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Supplementary Information

Submission from Ontario Power Generation

In the Matter of

Darlington Nuclear Generation Station: Update on Alpha Contamination Event

Supplementary information following
questions asked during the February 20,
2019 Commission Meeting

Commission Meeting

February 20, 2019

Renseignements supplémentaires

Mémoire d'Ontario Power Generation

À l'égard de

Centrale nucléaire de Darlington : Mise à jour sur l'événement de contamination alpha

Renseignements supplémentaires suite à
des questions posées durant la réunion de
la Commission du 20 février 2019

Réunion de la Commission

Le 20 février 2019

From: MANLEY Robin -NUCLEAR
Sent: Thursday, March 14, 2019 12:52 PM
To: Leblanc, Marc (CNSC/CCSN)
Cc: Riendeau, Nathalie (CNSC/CCSN); TZOTZOS Katherine -C I O; MCGEE Anca -NUCLEAR; Levert, Louise (CNSC/CCSN); MALEK Imtiaz -NUCLEAR
Subject: Follow-up to OPG responses at the February 20, 2019 Commission meeting
Attachments: Kinectrics - C-14 smears (002) - Initial Report.pdf; Kinectrics - HTD - Report_18-12915 (002).pdf; RWPB PT Smears - Kinectrics - FinalReport_18-10425 (002).pdf

N-CORR-00531-19628

Mr. Marc Leblanc
Commission Secretary
CNSC

Below please find the follow-up information stemming from questions posed at the Feb.20.2019 Commission Meeting that OPG was unable to answer at that time.

In addition, I would like to confirm to the Secretariat that the following information and attached reports are approved for public release. Specifically, while there are names on the attached reports, these are not confidential information as they are not related to workers exposed to any workplace hazards. Rather, they are employees of one or other company involved in the preparation of the report itself; such information is not normally redacted in other publicly available OPG submissions or materials.

Commission Question: A Commission Member inquired as to why there was no Fe-55 results for a specific report enclosure with N-CORR-00531-19471, Enclosure 2 to OPG Letter, B. Duncan to N. Riendeau, "Response to Commission Direction re: DNGS RWSB Internal Contamination Event"

OPG Follow Up: The report in question "Kinectrics – C-14 smears (002) – Initial Report" ([attached](#)) is dated December 11, 2018, and was primarily intended to address questions regarding C-14 in the RWPB. A separate report dated December 20, 2018 for the smears focused only on the hard-to-detect isotopes, does have Fe-55 results and is [attached](#) "Kinectrics - HTD - Report_18-12915 (002)" for your information.

Commission Question: A Commission Member inquired why the Kinectrics report (RWPB PT Smears - Kinectrics - FinalReport_18-10425 (002), see p6 of 17, [attached](#)) had gross beta activity that was significantly different than the total of all the activity for the listed and identified isotopes.

OPG Follow Up: The relationship between gross alpha or beta counts to the total activity for listed identified isotopes is not a one-to-one relationship due to the radioactive properties, instruments and methods used to analyse samples.

Gross alpha (direct count) and gross beta (direct count) are measurements done directly on the sample (filter, smear) without sample preparation. Gross alpha and gross beta measurements are done by digesting the

sample, depositing a portion of the digested solution on a planchet, and counting, then taking into account dilution, etc – this is a more precise measurement as it eliminates self-absorption.

Some pure beta radionuclides (C-14, Fe-55, Ni-63, Pu-241) are measured by performing chemical separation then LSC counting. The weak beta emitters (Fe-55, Ni-63) would not show up in the gross beta activity measurements because of the very low counting efficiency.

Alpha emitters are measured by chemical separation, then electrodeposition, then alpha spectrometry. In general the sum of alpha emitter activities should be in the ballpark of the gross alpha activity, but alpha spectrometry is more precise than gross alpha counting.

Activity of radionuclides which have measurable gamma emissions is determined by gamma spectrometry with HPGe detectors. The total activity of the gamma emitters will differ from the gross beta activity mainly because gross beta counting uses a generic counting efficiency and yield (e.g., it can't account for energy dependence of beta counting efficiency, beta emission yield).

If CNSC has any further questions on this matter please contact the undersigned.

Thank you.

Robin Manley
VP Nuclear Regulatory Affairs and Stakeholder Relations
OPG



Analytical and Environmental Services Laboratory

Test Report

Report Number: 18-12914

Version: 1

Report Date: 11-Dec-2018

Attn: Monique Stuve
OPG Darlington NGS
PO Box 4000, Holt Road S
Bowmanville ON M5G 1X6
Canada

Purchase Order: AN00275560L1
Sample(s) received: 11-Dec-2018

Authorized by:

Ruwan Wijesundera, MASC

Scientist

Ruwan.Wijesundera@Kinectrics.com

Description: *EMERGENCY* Smear Samples.

| Sample ID | Sample Name | Matrix | Sample Point | Sample Date |
|------------|--------------------|--------|--------------|-------------|
| 18-12914-1 | Rails North Line 1 | Smear | | 06-Dec-2018 |
| 18-12914-2 | Floor North Line 1 | Smear | | 06-Dec-2018 |
| 18-12914-3 | Floor South Line 1 | Smear | | 06-Dec-2018 |

Special Instructions:

Version comment: Initial report.

This test report shall not be reproduced except in full without written authorization of Kinectrics Inc.



Analytical and Environmental Services Laboratory

Test Report

Report Number: 18-12914

Version: 1

Report Date: 11-Dec-2018

| Sample ID | Sample Name | Matrix | Sample Point | Sample Date |
|------------|--------------------|--------|--------------|-------------|
| 18-12914-1 | Rails North Line 1 | Smear | | 06-Dec-2018 |

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|----------------------------|--------|-----------|---------|------|-------------|-----------------------|---------------------------------|
| Gross Alpha (Direct Count) | 1.83 | Bq/sample | 0.4 | 0.02 | | 10-Dec-18 | Gas Flow Proportional Counting* |
| Gross Beta (Direct Count) | 295 | Bq/sample | 60 | 0.09 | | 10-Dec-18 | Gas Flow Proportional Counting* |
| Ag-110m | <1 | Bq/sample | NA | 1 | | 10-Dec-18 | Gamma Spectrometry* |
| Ce-141 | <0.5 | Bq/sample | NA | 0.5 | | 10-Dec-18 | Gamma Spectrometry* |
| Ce-144 | <2 | Bq/sample | NA | 2 | | 10-Dec-18 | Gamma Spectrometry* |
| Co-58 | <0.8 | Bq/sample | NA | 0.8 | | 10-Dec-18 | Gamma Spectrometry* |
| Co-60 | 202 | Bq/sample | 20 | 1 | | 10-Dec-18 | Gamma Spectrometry* |
| Cr-51 | <4 | Bq/sample | NA | 4 | | 10-Dec-18 | Gamma Spectrometry* |
| Cs-134 | 0.906 | Bq/sample | 0.4 | 0.4 | | 10-Dec-18 | Gamma Spectrometry* |
| Cs-137 | 3.6 | Bq/sample | 0.5 | 0.6 | | 10-Dec-18 | Gamma Spectrometry* |
| Eu-154 | <0.5 | Bq/sample | NA | 0.5 | | 10-Dec-18 | Gamma Spectrometry* |
| Eu-155 | <0.9 | Bq/sample | NA | 0.9 | | 10-Dec-18 | Gamma Spectrometry* |
| Fe-59 | <1 | Bq/sample | NA | 1 | | 10-Dec-18 | Gamma Spectrometry* |
| Mn-54 | 5.26 | Bq/sample | 0.6 | 0.8 | | 10-Dec-18 | Gamma Spectrometry* |
| Nb-94 | 25.7 | Bq/sample | 2 | 0.6 | | 10-Dec-18 | Gamma Spectrometry* |
| Nb-95 | 12 | Bq/sample | 0.9 | 6 | | 10-Dec-18 | Gamma Spectrometry* |
| Pm-148 | <4 | Bq/sample | NA | 4 | | 10-Dec-18 | Gamma Spectrometry* |
| Ru-103 | <0.7 | Bq/sample | NA | 0.7 | | 10-Dec-18 | Gamma Spectrometry* |
| Ru-106 | <5 | Bq/sample | NA | 5 | | 10-Dec-18 | Gamma Spectrometry* |
| Sb-124 | <0.9 | Bq/sample | NA | 0.9 | | 10-Dec-18 | Gamma Spectrometry* |
| Sb-125 | 13 | Bq/sample | 2 | 2 | | 10-Dec-18 | Gamma Spectrometry* |
| Sn-113 | <0.7 | Bq/sample | NA | 0.7 | | 10-Dec-18 | Gamma Spectrometry* |
| Zn-65 | <3 | Bq/sample | NA | 3 | | 10-Dec-18 | Gamma Spectrometry* |
| Zr-95 | 5.57 | Bq/sample | 0.8 | 1 | | 10-Dec-18 | Gamma Spectrometry* |
| C-14 | 0.42 | Bq/Sample | 0.2 | 0.3 | | 11-Dec-18 | LSC* |

| Sample ID | Sample Name | Matrix | Sample Point | Sample Date |
|------------|--------------------|--------|--------------|-------------|
| 18-12914-2 | Floor North Line 1 | Smear | | 06-Dec-2018 |

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|----------------------------|--------|-----------|---------|------|-------------|-----------------------|---------------------------------|
| Gross Alpha (Direct Count) | 0.37 | Bq/sample | 0.08 | 0.02 | | 10-Dec-18 | Gas Flow Proportional Counting* |
| Gross Beta (Direct Count) | 37.5 | Bq/sample | 8 | 0.09 | | 10-Dec-18 | Gas Flow Proportional Counting* |



