of knowledge and experience</i>”. This begs a number of questions: Was the RP Coordinator qualified to do his (or her) job or not? If he <u>was</u> qualified, then how could he lack the knowledge and experience to do the job? But if</p>	<p>The OPG radiation protection training program applies the Systematic Approach to Training (SAT) model as expected by industry standards and CNSC expectations. The objective of the SAT model is to guide the development of performance-based training to support job performance requirements and individual development. OPG has an approved radiation protection training program which applies to Radiation Protection Coordinators (RPC) such as the RPC who provided protection to the two workers exposed in this event.</p> <p>OPG has thoroughly investigated the event, per our normal practice, and in doing so identified the causes of the event. Those causes are described in the documentation provided to CNSC.</p> <p>In response to the specific question at hand, the investigation determined that the radiation protection coordinator was trained and qualified according to OPG’s approved radiation protection training program.</p> <p>In March 2018, OPG initiated a common cause investigation (N-2018-05204) looking for common elements amongst several Station Condition Records. As part of the investigation, interviews were conducted with many RP staff to seek information related to all of these events, including the RWPB alpha uptake event. Immediate enhancement actions to our Radiation Technician training have been implemented based on the findings of the investigation. The corrective action plan has one open action to perform an effectiveness</p>	<p><b>CNSC staff are satisfied with OPG’s response.</b></p> <p>Placing an unqualified worker in charge of safety would be a concern to CNSC staff; however, OPG has provided sufficient evidence to demonstrate that this was not the case with respect to the RWPB.</p> <p>CNSC staff acknowledge that the activities performed within the RWPB at the time of the event were “first of a kind” for OPG, as no identical facility exists in Canada in which an Radiation Protection Coordinator (RPC) could obtain firsthand experience. Additionally, many of the RWPB RP Coordinators were newly qualified and lacked experience. CNSC staff concur with OPG that experience on first time activities cannot be taught solely in the classroom and is acquired through on the job experience.</p> <p>CNSC staff found that radiation protection coordinators are trained and qualified according to OPG’s approved radiation protection training program. CNSC staff found that the degradation occurred due to a difference between the overall responsibilities of the RPC and the normal day-to-day tasks normally encountered by the RPC.</p> <p><b>CNSC staff recommend that the issue be closed</b>, and any regulatory follow up has already been identified through conduct of the reactive inspection.</p>

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	<p>he was <i>not</i> qualified, <i>then why was he hired to do the job in the first place?</i></p>	<p>review of our corrective actions that is on track for completion January 13, 2019.</p> <p>Continuing training of RPCs is also ongoing to sustain and add proficiency to the workforce.</p> <p>The question quotes an excerpt of the findings of that investigation but does not provide any context. The essence of this finding, in combination with the fact that the worker was qualified, is this: Experience on first time activities cannot be taught solely in the classroom and requires some on the job experience. Therefore learning will occur as workers gain additional experience in new activities, e.g. the lidding operation on the two lines in the RWPB. Coming out of the event, there are enhancements OPG has made to improve the speed that learning can occur. We have developed dynamic learning activities to teach and give experience in our radiological work areas, for example to ensure staff recognize good pre-job briefing techniques and what types of surveys would be required for certain tasks. Additional surveys such as during-job and post-job were also reviewed as well as data management and documentation. Crew mentors have been developed and implemented to foster learning.</p>	
xiv.	<p>Does <b>OPG</b> stand by its claim that the performance of <i>two</i> workers, who were simply lidding some waste containers, could be on the refurbishment</p>	<p>OPG could not find a reference to support the question's statement that OPG has claimed that the job being performed by these workers was on critical path or that it was adversely affecting the schedule of the project.</p> <p>The fact is that the project's primary critical path activity at the time was the Pressure Tube removal and movement of Pressure Tube flasks activities in the Unit 2 reactor vault.</p>	<p><b>CNSC staff are satisfied with OPG's response.</b></p> <p>CNSC staff found that, as OPG stated, the RWPB Volume Reduction component could have impacted critical path if one, or both, of the process lines became unavailable to the point of all flask movements stopping, given the number of flasks available. However, this did not occur. CNSC staff found, during the conduct of the reactive inspection, that both the workers and the RPCs have the right to refuse and stop work. OPG also has processes in place to ensure an appropriate response in the event of a work stoppage or refusal due to radiological hazards.</p>

Item	Question	OPG Response	CNSC Staff Assessment
	<p>project's critical path, or could somehow adversely affect the schedule of a billion-dollar project?</p>	<p>As part of project schedule risk management, the flow of work in the RWPB Volume Reduction System processes was designed for two independent process lines. The ability for those lines to process incoming Pressure Tubes (in flasks received from Unit 2 Vault) was essential to the overall Pressure Tube removal process. The RWPB Volume Reduction component could have impacted critical path if one, or both, of the process lines became unavailable to the point of all flask movements stopping, due to the number of flasks available. However, this did not occur.</p> <p>Nonetheless, the investigation identified, and OPG recognized, the impact of production focus on RPCs, and for that reason took actions to address this issue.</p> <p>OPG has long had in place procedures that gives workers the right not just to refuse work but in fact to stop work. OPG procedure N-PROC-RA-0010 Facility Access And Working Rights (Radiological), Section 1.1.2 Right to Stop Work sets out the procedural requirement for a knowledgeable worker who observes another "worker performing or about to perform an activity in non-compliance with the RP Procedures" which includes: "Instruct the worker to stop work immediately and the worker shall comply."</p> <p>OPG has recognized in our investigation that with activities "near" the critical path there can be a perception that production targets must be met. To guard against the negative effects of perceived production pressure and reinforce that safety is always the overriding priority, an enhancement action was taken to author and issue A Stop Work Authority memorandum (NK38-CORR-09071-0705287) to all refurbishment RP staff, providing examples of radiological criteria and</p>	<p>CNSC staff note that OPG has issued the stop work memorandum on July 31 2018, which is six (6) months after the alpha contamination event. However, this memorandum was issued to reinforce expectations already set out in the OPG procedure for <i>Facility Access And Working Rights</i>.</p> <p><b>CNSC staff recommend that this item be closed.</b> CNSC staff will continue to ensure that OPG's primary concern remains the protection of workers against radiological hazards and their safety, irrespective of the project's schedule.</p>

Item	Question	OPG Response	CNSC Staff Assessment
		<p>expectations around response.</p> <p>The safety priority continues to be reinforced by RP oversight in the field, and Refurbishment line management.</p> <p>OPG therefore believes that no additional enhancement actions are required.</p>	