Analytical and Environmental Services Laboratory

Test Report

Report Number: 18-12914

Version: 1

Report Date: 11-Dec-2018

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|---------------------|--------|-----------|---------|-----|-------------|-----------------------|---------------------|
| Ag-110m | <0.5 | Bq/sample | NA | 0.5 | | 10-Dec-18 | Gamma Spectrometry* |
| Ce-141 | <0.3 | Bq/sample | NA | 0.3 | | 10-Dec-18 | Gamma Spectrometry* |
| Ce-144 | <1 | Bq/sample | NA | 1 | | 10-Dec-18 | Gamma Spectrometry* |
| Co-58 | <0.3 | Bq/sample | NA | 0.3 | | 10-Dec-18 | Gamma Spectrometry* |
| Co-60 | 12.2 | Bq/sample | 0.9 | 0.3 | | 10-Dec-18 | Gamma Spectrometry* |
| Cr-51 | <2 | Bq/sample | NA | 2 | | 10-Dec-18 | Gamma Spectrometry* |
| Cs-134 | <0.2 | Bq/sample | NA | 0.2 | | 10-Dec-18 | Gamma Spectrometry* |
| Cs-137 | <0.2 | Bq/sample | NA | 0.2 | | 10-Dec-18 | Gamma Spectrometry* |
| Eu-154 | <0.3 | Bq/sample | NA | 0.3 | | 10-Dec-18 | Gamma Spectrometry* |
| Eu-155 | <0.5 | Bq/sample | NA | 0.5 | | 10-Dec-18 | Gamma Spectrometry* |
| Fe-59 | <0.6 | Bq/sample | NA | 0.6 | | 10-Dec-18 | Gamma Spectrometry* |
| Mn-54 | 0.261 | Bq/sample | 0.2 | 0.2 | | 10-Dec-18 | Gamma Spectrometry* |
| Nb-94 | 1.92 | Bq/sample | 0.2 | 0.2 | | 10-Dec-18 | Gamma Spectrometry* |
| Nb-95 | 0.778 | Bq/sample | 0.2 | 0.2 | | 10-Dec-18 | Gamma Spectrometry* |
| Pm-148 | <2 | Bq/sample | NA | 2 | | 10-Dec-18 | Gamma Spectrometry* |
| Ru-103 | <0.3 | Bq/sample | NA | 0.3 | | 10-Dec-18 | Gamma Spectrometry* |
| Ru-106 | <2 | Bq/sample | NA | 2 | | 10-Dec-18 | Gamma Spectrometry* |
| Sb-124 | <0.4 | Bq/sample | NA | 0.4 | | 10-Dec-18 | Gamma Spectrometry* |
| Sb-125 | 2.82 | Bq/sample | 0.6 | 0.5 | | 10-Dec-18 | Gamma Spectrometry* |
| Sn-113 | <0.3 | Bq/sample | NA | 0.3 | | 10-Dec-18 | Gamma Spectrometry* |
| Zn-65 | <0.7 | Bq/sample | NA | 0.7 | | 10-Dec-18 | Gamma Spectrometry* |
| Zr-95 | <0.4 | Bq/sample | NA | 0.4 | | 10-Dec-18 | Gamma Spectrometry* |
| C-14 | 0.4 | Bq/Sample | 0.2 | 0.3 | | 11-Dec-18 | LSC* |

| Sample ID | Sample Name | Matrix | Sample Point | Sample Date |
|------------|--------------------|--------|--------------|-------------|
| 18-12914-3 | Floor South Line 1 | Smear | | 06-Dec-2018 |

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|----------------------------|--------|-----------|---------|------|-------------|-----------------------|---------------------------------|
| Gross Alpha (Direct Count) | 0.55 | Bq/sample | 0.1 | 0.02 | | 10-Dec-18 | Gas Flow Proportional Counting* |
| Gross Beta (Direct Count) | 39.9 | Bq/sample | 8 | 0.09 | | 10-Dec-18 | Gas Flow Proportional Counting* |
| Ag-110m | <0.5 | Bq/sample | NA | 0.5 | | 10-Dec-18 | Gamma Spectrometry* |
| Ce-141 | <0.3 | Bq/sample | NA | 0.3 | | 10-Dec-18 | Gamma Spectrometry* |
| Ce-144 | <1 | Bq/sample | NA | 1 | | 10-Dec-18 | Gamma Spectrometry* |
| Co-58 | <0.3 | Bq/sample | NA | 0.3 | | 10-Dec-18 | Gamma Spectrometry* |
| Co-60 | 21.2 | Bq/sample | 2 | 0.3 | | 10-Dec-18 | Gamma Spectrometry* |
| Cr-51 | <2 | Bq/sample | NA | 2 | | 10-Dec-18 | Gamma Spectrometry* |
| Cs-134 | <0.2 | Bq/sample | NA | 0.2 | | 10-Dec-18 | Gamma Spectrometry* |



Analytical and Environmental Services Laboratory

Test Report

Report Number: 18-12914

Version: 1

Report Date: 11-Dec-2018

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|---------------------|--|-----------|---------|-----|-------------|-----------------------|---------------------|
| Cs-137 | 0.484 | Bq/sample | 0.2 | 0.2 | | 10-Dec-18 | Gamma Spectrometry* |
| Eu-154 | <0.3 | Bq/sample | NA | 0.3 | | 10-Dec-18 | Gamma Spectrometry* |
| Eu-155 | <0.5 | Bq/sample | NA | 0.5 | | 10-Dec-18 | Gamma Spectrometry* |
| Fe-59 | <0.6 | Bq/sample | NA | 0.6 | | 10-Dec-18 | Gamma Spectrometry* |
| Mn-54 | 0.748 | Bq/sample | 0.2 | 0.3 | | 10-Dec-18 | Gamma Spectrometry* |
| Nb-94 | 2.09 | Bq/sample | 0.3 | 0.3 | | 10-Dec-18 | Gamma Spectrometry* |
| Nb-95 | 0.764 | Bq/sample | 0.2 | 0.3 | | 10-Dec-18 | Gamma Spectrometry* |
| Pm-148 | <2 | Bq/sample | NA | 2 | | 10-Dec-18 | Gamma Spectrometry* |
| Ru-103 | <0.3 | Bq/sample | NA | 0.3 | | 10-Dec-18 | Gamma Spectrometry* |
| Ru-106 | <2 | Bq/sample | NA | 2 | | 10-Dec-18 | Gamma Spectrometry* |
| Sb-124 | <0.4 | Bq/sample | NA | 0.4 | | 10-Dec-18 | Gamma Spectrometry* |
| Sb-125 | 3.75 | Bq/sample | 0.6 | 0.5 | | 10-Dec-18 | Gamma Spectrometry* |
| Sn-113 | <0.3 | Bq/sample | NA | 0.3 | | 10-Dec-18 | Gamma Spectrometry* |
| Zn-65 | <0.7 | Bq/sample | NA | 0.7 | | 10-Dec-18 | Gamma Spectrometry* |
| Zr-95 | <0.4 | Bq/sample | NA | 0.4 | | 10-Dec-18 | Gamma Spectrometry* |
| C-14 | <0.4 | Bq/Sample | 0.2 | 0.4 | | 11-Dec-18 | LSC* |
| Comments | Even though Nb-95 is above the detection limit, the expected Zr-95 activity based upon activity ratios, is lower than the detection limit of the instrument. | | | | | | |

Instruments Used

| Name | Serial Number | Last Calibration | Calibration Due |
|---|---------------|------------------|-----------------|
| ENV-GAMMA-DET#1 | 53098 | 12-Sep-2018 | 12-Sep-2020 |
| ENV-GAMMA-DET#2 | 1953466 | 12-Sep-2018 | 12-Sep-2020 |
| Gross Alpha/Beta Counter | 527860 | 04-Oct-2018 | 04-Oct-2020 |
| Perkin Elmer Tri-Carb 2900TR (LSC for C-14) | DG11061765 | 07-Nov-2018 | 07-Nov-2020 |

The Analytical and Environmental Services Laboratory of Kinectrics is accredited by the Standards Council of Canada as conforming with ISO 17025.

The DL is the reported detection limit. All analytical data is subject to uncertainty, and is a function of the sample matrix, method and instrumental variations. As a general guideline, it can be expressed as +/-50% of the result at the detection limit (RDL) and approximately +/-10% of the result at greater than 10 times the RDL. Results in this report relate only to the items/samples tested and to all the items tested, as received. All tests are as defined by our understanding of customer requirements.

TECHNIQUE '*' = ISO 17025 accredited

TECHNIQUE 'x' = Indicates a modified test method

TECHNIQUE '+' = Indicates a sub-contracted analysis

All deliverables are provided as per our standard terms which can be found at the Terms of Business at:
<http://www.kinectrics.com/SiteCollectionDocuments/KinectricsStandardTCs.pdf>



Analytical and Environmental Services Laboratory

Test Report

Report Number: 18-12915

Version: 1

Report Date: 20-Dec-2018

Attn: Monique Stuve
OPG Darlington NGS
PO Box 4000, Holt Road S
Bowmanville ON M5G 1X6
Canada

Purchase Order: AN00275560L1
Sample(s) received: 11-Dec-2018

Authorized by:

Ruwan Wijesundera, MASC

Scientist

Ruwan.Wijesundera@Kinectrics.com

Description: Smear samples for analysis.

| Sample ID | Sample Name | Matrix | Sample Point | Sample Date |
|------------|--------------------|--------|--------------|-------------|
| 18-12915-1 | Rails North Line 1 | Smear | | 06-Dec-2018 |
| 18-12915-2 | Floor North Line 1 | Smear | | 06-Dec-2018 |
| 18-12915-3 | Floor South Line 1 | Smear | | 06-Dec-2018 |
| 18-12915-4 | QC package | QC | | 19-Dec-2018 |

Special Instructions:

Version comment: Initial report.

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Analytical and Environmental Services Laboratory

Test Report

Report Number: 18-12915

Version: 1

Report Date: 20-Dec-2018

| Sample ID | Sample Name | Matrix | Sample Point | Sample Date |
|------------|--------------------|--------|--------------|-------------|
| 18-12915-1 | Rails North Line 1 | Smear | | 06-Dec-2018 |

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|---------------------|-----------|-----------|---------|-------|-------------|-----------------------|---|
| Pu-238 | 0.02 | Bq/sample | 0.005 | 0.002 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-239+240 | 0.016 | Bq/sample | 0.004 | 0.005 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Am-241 | <0.2 | Bq/sample | NA | 0.2 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-242 | 0.018 | Bq/sample | 0.005 | 0.001 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-243+244 | 1.96 | Bq/sample | 0.24 | 0.001 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Fe-55 | 733 | Bq/sample | 81 | 0.9 | | 18-Dec-18 | Chemical Separation/LSC* |
| Ni-63 | 51.3 | Bq/sample | 5.6 | 1 | | 19-Dec-18 | Chemical Separation/LSC* |
| Sr-90 | <0.7 | Bq/sample | NA | 0.7 | | 13-Dec-18 | Chemical Separation & GFPC or LSC* |
| Pu-241 | <2.4 | Bq/sample | NA | 2.4 | | 19-Dec-18 | Chemical Separation/LSC |
| U-234 | 0.00011 | Bq/sample | 2E-5 | 5E-5 | | 18-Dec-18 | ICPMS* |
| U-235 | 0.0000488 | Bq/sample | 9.8E-7 | 2E-6 | | 18-Dec-18 | ICPMS* |
| U-238 | 0.000108 | Bq/sample | 2.2E-5 | 5E-5 | | 18-Dec-18 | ICPMS* |
| Y-91 | <10 | Bq/sample | NA | 10 | | 20-Dec-18 | Chemical Separation/LSC |
| Gross Alpha | 2.6 | Bq/sample | 0.8 | 0.2 | | 12-Dec-18 | Gas Flow Proportional Counting* |
| Gross Beta | 308 | Bq/sample | 62 | 1.1 | | 12-Dec-18 | Gas Flow Proportional Counting* |

| Sample ID | Sample Name | Matrix | Sample Point | Sample Date |
|------------|--------------------|--------|--------------|-------------|
| 18-12915-2 | Floor North Line 1 | Smear | | 06-Dec-2018 |

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|---------------------|--------|-----------|---------|-------|-------------|-----------------------|---|
| Pu-238 | <0.003 | Bq/sample | NA | 0.003 | | 13-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-239+240 | 0.028 | Bq/sample | 0.006 | 0.005 | | 13-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Am-241 | <0.04 | Bq/sample | NA | 0.04 | | 13-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-242 | <0.002 | Bq/sample | NA | 0.002 | | 13-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-243+244 | 0.388 | Bq/sample | 0.055 | 0.016 | | 13-Dec-18 | Chemical Separation/ Alpha Spectrometry* |



Analytical and Environmental Services Laboratory

Test Report

Report Number: 18-12915

Version: 1

Report Date: 20-Dec-2018

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|---------------------|------------|-----------|---------|------|-------------|-----------------------|------------------------------------|
| Fe-55 | 139 | Bq/sample | 15 | 0.7 | | 18-Dec-18 | Chemical Separation/LSC* |
| Ni-63 | 1.9 | Bq/sample | 0.4 | 0.6 | | 19-Dec-18 | Chemical Separation/LSC* |
| Sr-90 | <0.4 | Bq/sample | NA | 0.4 | | 13-Dec-18 | Chemical Separation & GFPC or LSC* |
| Pu-241 | <1.1 | Bq/sample | NA | 1.1 | | 19-Dec-18 | Chemical Separation/LSC |
| U-234 | 0.000135 | Bq/sample | 3E-5 | 5E-5 | | 18-Dec-18 | ICPMS* |
| U-235 | 0.00000592 | Bq/sample | 1.2E-6 | 2E-6 | | 18-Dec-18 | ICPMS* |
| U-238 | 0.000133 | Bq/sample | 2.7E-5 | 5E-5 | | 18-Dec-18 | ICPMS* |
| Y-91 | <10 | Bq/sample | NA | 10 | | 20-Dec-18 | Chemical Separation/LSC |
| Gross Alpha | 0.4 | Bq/sample | 0.1 | 0.2 | | 12-Dec-18 | Gas Flow Proportional Counting* |
| Gross Beta | 48.4 | Bq/sample | 9.7 | 1.4 | | 12-Dec-18 | Gas Flow Proportional Counting* |

| Sample ID | Sample Name | Matrix | Sample Point | Sample Date |
|------------|--------------------|--------|--------------|-------------|
| 18-12915-3 | Floor South Line 1 | Smear | | 06-Dec-2018 |

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|---------------------|------------|-----------|---------|-------|-------------|-----------------------|--|
| Pu-238 | 0.013 | Bq/sample | 0.004 | 0.003 | | 13-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-239+240 | 0.019 | Bq/sample | 0.005 | 0.004 | | 13-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Am-241 | <0.04 | Bq/sample | NA | 0.04 | | 13-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-242 | 0.006 | Bq/sample | 0.004 | 0.006 | | 13-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-243+244 | 0.548 | Bq/sample | 0.074 | 0.009 | | 13-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Fe-55 | 129 | Bq/sample | 14 | 0.6 | | 18-Dec-18 | Chemical Separation/LSC* |
| Ni-63 | 1.9 | Bq/sample | 0.4 | 0.5 | | 19-Dec-18 | Chemical Separation/LSC* |
| Sr-90 | <0.4 | Bq/sample | NA | 0.4 | | 13-Dec-18 | Chemical Separation & GFPC or LSC* |
| Pu-241 | <1.1 | Bq/sample | NA | 1.1 | | 19-Dec-18 | Chemical Separation/LSC |
| U-234 | 0.000072 | Bq/sample | 2E-5 | 5E-5 | | 18-Dec-18 | ICPMS* |
| U-235 | 0.00000312 | Bq/sample | 6.2E-7 | 2E-6 | | 18-Dec-18 | ICPMS* |
| U-238 | 0.000071 | Bq/sample | 1.4E-5 | 5E-5 | | 18-Dec-18 | ICPMS* |
| Y-91 | <10 | Bq/sample | NA | 10 | | 20-Dec-18 | Chemical Separation/LSC |
| Gross Alpha | 1.1 | Bq/sample | 0.3 | 0.1 | | 12-Dec-18 | Gas Flow Proportional Counting* |
| Gross Beta | 37.9 | Bq/sample | 7.6 | 1 | | 12-Dec-18 | Gas Flow Proportional Counting* |



Analytical and Environmental Services Laboratory

Test Report

Report Number: 18-12915

Version: 1

Report Date: 20-Dec-2018

| Sample ID | Sample Name | Matrix | Sample Point | Sample Date |
|------------|-------------|--------|--------------|-------------|
| 18-12915-4 | QC package | QC | | 19-Dec-2018 |

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|-----------------------------------|--------|-----------|---------|-------|-------------|-----------------------|---|
| Pu-238 QC | 0.215 | Bq/sample | 0.03 | 0.001 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-238 QC Expected | 0.212 | % | | | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-238 QC Recovery | 101.4 | Bq/sample | | | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-238 Replicate | 0.024 | Bq/sample | 0.005 | 0.002 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Replicate of 18-12915-1. | | | | | | | |
| Pu-238 Replicate Expected | 0.02 | Bq/sample | 0.005 | 0.002 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-238 Replicate % Difference | 20 | % | | | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-238 Method Blank | <0.001 | Bq/sample | NA | 0.001 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-239+240 QC | 0.217 | Bq/sample | 0.02 | 0.001 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-239+240 QC Expected | 0.212 | Bq/sample | | | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-239+240 QC Recovery | 102.4 | % | | | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-239+240 Replicate | 0.012 | Bq/sample | 0.002 | 0.005 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Replicate of 18-12915-1. | | | | | | | |
| Pu-239+240 Replicate Expected | 0.016 | Bq/sample | 0.004 | 0.005 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-239+240 Replicate % Difference | 25 | % | | | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-239+240 Method Blank | <0.001 | Bq/sample | NA | 0.001 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Am-241 QC | 0.206 | Bq/sample | 0.03 | 0.001 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Am-241 QC Expected | 0.212 | Bq/sample | | | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Am-241 QC Recovery | 97.2 | % | | | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Am-241 Replicate | <0.2 | Bq/sample | NA | 0.2 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Replicate of 18-12915-1. | | | | | | | |



Analytical and Environmental Services Laboratory

Test Report

Report Number: 18-12915

Version: 1

Report Date: 20-Dec-2018

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|--|--------|-----------|---------|-------|-------------|--------------------------|---|
| Am-241 Replicate Expected | <0.2 | Bq/sample | NA | 0.2 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Am-241 Replicate % Difference | 0 | % | | | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Replicate and replicate expected are both less than MDA. | | | | | | | |
| Am-241 Method Blank | <0.001 | Bq/sample | NA | 0.001 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-242 Replicate | 0.017 | Bq/sample | 0.005 | 0.001 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Replicate of 18-12915-1. | | | | | | | |
| Cm-242 Replicate Expected | 0.018 | Bq/sample | 0.005 | 0.001 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-242 Replicate % Difference | 5.6 | % | | | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-244 QC | 0.192 | Bq/sample | 0.03 | 0.001 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-244 QC Expected | 0.211 | Bq/sample | | | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-244 QC Recovery | 91 | % | | | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-244 Replicate | 1.92 | Bq/sample | 0.24 | 0.014 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Replicate of 18-12915-1. | | | | | | | |
| Cm-244 Replicate Expected | 1.96 | Bq/sample | 0.24 | 0.001 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-244 Replicate % Difference | 2 | % | | | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-244 Method Blank | <0.001 | Bq/sample | NA | 0.001 | | 14-Dec-18 | Chemical Separation/ Alpha Spectrometry* |
| Fe-55 QC | 32 | Bq/sample | 3.5 | 0.5 | | 18-Dec-18 | Chemical Separation/LSC* |
| Fe-55 QC Expected | 32.3 | Bq/sample | | | | 18-Dec-18 | Chemical Separation/LSC* |
| Fe-55 QC Recovery | 99.1 | % | | | | 18-Dec-18 | Chemical Separation/LSC* |
| Fe-55 Replicate | 715 | Bq/sample | 79 | 0.9 | | 18-Dec-18 | Chemical Separation/LSC* |
| Replicate of 18-12915-1. | | | | | | | |
| Fe-55 Replicate Expected | 733 | Bq/sample | 81 | 0.9 | | 18-Dec-18 | Chemical Separation/LSC* |
| Fe-55 Replicate % Difference | -2.5 | % | | | | 18-Dec-18 | Chemical Separation/LSC* |
| Fe-55 Method Blank | <0.5 | Bq/sample | NA | 0.5 | | 18-Dec-18 | Chemical Separation/LSC* |
| Ni-63 QC | 16.7 | Bq/sample | 1.8 | 0.5 | | 19-Dec-18 | Chemical Separation/LSC* |
| Ni-63 QC Expected | 16.4 | Bq/sample | | | | 19-Dec-18 | Chemical Separation/LSC* |
| Ni-63 QC Recovery | 101.8 | % | | | | 19-Dec-18 | Chemical Separation/LSC* |
| Ni-63 Replicate | 51.7 | Bq/sample | 5.7 | 1 | | 19-Dec-18 | Chemical Separation/LSC* |



Analytical and Environmental Services Laboratory

Test Report

Report Number: 18-12915

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Report Date: 20-Dec-2018

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|-------------------------------|--|-----------|---------|-----|-------------|--------------------------|------------------------------------|
| | Replicate of 18-12915-1. | | | | | | |
| Ni-63 Replicate Expected | 51.3 | Bq/sample | 5.6 | 1 | | 19-Dec-18 | Chemical Separation/LSC* |
| Ni-63 Replicate % Difference | 0.8 | % | | | | 19-Dec-18 | Chemical Separation/LSC* |
| Ni-63 QC Method Blank | <0.5 | Bq/sample | NA | 0.5 | | 19-Dec-18 | Chemical Separation/LSC* |
| Sr-90 QC | 26.7 | Bq/sample | | | | 13-Dec-18 | Chemical Separation & GFPC or LSC* |
| Sr-90 QC Expected | 29.1 | Bq/sample | | | | 13-Dec-18 | Chemical Separation & GFPC or LSC* |
| Sr-90 QC Recovery | 91.8 | % | | | | 13-Dec-18 | Chemical Separation & GFPC or LSC* |
| Sr-90 Replicate | <0.7 | Bq/sample | NA | 0.7 | | 13-Dec-18 | Chemical Separation & GFPC or LSC* |
| | Replicate of 18-12915-1. | | | | | | |
| Sr-90 Replicate Expected | <0.7 | Bq/sample | NA | 0.7 | | 13-Dec-18 | Chemical Separation & GFPC or LSC* |
| Sr-90 Replicate % Difference | 0 | % | | | | 13-Dec-18 | Chemical Separation & GFPC or LSC* |
| | Replicate and replicate expected are both less than MDA. | | | | | | |
| Sr-90 QC Method Blank | <0.5 | Bq/sample | NA | 0.5 | | 13-Dec-18 | Chemical Separation & GFPC or LSC* |
| Pu-241 QC | 74.4 | Bq/sample | | | | 19-Dec-18 | Chemical Separation/LSC |
| Pu-241 QC Expected | 74 | Bq/sample | | | | 19-Dec-18 | Chemical Separation/LSC |
| Pu-241 QC Recovery | 100.5 | % | | | | 19-Dec-18 | Chemical Separation/LSC |
| Pu-241 Method Blank | <0.5 | Bq/sample | NA | 0.5 | | 19-Dec-18 | Chemical Separation/LSC |
| Pu-241 Replicate | <2.4 | Bq/sample | NA | 2.4 | | 19-Dec-18 | Chemical Separation/LSC |
| | Replicate of 18-12915-1. | | | | | | |
| Pu-241 Replicate Expected | <2.4 | Bq/sample | NA | 2.4 | | 19-Dec-18 | Chemical Separation/LSC |
| Pu-241 Replicate % Difference | 0 | % | | | | 19-Dec-18 | Chemical Separation/LSC |
| | Replicate and replicate expected are both less than MDA. | | | | | | |
| Gross Alpha QC | 53.7 | Bq/sample | | | | 12-Dec-18 | Gas Flow Proportional Counting* |
| Gross Alpha QC Expected | 52.3 | Bq/sample | | | | 12-Dec-18 | Gas Flow Proportional Counting* |
| Gross Alpha QC Recovery | 102.7 | % | | | | 12-Dec-18 | Gas Flow Proportional Counting* |
| Gross Alpha Replicate | 2.4 | Bq/sample | 0.7 | 0.2 | | 12-Dec-18 | Gas Flow Proportional Counting* |



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| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|------------------------------------|--------|-----------|---------|-----|-------------|-----------------------|---------------------------------|
| Replicate of 18-12915-1. | | | | | | | |
| Gross Alpha Replicate Expected | 2.6 | Bq/sample | 0.8 | 0.2 | | 12-Dec-18 | Gas Flow Proportional Counting* |
| Gross Alpha Replicate % Difference | 7.7 | % | | | | 12-Dec-18 | Gas Flow Proportional Counting* |
| Gross Alpha Method Blank | <0.1 | Bq/sample | NA | 0.1 | | 12-Dec-18 | Gas Flow Proportional Counting* |
| Gross Beta QC | 64 | Bq/sample | | | | 12-Dec-18 | Gas Flow Proportional Counting* |
| Gross Beta QC Expected | 65.5 | Bq/sample | | | | 12-Dec-18 | Gas Flow Proportional Counting* |
| Gross Beta QC Recovery | 97.7 | % | | | | 12-Dec-18 | Gas Flow Proportional Counting* |
| Gross Beta Replicate | 311 | Bq/sample | 62 | 1.4 | | 12-Dec-18 | Gas Flow Proportional Counting* |
| Replicate of 18-12915-1. | | | | | | | |
| Gross Beta Replicate Expected | 308 | Bq/sample | 62 | 1.1 | | 12-Dec-18 | Gas Flow Proportional Counting* |
| Gross Beta Replicate % Difference | 1 | % | | | | 12-Dec-18 | Gas Flow Proportional Counting* |
| Gross Beta Method Blank | <0.1 | Bq/sample | NA | 0.1 | | 12-Dec-18 | Gas Flow Proportional Counting* |

Instruments Used

| Name | Serial Number | Last Calibration | Calibration Due |
|---|---------------|-----------------------|-----------------|
| Alpha Spectrometer 516-1 | 10224475 | 30-Apr-2018 | 30-Apr-2020 |
| Alpha Spectrometer 516-10 | 10224476 | 30-Apr-2018 | 30-Apr-2020 |
| Alpha Spectrometer 516-2 | 10224475 | 30-Apr-2018 | 30-Apr-2020 |
| Alpha Spectrometer 516-5 | 10222516 | 30-Apr-2018 | 30-Apr-2020 |
| Alpha Spectrometer 516-6 | 10222516 | 30-Apr-2018 | 30-Apr-2020 |
| Alpha Spectrometer 516-9 | 10224476 | 30-Apr-2018 | 30-Apr-2020 |
| Gross Alpha/Beta Counter | 527860 | 04-Oct-2018 | 04-Oct-2020 |
| Varian 820 ICPMS | IP0810M006 | Calibrated Before Use | |
| Perkin Elmer Tri-Carb 2900TR (LSC for Fe-55) | DG11061765 | 29-Mar-2018 | 29-Mar-2020 |
| Perkin Elmer Tri-Carb 2900TR (LSC for Ni-63) | DG11061765 | 05-Nov-2018 | 05-Nov-2020 |
| Perkin Elmer Tri-Carb 2900TR (LSC for Sr-90, Sr-89, Y-91) | DG11061765 | 02-Nov-2018 | 02-Nov-2020 |



Analytical and Environmental Services Laboratory

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Report Number: 18-12915

Version: 1

Report Date: 20-Dec-2018

The Analytical and Environmental Services Laboratory of Kinectrics is accredited by the Standards Council of Canada as conforming with ISO 17025.

The DL is the reported detection limit. All analytical data is subject to uncertainty, and is a function of the sample matrix, method and instrumental variations. As a general guideline, it can be expressed as +/-50% of the result at the detection limit (RDL) and approximately +/-10% of the result at greater than 10 times the RDL. Results in this report relate only to the items/samples tested and to all the items tested, as received. All tests are as defined by our understanding of customer requirements.

TECHNIQUE '*' = ISO 17025 accredited

TECHNIQUE 'x' = Indicates a modified test method

TECHNIQUE '+' = Indicates a sub-contracted analysis

All deliverables are provided as per our standard terms which can be found at the Terms of Business at:
<http://www.kinectrics.com/SiteCollectionDocuments/KinectricsStandardTCs.pdf>



Analytical and Environmental Services Laboratory

Test Report

Report Number: 18-10425

Version: 1

Report Date: 25-Apr-2018

Attn: Jeff Johansson
OPG Darlington NGS
PO Box 4000, Holt Road S
Bowmanville ON M5G 1X6
Canada

Purchase Order: AN00275560L1
Sample(s) received: 27-Mar-2018

Authorized by:

Rob Taylor
Senior Scientist - Radiochemistry
Rob.Taylor@kinectrics.com

Description: Smear Samples

| Sample ID | Sample Name | Matrix | Sample Point | Sample Date |
|-------------|--|--------|--------------|-------------|
| 18-10425-1 | RWPB Line #1 Hardware Station Platform | Smear | Darlington | 20-Feb-2018 |
| 18-10425-2 | RWPB Line #1 Hdwr Stn-Trolley floor area | Smear | Darlington | 20-Feb-2018 |
| 18-10425-3 | RWPB Line #1 Hdwr Stn-Trolley floor area | Smear | Darlington | 20-Feb-2018 |
| 18-10425-4 | RWPB DSO Decon Rubber Area Floor | Smear | Darlington | 20-Feb-2018 |
| 18-10425-5 | RWPB DSO Decon Rubber Area Floor | Smear | Darlington | 20-Feb-2018 |
| 18-10425-6 | RWPB Line #2 Hardware Station Platform | Smear | Darlington | 20-Feb-2018 |
| 18-10425-7 | RWPB Line #2 Hdwr Stn-Trolley floor area | Smear | Darlington | 20-Feb-2018 |
| 18-10425-8 | RWPB Line #2 Hdwr Stn-Trolley floor area | Smear | Darlington | 20-Feb-2018 |
| 18-10425-9 | RWPB DSO Line #2 lifting Laptop | Smear | Darlington | 20-Feb-2018 |
| 18-10425-10 | RWPB DSO Line #2 Lifting Laptop | Smear | Darlington | 20-Feb-2018 |

Special Instructions: Plase refer to PO 275560 for analysis details. NOTE: C-14 analysis not required on any smears.

Version comment: Initial report.

This test report shall not be reproduced except in full without written authorization of Kinectrics Inc.



Analytical and Environmental Services Laboratory

Test Report

Report Number: 18-10425

Version: 1

Report Date: 25-Apr-2018

| Sample ID | Sample Name | Matrix | Sample Point | Sample Date |
|------------|--|--------|--------------|-------------|
| 18-10425-1 | RWPB Line #1 Hardware Station Platform | Smear | Darlington | 20-Feb-2018 |

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|---|--------|--------|---------|-------|-------------|-----------------------|---|
| Gross Beta | 1240 | Bq/smp | 250 | 0.9 | | 28-Mar-18 | Gas Flow Proportional Counting* |
| Ag-110m | <3.8 | Bq/smp | NA | 3.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Ce-141 | <3 | Bq/smp | NA | 3 | | 26-Mar-18 | Gamma Spectrometry* |
| Ce-144 | 12.9 | Bq/smp | 3.5 | 5.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Co-58 | <2.9 | Bq/smp | NA | 2.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Co-60 | 539 | Bq/smp | 59.3 | 1.6 | | 26-Mar-18 | Gamma Spectrometry* |
| Cr-51 | <29.9 | Bq/smp | NA | 29.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Cs-134 | 7.7 | Bq/smp | 1.7 | 2.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Cs-137 | 15.3 | Bq/smp | 2 | 2.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-152 | <4.9 | Bq/smp | NA | 4.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-154 | <1.7 | Bq/smp | NA | 1.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-155 | <2.1 | Bq/smp | NA | 2.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Fe-59 | <5 | Bq/smp | NA | 5 | | 26-Mar-18 | Gamma Spectrometry* |
| Gd-153 | <2.8 | Bq/smp | NA | 2.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Hf-181 | <4.1 | Bq/smp | NA | 4.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Mn-54 | 43.7 | Bq/smp | 4.5 | 2.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Nb-94 | 83.6 | Bq/smp | 8.1 | 2.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Nb-95 | 880 | Bq/smp | 77.2 | 2.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Pm-148 | <907 | Bq/smp | NA | 907 | | 26-Mar-18 | Gamma Spectrometry* |
| Ru-103 | <4.5 | Bq/smp | NA | 4.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Ru-106 | <22.6 | Bq/smp | NA | 22.6 | | 26-Mar-18 | Gamma Spectrometry* |
| Sb-124 | <2.9 | Bq/smp | NA | 2.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Sb-125 | 7.6 | Bq/smp | 3.7 | 5.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Sc-46 | <3.4 | Bq/smp | NA | 3.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Sn-113 | <2.9 | Bq/smp | NA | 2.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Zn-65 | 10.8 | Bq/smp | 3.9 | 5.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Zr-95 | 391 | Bq/smp | 34.7 | 5.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Pu-238 | 0.051 | Bq/smp | 0.008 | 0.004 | | 06-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-239+240 | 0.047 | Bq/smp | 0.006 | 0.004 | | 06-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Am-241 | <0.033 | Bq/smp | NA | 0.033 | | 09-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Elevated MDA due to interference from Cm-244. | | | | | | | |
| Cm-242 | 0.342 | Bq/smp | 0.045 | 0.003 | | 09-Apr-18 | Chemical Separation/ Alpha Spectrometry* |



Analytical and Environmental Services Laboratory

Test Report

Report Number: 18-10425

Version: 1

Report Date: 25-Apr-2018

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|---------------------|----------|--------|---------|--------|-------------|-----------------------|---|
| Cm-243+244 | 12.8 | Bq/smp | 8.97 | 0.012 | | 09-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Fe-55 | 5630 | Bq/smp | 620 | 1.5 | | 11-Apr-18 | Chemical Separation/LSC* |
| Ni-63 | 14.1 | Bq/smp | 1.6 | 0.5 | | 10-Apr-18 | Chemical Separation/LSC* |
| Sr-90 | 4.4 | Bq/smp | 0.7 | 0.3 | | 04-Apr-18 | Chemical Separation & GFPC or LSC* |
| Pu-241 | 4.8 | Bq/smp | 1.1 | 0.9 | | 13-Apr-18 | Chemical Separation/LSC |
| U-234 | 0.000804 | Bq/smp | 0.0001 | 0.0006 | | 27-Mar-18 | ICPMS* |
| U-235 | <0.00006 | Bq/smp | NA | 6E-5 | | 27-Mar-18 | ICPMS* |
| U-238 | 0.000758 | Bq/smp | 0.0001 | 6E-5 | | 27-Mar-18 | ICPMS* |
| Y-91 | <10 | Bq/smp | NA | 10 | | 14-Apr-18 | Chemical Separation/LSC |
| Gross Alpha | 12.8 | Bq/smp | 3.2 | 0.3 | | 28-Mar-18 | Gas Flow Proportional Counting* |

| Sample ID | Sample Name | Matrix | Sample Point | Sample Date |
|------------|--|--------|--------------|-------------|
| 18-10425-2 | RWPB Line #1 Hdwr Stn-Trolley floor area | Smear | Darlington | 20-Feb-2018 |

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|----------------------------|--------|--------|---------|------|-------------|-----------------------|------------------------------------|
| Gross Alpha | 9 | Bq/smp | 2.7 | 0.3 | | 28-Mar-18 | Gas Flow Proportional Counting* |
| Gross Alpha (Direct Count) | 4 | Bq/smp | 1.2 | 0.1 | | 26-Mar-18 | Gas Flow Proportional Counting* |
| Gross Beta | 844 | Bq/smp | 169 | 0.8 | | 28-Mar-18 | Gas Flow Proportional Counting* |
| Gross Beta (Direct Count) | 531 | Bq/smp | 106 | 0.1 | | 26-Mar-18 | Gas Flow Proportional Counting* |
| Ag-110m | <2.4 | Bq/smp | NA | 2.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Ce-141 | <2.1 | Bq/smp | NA | 2.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Ce-144 | 8 | Bq/smp | 2 | 3.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Co-58 | <1.8 | Bq/smp | NA | 1.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Co-60 | 326 | Bq/smp | 20 | 1 | | 26-Mar-18 | Gamma Spectrometry* |
| Cr-51 | <19.3 | Bq/smp | NA | 19.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Cs-134 | 4.4 | Bq/smp | 0.9 | 1.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Cs-137 | 9.7 | Bq/smp | 1 | 1.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-152 | <3.2 | Bq/smp | NA | 3.2 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-154 | <1.2 | Bq/smp | NA | 1.2 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-155 | <1.7 | Bq/smp | NA | 1.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Fe-59 | <3.3 | Bq/smp | NA | 3.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Gd-153 | <2.1 | Bq/smp | NA | 2.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Hf-181 | <2.7 | Bq/smp | NA | 2.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Mn-54 | 23.7 | Bq/smp | 2 | 1.3 | | 26-Mar-18 | Gamma Spectrometry* |



Analytical and Environmental Services Laboratory

Test Report

Report Number: 18-10425

Version: 1

Report Date: 25-Apr-2018

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|---------------------|----------|--------|---------|--------|-------------|-----------------------|---|
| Nb-94 | 53.3 | Bq/smp | 3 | 1.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Nb-95 | 571 | Bq/smp | 30 | 1.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Pm-148 | <575 | Bq/smp | NA | 575 | | 26-Mar-18 | Gamma Spectrometry* |
| Ru-103 | <2.9 | Bq/smp | NA | 2.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Ru-106 | <13.2 | Bq/smp | NA | 13.2 | | 26-Mar-18 | Gamma Spectrometry* |
| Sb-124 | <2 | Bq/smp | NA | 2 | | 26-Mar-18 | Gamma Spectrometry* |
| Sb-125 | <3.3 | Bq/smp | NA | 3.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Sc-46 | <2.2 | Bq/smp | NA | 2.2 | | 26-Mar-18 | Gamma Spectrometry* |
| Sn-113 | <1.9 | Bq/smp | NA | 1.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Zn-65 | <3.7 | Bq/smp | NA | 3.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Zr-95 | 254 | Bq/smp | 10 | 3.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Pu-238 | 0.029 | Bq/smp | 0.009 | 0.011 | | 11-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-239+240 | <0.01 | Bq/smp | NA | 0.01 | | 11-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Am-241 | 0.086 | Bq/smp | 0.017 | 0.011 | | 06-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-242 | 0.125 | Bq/smp | 0.021 | 0.037 | | 06-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-243+244 | 10 | Bq/smp | 1.23 | 0.048 | | 06-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Fe-55 | 3270 | Bq/smp | 360 | 1.2 | | 11-Apr-18 | Chemical Separation/LSC* |
| Ni-63 | 25 | Bq/smp | 2.8 | 0.7 | | 10-Apr-18 | Chemical Separation/LSC* |
| Sr-90 | 2.8 | Bq/smp | 0.4 | 0.4 | | 04-Apr-18 | Chemical Separation & GFPC or LSC* |
| Pu-241 | 2.2 | Bq/smp | 0.51 | 1.3 | | 13-Apr-18 | Chemical Separation/LSC |
| U-234 | <0.0006 | Bq/smp | NA | 0.0006 | | 27-Mar-18 | ICPMS* |
| U-235 | <0.00006 | Bq/smp | NA | 6E-5 | | 27-Mar-18 | ICPMS* |
| U-238 | <0.00006 | Bq/smp | NA | 6E-5 | | 27-Mar-18 | ICPMS* |
| Y-91 | <10 | Bq/smp | NA | 10 | | 14-Apr-18 | Chemical Separation/LSC |

| Sample ID | Sample Name | Matrix | Sample Point | Sample Date |
|------------|--|--------|--------------|-------------|
| 18-10425-3 | RWPB Line #1 Hdwr Stn-Trolley floor area | Smear | Darlington | 20-Feb-2018 |

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|----------------------------|--------|--------|---------|-----|-------------|-----------------------|------------------------------------|
| Gross Alpha | 4 | Bq/smp | 1.2 | 0.3 | | 28-Mar-18 | Gas Flow Proportional Counting* |
| Gross Alpha (Direct Count) | 1.7 | Bq/smp | 0.51 | 0.1 | | 26-Mar-18 | Gas Flow Proportional Counting* |
| Gross Beta | 473 | Bq/smp | 95 | 0.9 | | 28-Mar-18 | Gas Flow Proportional Counting* |



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| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|---|--------|--------|---------|-------|-------------|-----------------------|---|
| Gross Beta (Direct Count) | 258 | Bq/smp | 52 | 0.1 | | 26-Mar-18 | Gas Flow Proportional Counting* |
| Ag-110m | <1.6 | Bq/smp | NA | 1.6 | | 26-Mar-18 | Gamma Spectrometry* |
| Ce-141 | <1.5 | Bq/smp | NA | 1.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Ce-144 | 3.4 | Bq/smp | 2 | 2.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Co-58 | <1.2 | Bq/smp | NA | 1.2 | | 26-Mar-18 | Gamma Spectrometry* |
| Co-60 | 229 | Bq/smp | 10 | 0.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Cr-51 | <13.4 | Bq/smp | NA | 13.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Cs-134 | 3.1 | Bq/smp | 0.6 | 0.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Cs-137 | 5.4 | Bq/smp | 0.6 | 0.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-152 | <2.1 | Bq/smp | NA | 2.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-154 | <0.8 | Bq/smp | NA | 0.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-155 | <1.3 | Bq/smp | NA | 1.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Fe-59 | <2.2 | Bq/smp | NA | 2.2 | | 26-Mar-18 | Gamma Spectrometry* |
| Gd-153 | <1.4 | Bq/smp | NA | 1.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Hf-181 | <1.9 | Bq/smp | NA | 1.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Mn-54 | 17 | Bq/smp | 1 | 0.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Nb-94 | 37.2 | Bq/smp | 2 | 0.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Nb-95 | 401 | Bq/smp | 20 | 1.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Pm-148 | <403 | Bq/smp | NA | 403 | | 26-Mar-18 | Gamma Spectrometry* |
| Ru-103 | <2.1 | Bq/smp | NA | 2.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Ru-106 | <9.6 | Bq/smp | NA | 9.6 | | 26-Mar-18 | Gamma Spectrometry* |
| Sb-124 | <1.3 | Bq/smp | NA | 1.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Sb-125 | 4 | Bq/smp | 1 | 2.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Sc-46 | <1.4 | Bq/smp | NA | 1.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Sn-113 | <1.3 | Bq/smp | NA | 1.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Zn-65 | <2.8 | Bq/smp | NA | 2.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Zr-95 | 178 | Bq/smp | 8 | 2.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Pu-238 | 0.019 | Bq/smp | 0.006 | 0.01 | | 05-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-239+240 | <0.01 | Bq/smp | NA | 0.01 | | 05-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Am-241 | <0.028 | Bq/smp | NA | 0.028 | | 05-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Elevated MDA due to interference from Cm-244. | | | | | | | |
| Cm-242 | 0.087 | Bq/smp | 0.022 | 0.008 | | 05-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-243+244 | 3.08 | Bq/smp | 0.388 | 0.003 | | 05-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Fe-55 | 1410 | Bq/smp | 160 | 0.8 | | 11-Apr-18 | Chemical Separation/LSC* |
| Ni-63 | 15.2 | Bq/smp | 1.7 | 0.6 | | 10-Apr-18 | Chemical Separation/LSC* |



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| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|---------------------|----------|--------|---------|--------|-------------|-----------------------|------------------------------------|
| Sr-90 | 1.1 | Bq/smp | 0.2 | 0.3 | | 04-Apr-18 | Chemical Separation & GFPC or LSC* |
| Pu-241 | 1.4 | Bq/smp | 0.33 | 1.3 | | 13-Apr-18 | Chemical Separation/LSC |
| U-234 | <0.0006 | Bq/smp | NA | 0.0006 | | 27-Mar-18 | ICPMS* |
| U-235 | <0.00006 | Bq/smp | NA | 6E-5 | | 27-Mar-18 | ICPMS* |
| U-238 | 0.000366 | Bq/smp | 5E-5 | 6E-5 | | 27-Mar-18 | ICPMS* |
| Y-91 | <10 | Bq/smp | NA | 10 | | 14-Apr-18 | Chemical Separation/LSC |

| Sample ID | Sample Name | Matrix | Sample Point | Sample Date |
|------------|----------------------------------|--------|--------------|-------------|
| 18-10425-4 | RWPB DSO Decon Rubber Area Floor | Smear | Darlington | 20-Feb-2018 |

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|----------------------------|--------|--------|---------|------|-------------|-----------------------|---------------------------------|
| Gross Alpha | 29.2 | Bq/smp | 7.3 | 0.3 | | 28-Mar-18 | Gas Flow Proportional Counting* |
| Gross Alpha (Direct Count) | 25.9 | Bq/smp | 6.5 | 0.1 | | 26-Mar-18 | Gas Flow Proportional Counting* |
| Gross Beta | 4230 | Bq/smp | 850 | 0.9 | | 28-Mar-18 | Gas Flow Proportional Counting* |
| Gross Beta (Direct Count) | 3370 | Bq/smp | 670 | 0.1 | | 26-Mar-18 | Gas Flow Proportional Counting* |
| Ag-110m | <6.1 | Bq/smp | NA | 6.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Ce-141 | <4.9 | Bq/smp | NA | 4.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Ce-144 | 32.9 | Bq/smp | 6 | 9.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Co-58 | <4.7 | Bq/smp | NA | 4.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Co-60 | 2250 | Bq/smp | 300 | 2.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Cr-51 | <48.8 | Bq/smp | NA | 48.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Cs-134 | 23.1 | Bq/smp | 3 | 3.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Cs-137 | 47.5 | Bq/smp | 5 | 3.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-152 | <7.4 | Bq/smp | NA | 7.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-154 | <2.7 | Bq/smp | NA | 2.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-155 | <3.7 | Bq/smp | NA | 3.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Fe-59 | <8 | Bq/smp | NA | 8 | | 26-Mar-18 | Gamma Spectrometry* |
| Gd-153 | <4.5 | Bq/smp | NA | 4.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Hf-181 | <6.7 | Bq/smp | NA | 6.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Mn-54 | 135 | Bq/smp | 10 | 3.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Nb-94 | 382 | Bq/smp | 40 | 3.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Nb-95 | 3720 | Bq/smp | 300 | 5.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Pm-148 | <1470 | Bq/smp | NA | 1470 | | 26-Mar-18 | Gamma Spectrometry* |
| Ru-103 | <7.4 | Bq/smp | NA | 7.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Ru-106 | <34.6 | Bq/smp | NA | 34.6 | | 26-Mar-18 | Gamma Spectrometry* |



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| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|---|----------|--------|---------|--------|-------------|-----------------------|---|
| Sb-124 | <4.6 | Bq/smp | NA | 4.6 | | 26-Mar-18 | Gamma Spectrometry* |
| Sb-125 | 23.4 | Bq/smp | 6 | 9.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Sc-46 | <5.4 | Bq/smp | NA | 5.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Sn-113 | <4.8 | Bq/smp | NA | 4.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Zn-65 | 48 | Bq/smp | 8 | 9.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Zr-95 | 1660 | Bq/smp | 200 | 8.6 | | 26-Mar-18 | Gamma Spectrometry* |
| Pu-238 | 0.134 | Bq/smp | 0.029 | 0.014 | | 09-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-239+240 | 0.076 | Bq/smp | 0.019 | 0.012 | | 09-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Am-241 | <0.091 | Bq/smp | NA | 0.091 | | 09-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Elevated MDA due to interference from Cm-244. | | | | | | | |
| Cm-242 | 0.789 | Bq/smp | 0.125 | 0.011 | | 09-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-243+244 | 25.9 | Bq/smp | 3.18 | 0.005 | | 09-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Fe-55 | 13000 | Bq/smp | 1400 | 2.3 | | 11-Apr-18 | Chemical Separation/LSC* |
| Ni-63 | 220 | Bq/smp | 24 | 0.6 | | 10-Apr-18 | Chemical Separation/LSC* |
| Sr-90 | 12.1 | Bq/smp | 2 | 0.3 | | 04-Apr-18 | Chemical Separation & GFPC or LSC* |
| Pu-241 | 10.9 | Bq/smp | 1.4 | 1.2 | | 13-Apr-18 | Chemical Separation/LSC |
| U-234 | <0.0006 | Bq/smp | NA | 0.0006 | | 27-Mar-18 | ICPMS* |
| U-235 | <0.00006 | Bq/smp | NA | 6E-5 | | 27-Mar-18 | ICPMS* |
| U-238 | 0.000102 | Bq/smp | 2E-5 | 6E-5 | | 27-Mar-18 | ICPMS* |
| Y-91 | <10 | Bq/smp | NA | 10 | | 18-Apr-18 | Chemical Separation/LSC |

| Sample ID | Sample Name | Matrix | Sample Point | Sample Date |
|------------|----------------------------------|--------|--------------|-------------|
| 18-10425-5 | RWPB DSO Decon Rubber Area Floor | Smear | Darlington | 20-Feb-2018 |

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|----------------------------|--------|--------|---------|-----|-------------|-----------------------|------------------------------------|
| Gross Alpha | 1.1 | Bq/smp | 0.3 | 0.3 | | 28-Mar-18 | Gas Flow Proportional Counting* |
| Gross Alpha (Direct Count) | 0.6 | Bq/smp | 0.18 | 0.1 | | 26-Mar-18 | Gas Flow Proportional Counting* |
| Gross Beta | 137 | Bq/smp | 27 | 0.8 | | 28-Mar-18 | Gas Flow Proportional Counting* |
| Gross Beta (Direct Count) | 82.5 | Bq/smp | 16.5 | 0.1 | | 26-Mar-18 | Gas Flow Proportional Counting* |
| Ag-110m | <1.2 | Bq/smp | NA | 1.2 | | 26-Mar-18 | Gamma Spectrometry* |
| Ce-141 | <0.9 | Bq/smp | NA | 0.9 | | 26-Mar-18 | Gamma Spectrometry* |



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| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|---------------------|--|--------|---------|-------|-------------|-----------------------|---|
| Ce-144 | <1.7 | Bq/smp | NA | 1.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Co-58 | <0.9 | Bq/smp | NA | 0.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Co-60 | 58.1 | Bq/smp | 4 | 0.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Cr-51 | <9.2 | Bq/smp | NA | 9.2 | | 26-Mar-18 | Gamma Spectrometry* |
| Cs-134 | <0.7 | Bq/smp | NA | 0.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Cs-137 | 1.9 | Bq/smp | 0.4 | 0.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-152 | <1.5 | Bq/smp | NA | 1.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-154 | <0.5 | Bq/smp | NA | 0.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-155 | <0.9 | Bq/smp | NA | 0.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Fe-59 | <1.6 | Bq/smp | NA | 1.6 | | 26-Mar-18 | Gamma Spectrometry* |
| Gd-153 | <1.1 | Bq/smp | NA | 1.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Hf-181 | <1.1 | Bq/smp | NA | 1.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Mn-54 | 3.8 | Bq/smp | 0.5 | 0.6 | | 26-Mar-18 | Gamma Spectrometry* |
| Nb-94 | 8.9 | Bq/smp | 0.8 | 0.6 | | 26-Mar-18 | Gamma Spectrometry* |
| Nb-95 | 90.6 | Bq/smp | 5 | 0.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Pm-148 | <259 | Bq/smp | NA | 259 | | 26-Mar-18 | Gamma Spectrometry* |
| Ru-103 | <1.3 | Bq/smp | NA | 1.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Ru-106 | <6.7 | Bq/smp | NA | 6.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Sb-124 | <0.9 | Bq/smp | NA | 0.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Sb-125 | <1.8 | Bq/smp | NA | 1.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Sc-46 | <1 | Bq/smp | NA | 1 | | 26-Mar-18 | Gamma Spectrometry* |
| Sn-113 | <0.9 | Bq/smp | NA | 0.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Zn-65 | <1.9 | Bq/smp | NA | 1.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Zr-95 | 41.9 | Bq/smp | 3 | 1.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Pu-238 | <0.021 | Bq/smp | NA | 0.021 | | 06-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| | Elevated MDL due to lower Pu recovery. | | | | | | |
| Pu-239+240 | <0.019 | Bq/smp | NA | 0.019 | | 06-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| | Elevated MDL due to lower Pu recovery. | | | | | | |
| Am-241 | 0.029 | Bq/smp | 0.01 | 0.015 | | 05-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-242 | <0.037 | Bq/smp | NA | 0.037 | | 05-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-243+244 | 1 | Bq/smp | 0.136 | 0.048 | | 05-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Fe-55 | 513 | Bq/smp | 56 | 0.9 | | 11-Apr-18 | Chemical Separation/LSC* |
| Ni-63 | 0.9 | Bq/smp | 0.2 | 0.7 | | 10-Apr-18 | Chemical Separation/LSC* |
| Sr-90 | <0.4 | Bq/smp | NA | 0.4 | | 04-Apr-18 | Chemical Separation & GFPC or LSC* |
| Pu-241 | <4.3 | Bq/smp | NA | 4.3 | | 13-Apr-18 | Chemical Separation/LSC |



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| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|--|----------|--------|---------|--------|-------------|-----------------------|-------------------------|
| Elevated MDL due to lower Pu recovery. | | | | | | | |
| U-234 | <0.0006 | Bq/smp | NA | 0.0006 | | 27-Mar-18 | ICPMS* |
| U-235 | <0.00006 | Bq/smp | NA | 6E-5 | | 27-Mar-18 | ICPMS* |
| U-238 | <0.00006 | Bq/smp | NA | 6E-5 | | 27-Mar-18 | ICPMS* |
| Y-91 | <10 | Bq/smp | NA | 10 | | 14-Apr-18 | Chemical Separation/LSC |

| Sample ID | Sample Name | Matrix | Sample Point | Sample Date |
|------------|--|--------|--------------|-------------|
| 18-10425-6 | RWPB Line #2 Hardware Station Platform | Smear | Darlington | 20-Feb-2018 |

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|----------------------------|--------|--------|---------|------|-------------|-----------------------|---------------------------------|
| Gross Alpha | 2.5 | Bq/smp | 0.8 | 0.3 | | 28-Mar-18 | Gas Flow Proportional Counting* |
| Gross Alpha (Direct Count) | 1.2 | Bq/smp | 0.36 | 0.1 | | 26-Mar-18 | Gas Flow Proportional Counting* |
| Gross Beta | 207 | Bq/smp | 41 | 0.8 | | 28-Mar-18 | Gas Flow Proportional Counting* |
| Gross Beta (Direct Count) | 134 | Bq/smp | 27 | 0.1 | | 26-Mar-18 | Gas Flow Proportional Counting* |
| Ag-110m | <1.6 | Bq/smp | NA | 1.6 | | 26-Mar-18 | Gamma Spectrometry* |
| Ce-141 | <1.5 | Bq/smp | NA | 1.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Ce-144 | <3.2 | Bq/smp | NA | 3.2 | | 26-Mar-18 | Gamma Spectrometry* |
| Co-58 | <1.2 | Bq/smp | NA | 1.2 | | 26-Mar-18 | Gamma Spectrometry* |
| Co-60 | 65.6 | Bq/smp | 8 | 0.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Cr-51 | <13.7 | Bq/smp | NA | 13.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Cs-134 | 1.4 | Bq/smp | 0.7 | 1 | | 26-Mar-18 | Gamma Spectrometry* |
| Cs-137 | 2.61 | Bq/smp | 0.7 | 1 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-152 | <1.9 | Bq/smp | NA | 1.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-154 | <0.8 | Bq/smp | NA | 0.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-155 | <1 | Bq/smp | NA | 1 | | 26-Mar-18 | Gamma Spectrometry* |
| Fe-59 | <1.9 | Bq/smp | NA | 1.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Gd-153 | <1.3 | Bq/smp | NA | 1.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Hf-181 | <1.8 | Bq/smp | NA | 1.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Mn-54 | 3.8 | Bq/smp | 0.8 | 0.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Nb-94 | 14.6 | Bq/smp | 2 | 1.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Nb-95 | 143 | Bq/smp | 20 | 1.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Pm-148 | <408 | Bq/smp | NA | 408 | | 26-Mar-18 | Gamma Spectrometry* |
| Ru-103 | <2 | Bq/smp | NA | 2 | | 26-Mar-18 | Gamma Spectrometry* |
| Ru-106 | <9.9 | Bq/smp | NA | 9.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Sb-124 | <1 | Bq/smp | NA | 1 | | 26-Mar-18 | Gamma Spectrometry* |
| Sb-125 | <2.6 | Bq/smp | NA | 2.6 | | 26-Mar-18 | Gamma Spectrometry* |



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| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|---------------------|----------|--------|---------|--------|-------------|-----------------------|---|
| Sc-46 | <1.4 | Bq/smp | NA | 1.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Sn-113 | <1.3 | Bq/smp | NA | 1.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Zn-65 | <2.7 | Bq/smp | NA | 2.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Zr-95 | 64.6 | Bq/smp | 7 | 2.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Pu-238 | 0.015 | Bq/smp | 0.007 | 0.012 | | 06-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-239+240 | 0.037 | Bq/smp | 0.012 | 0.011 | | 06-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Am-241 | 0.063 | Bq/smp | 0.03 | 0.029 | | 05-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-242 | 0.049 | Bq/smp | 0.029 | 0.03 | | 05-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-243+244 | 1.55 | Bq/smp | 0.231 | 0.139 | | 05-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Fe-55 | 636 | Bq/smp | 70 | 0.7 | | 11-Apr-18 | Chemical Separation/LSC* |
| Ni-63 | 5.1 | Bq/smp | 1.1 | 0.5 | | 10-Apr-18 | Chemical Separation/LSC* |
| Sr-90 | 0.7 | Bq/smp | 0.1 | 0.3 | | 04-Apr-18 | Chemical Separation & GFPC or LSC* |
| Pu-241 | <2 | Bq/smp | NA | 2 | | 13-Apr-18 | Chemical Separation/LSC |
| U-234 | <0.0006 | Bq/smp | NA | 0.0006 | | 27-Mar-18 | ICPMS* |
| U-235 | <0.00006 | Bq/smp | NA | 6E-5 | | 27-Mar-18 | ICPMS* |
| U-238 | <0.00006 | Bq/smp | NA | 6E-5 | | 27-Mar-18 | ICPMS* |
| Y-91 | <10 | Bq/smp | NA | 10 | | 14-Apr-18 | Chemical Separation/LSC |

| Sample ID | Sample Name | Matrix | Sample Point | Sample Date |
|------------|--|--------|--------------|-------------|
| 18-10425-7 | RWPB Line #2 Hdwr Stn-Trolley floor area | Smear | Darlington | 20-Feb-2018 |

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|-------------------------------|--------|--------|---------|-----|-------------|-----------------------|------------------------------------|
| Gross Alpha | 20 | Bq/smp | 5 | 0.3 | | 28-Mar-18 | Gas Flow Proportional Counting* |
| Gross Alpha (Direct Count) | 23.2 | Bq/smp | 5.8 | 0.1 | | 26-Mar-18 | Gas Flow Proportional Counting* |
| Gross Beta | 4200 | Bq/smp | 840 | 0.8 | | 28-Mar-18 | Gas Flow Proportional Counting* |
| Gross Beta (Direct Count) | 3260 | Bq/smp | 650 | 0.1 | | 26-Mar-18 | Gas Flow Proportional Counting* |
| Ag-110m | <5.3 | Bq/smp | NA | 5.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Ce-141 | <4.8 | Bq/smp | NA | 4.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Ce-144 | 30.4 | Bq/smp | 5.1 | 8.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Co-58 | <4 | Bq/smp | NA | 4 | | 26-Mar-18 | Gamma Spectrometry* |
| Co-60 | 1640 | Bq/smp | 90 | 2.2 | | 26-Mar-18 | Gamma Spectrometry* |



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| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|---|----------|--------|---------|--------|-------------|-----------------------|---|
| Cr-51 | <45.3 | Bq/smp | NA | 45.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Cs-134 | 16.6 | Bq/smp | 2 | 2.6 | | 26-Mar-18 | Gamma Spectrometry* |
| Cs-137 | 24.9 | Bq/smp | 2 | 2.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-152 | <6.3 | Bq/smp | NA | 6.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-154 | <2.7 | Bq/smp | NA | 2.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-155 | <3.9 | Bq/smp | NA | 3.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Fe-59 | <6.8 | Bq/smp | NA | 6.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Gd-153 | <4.8 | Bq/smp | NA | 4.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Hf-181 | <6.1 | Bq/smp | NA | 6.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Mn-54 | 81.9 | Bq/smp | 4 | 2.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Nb-94 | 302 | Bq/smp | 20 | 3.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Nb-95 | 2980 | Bq/smp | 200 | 4.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Pm-148 | <1340 | Bq/smp | NA | 1340 | | 26-Mar-18 | Gamma Spectrometry* |
| Ru-103 | <6.7 | Bq/smp | NA | 6.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Ru-106 | <24.7 | Bq/smp | NA | 24.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Sb-124 | <4.1 | Bq/smp | NA | 4.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Sb-125 | 21.4 | Bq/smp | 4 | 6.6 | | 26-Mar-18 | Gamma Spectrometry* |
| Sc-46 | <4.7 | Bq/smp | NA | 4.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Sn-113 | <4.3 | Bq/smp | NA | 4.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Zn-65 | 36.8 | Bq/smp | 5 | 6.2 | | 26-Mar-18 | Gamma Spectrometry* |
| Zr-95 | 1320 | Bq/smp | 60 | 7.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Pu-238 | 0.094 | Bq/smp | 0.033 | 0.031 | | 09-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-239+240 | 0.06 | Bq/smp | 0.025 | 0.028 | | 09-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Am-241 | <0.134 | Bq/smp | NA | 0.134 | | 09-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Elevated MDA due to interference from Cm-244. | | | | | | | |
| Cm-242 | 0.78 | Bq/smp | 0.165 | 0.031 | | 09-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-243+244 | 22.4 | Bq/smp | 2.8 | 0.117 | | 09-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Fe-55 | 9510 | Bq/smp | 1050 | 2.6 | | 11-Apr-18 | Chemical Separation/LSC* |
| Ni-63 | 281 | Bq/smp | 31 | 1.1 | | 10-Apr-18 | Chemical Separation/LSC* |
| Sr-90 | 477 | Bq/smp | 70 | 0.6 | | 04-Apr-18 | Chemical Separation & GFPC or LSC* |
| Pu-241 | 8.2 | Bq/smp | 1.89 | 2.3 | | 13-Apr-18 | Chemical Separation/LSC |
| U-234 | <0.0006 | Bq/smp | NA | 0.0006 | | 27-Mar-18 | ICPMS* |
| U-235 | <0.00006 | Bq/smp | NA | 6E-5 | | 27-Mar-18 | ICPMS* |
| U-238 | <0.00006 | Bq/smp | NA | 6E-5 | | 27-Mar-18 | ICPMS* |
| Y-91 | <10 | Bq/smp | NA | 10 | | 14-Apr-18 | Chemical Separation/LSC |



Analytical and Environmental Services Laboratory

Test Report

Report Number: 18-10425

Version: 1

Report Date: 25-Apr-2018

| Sample ID | Sample Name | Matrix | Sample Point | Sample Date |
|------------|--|--------|--------------|-------------|
| 18-10425-8 | RWPB Line #2 Hdwr Stn-Trolley floor area | Smear | Darlington | 20-Feb-2018 |

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|----------------------------|--------|--------|---------|-------|-------------|-----------------------|---|
| Gross Alpha | 17.6 | Bq/smp | 4.4 | 0.3 | | 28-Mar-18 | Gas Flow Proportional Counting* |
| Gross Alpha (Direct Count) | 18.5 | Bq/smp | 4.6 | 0.1 | | 26-Mar-18 | Gas Flow Proportional Counting* |
| Gross Beta | 3410 | Bq/smp | 680 | 0.8 | | 28-Mar-18 | Gas Flow Proportional Counting* |
| Gross Beta (Direct Count) | 2830 | Bq/smp | 570 | 0.1 | | 26-Mar-18 | Gas Flow Proportional Counting* |
| Ag-110m | <6.9 | Bq/smp | NA | 6.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Ce-141 | <5.9 | Bq/smp | NA | 5.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Ce-144 | 29.2 | Bq/smp | 6.9 | 10.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Co-58 | <5.5 | Bq/smp | NA | 5.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Co-60 | 1688 | Bq/smp | 200 | 2.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Cr-51 | <57.6 | Bq/smp | NA | 57.6 | | 26-Mar-18 | Gamma Spectrometry* |
| Cs-134 | 11.8 | Bq/smp | 3 | 4.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Cs-137 | 28.6 | Bq/smp | 3 | 3.6 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-152 | <8.9 | Bq/smp | NA | 8.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-154 | <3.2 | Bq/smp | NA | 3.2 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-155 | <4.3 | Bq/smp | NA | 4.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Fe-59 | <9.2 | Bq/smp | NA | 9.2 | | 26-Mar-18 | Gamma Spectrometry* |
| Gd-153 | <5.3 | Bq/smp | NA | 5.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Hf-181 | <8 | Bq/smp | NA | 8 | | 26-Mar-18 | Gamma Spectrometry* |
| Mn-54 | 79.3 | Bq/smp | 8 | 4.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Nb-94 | 314 | Bq/smp | 30 | 4.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Nb-95 | 3190 | Bq/smp | 300 | 5.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Pm-148 | <1770 | Bq/smp | NA | 1770 | | 26-Mar-18 | Gamma Spectrometry* |
| Ru-103 | <8.7 | Bq/smp | NA | 8.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Ru-106 | <43.5 | Bq/smp | NA | 43.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Sb-124 | <5.8 | Bq/smp | NA | 5.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Sb-125 | 28.8 | Bq/smp | 7 | 11.2 | | 26-Mar-18 | Gamma Spectrometry* |
| Sc-46 | <6.2 | Bq/smp | NA | 6.2 | | 26-Mar-18 | Gamma Spectrometry* |
| Sn-113 | <5.7 | Bq/smp | NA | 5.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Zn-65 | 35.5 | Bq/smp | 8 | 11.2 | | 26-Mar-18 | Gamma Spectrometry* |
| Zr-95 | 1410 | Bq/smp | 100 | 10.2 | | 26-Mar-18 | Gamma Spectrometry* |
| Pu-238 | 0.102 | Bq/smp | 0.027 | 0.025 | | 11-Apr-18 | Chemical Separation/ Alpha Spectrometry* |



Analytical and Environmental Services Laboratory

Test Report

Report Number: 18-10425

Version: 1

Report Date: 25-Apr-2018

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|---------------------|---|--------|---------|--------|-------------|-----------------------|---|
| Pu-239+240 | 0.069 | Bq/smp | 0.02 | 0.022 | | 11-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Am-241 | <0.134 | Bq/smp | NA | 0.134 | | 11-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| | Elevated MDA due to interference from Cm-244. | | | | | | |
| Cm-242 | 0.542 | Bq/smp | 0.089 | 0.011 | | 11-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-243+244 | 18 | Bq/smp | 2.21 | 0.045 | | 11-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Fe-55 | 7560 | Bq/smp | 830 | 2.5 | | 11-Apr-18 | Chemical Separation/LSC* |
| Ni-63 | 222 | Bq/smp | 24 | 1.3 | | 10-Apr-18 | Chemical Separation/LSC* |
| Sr-90 | 8 | Bq/smp | 1 | 0.7 | | 04-Apr-18 | Chemical Separation & GFPC or LSC* |
| Pu-241 | 9.5 | Bq/smp | 2.19 | 2.6 | | 13-Apr-18 | Chemical Separation/LSC |
| U-234 | <0.0006 | Bq/smp | NA | 0.0006 | | 27-Mar-18 | ICPMS* |
| U-235 | <0.00006 | Bq/smp | NA | 6E-5 | | 27-Mar-18 | ICPMS* |
| U-238 | <0.00006 | Bq/smp | NA | 6E-5 | | 27-Mar-18 | ICPMS* |
| Y-91 | <10 | Bq/smp | NA | 10 | | 14-Apr-18 | Chemical Separation/LSC |

| Sample ID | Sample Name | Matrix | Sample Point | Sample Date |
|------------|---------------------------------|--------|--------------|-------------|
| 18-10425-9 | RWPB DSO Line #2 lifting Laptop | Smear | Darlington | 20-Feb-2018 |

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|----------------------------|--------|--------|---------|------|-------------|-----------------------|------------------------------------|
| Gross Alpha | 17.3 | Bq/smp | 4.3 | 0.3 | | 28-Mar-18 | Gas Flow Proportional Counting* |
| Gross Alpha (Direct Count) | 15.4 | Bq/smp | 3.9 | 0.1 | | 26-Mar-18 | Gas Flow Proportional Counting* |
| Gross Beta | 4450 | Bq/smp | 890 | 0.8 | | 28-Mar-18 | Gas Flow Proportional Counting* |
| Gross Beta (Direct Count) | 3480 | Bq/smp | 700 | 0.1 | | 26-Mar-18 | Gas Flow Proportional Counting* |
| Ag-110m | <8.4 | Bq/smp | NA | 8.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Ce-141 | <6.3 | Bq/smp | NA | 6.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Ce-144 | 16.1 | Bq/smp | 5.9 | 9.6 | | 26-Mar-18 | Gamma Spectrometry* |
| Co-58 | <6.3 | Bq/smp | NA | 6.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Co-60 | 3460 | Bq/smp | 200 | 3.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Cr-51 | <57.7 | Bq/smp | NA | 57.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Cs-134 | 9.2 | Bq/smp | 3 | 4.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Cs-137 | 25.8 | Bq/smp | 3 | 3.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-152 | <11.4 | Bq/smp | NA | 11.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-154 | <3.5 | Bq/smp | NA | 3.5 | | 26-Mar-18 | Gamma Spectrometry* |



Analytical and Environmental Services Laboratory

Test Report

Report Number: 18-10425

Version: 1

Report Date: 25-Apr-2018

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|---|----------|--------|---------|--------|-------------|-----------------------|---|
| Eu-155 | <5.2 | Bq/smp | NA | 5.2 | | 26-Mar-18 | Gamma Spectrometry* |
| Fe-59 | <11.7 | Bq/smp | NA | 11.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Gd-153 | <6.1 | Bq/smp | NA | 6.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Hf-181 | <7.5 | Bq/smp | NA | 7.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Mn-54 | 73.6 | Bq/smp | 5 | 5.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Nb-94 | 283 | Bq/smp | 10 | 5.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Nb-95 | 3030 | Bq/smp | 100 | 6.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Pm-148 | <1680 | Bq/smp | NA | 1680 | | 26-Mar-18 | Gamma Spectrometry* |
| Ru-103 | <8.3 | Bq/smp | NA | 8.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Ru-106 | <41 | Bq/smp | NA | 41 | | 26-Mar-18 | Gamma Spectrometry* |
| Sb-124 | <7.5 | Bq/smp | NA | 7.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Sb-125 | 25.8 | Bq/smp | 6 | 8.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Sc-46 | <7.4 | Bq/smp | NA | 7.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Sn-113 | <5.5 | Bq/smp | NA | 5.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Zn-65 | 44.2 | Bq/smp | 8 | 11.2 | | 26-Mar-18 | Gamma Spectrometry* |
| Zr-95 | 1310 | Bq/smp | 60 | 11.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Pu-238 | 0.06 | Bq/smp | 0.02 | 0.028 | | 11-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-239+240 | 0.051 | Bq/smp | 0.018 | 0.025 | | 11-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Am-241 | <0.116 | Bq/smp | NA | 0.116 | | 11-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Elevated MDA due to interference from Cm-244. | | | | | | | |
| Cm-242 | 0.391 | Bq/smp | 0.072 | 0.012 | | 11-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-243+244 | 16.6 | Bq/smp | 2.05 | 0.005 | | 11-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Fe-55 | 7990 | Bq/smp | 880 | 1.7 | | 11-Apr-18 | Chemical Separation/LSC* |
| Ni-63 | 803 | Bq/smp | 88 | 0.6 | | 10-Apr-18 | Chemical Separation/LSC* |
| Sr-90 | 8.1 | Bq/smp | 1 | 0.3 | | 04-Apr-18 | Chemical Separation & GFPC or LSC* |
| Pu-241 | 9.4 | Bq/smp | 2.17 | 3 | | 13-Apr-18 | Chemical Separation/LSC |
| U-234 | <0.0006 | Bq/smp | NA | 0.0006 | | 27-Mar-18 | ICPMS* |
| U-235 | <0.00006 | Bq/smp | NA | 6E-5 | | 27-Mar-18 | ICPMS* |
| U-238 | <0.00006 | Bq/smp | NA | 6E-5 | | 27-Mar-18 | ICPMS* |
| Y-91 | <10 | Bq/smp | NA | 10 | | 18-Apr-18 | Chemical Separation/LSC |

| Sample ID | Sample Name | Matrix | Sample Point | Sample Date |
|-------------|---------------------------------|--------|--------------|-------------|
| 18-10425-10 | RWPB DSO Line #2 Lifting Laptop | Smear | Darlington | 20-Feb-2018 |



Analytical and Environmental Services Laboratory

Test Report

Report Number: 18-10425

Version: 1

Report Date: 25-Apr-2018

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|---|--------|--------|---------|-------|-------------|-----------------------|---|
| Gross Alpha | 52.3 | Bq/smp | 13.1 | 0.3 | | 28-Mar-18 | Gas Flow Proportional Counting* |
| Gross Beta | 7430 | Bq/smp | 1490 | 0.8 | | 28-Mar-18 | Gas Flow Proportional Counting* |
| Ag-110m | <11.6 | Bq/smp | NA | 11.6 | | 26-Mar-18 | Gamma Spectrometry* |
| Ce-141 | <9.6 | Bq/smp | NA | 9.6 | | 26-Mar-18 | Gamma Spectrometry* |
| Ce-144 | 42.2 | Bq/smp | 8.8 | 13.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Co-58 | <9 | Bq/smp | NA | 9 | | 26-Mar-18 | Gamma Spectrometry* |
| Co-60 | 3140 | Bq/smp | 400 | 4.6 | | 26-Mar-18 | Gamma Spectrometry* |
| Cr-51 | <95.4 | Bq/smp | NA | 95.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Cs-134 | 29.3 | Bq/smp | 5 | 6.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Cs-137 | 64.1 | Bq/smp | 7 | 5.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-152 | <15.5 | Bq/smp | NA | 15.5 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-154 | <5.3 | Bq/smp | NA | 5.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Eu-155 | <7.1 | Bq/smp | NA | 7.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Fe-59 | <15.8 | Bq/smp | NA | 15.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Gd-153 | <8.8 | Bq/smp | NA | 8.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Hf-181 | <13.1 | Bq/smp | NA | 13.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Mn-54 | 171 | Bq/smp | 20 | 5.9 | | 26-Mar-18 | Gamma Spectrometry* |
| Nb-94 | 554 | Bq/smp | 50 | 7.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Nb-95 | 5700 | Bq/smp | 500 | 9.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Pm-148 | <2920 | Bq/smp | NA | 2920 | | 26-Mar-18 | Gamma Spectrometry* |
| Ru-103 | <14.3 | Bq/smp | NA | 14.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Ru-106 | <70.7 | Bq/smp | NA | 70.7 | | 26-Mar-18 | Gamma Spectrometry* |
| Sb-124 | <9.1 | Bq/smp | NA | 9.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Sb-125 | 27.3 | Bq/smp | 10 | 16.1 | | 26-Mar-18 | Gamma Spectrometry* |
| Sc-46 | <10.4 | Bq/smp | NA | 10.4 | | 26-Mar-18 | Gamma Spectrometry* |
| Sn-113 | <9.3 | Bq/smp | NA | 9.3 | | 26-Mar-18 | Gamma Spectrometry* |
| Zn-65 | 77.7 | Bq/smp | 10 | 16.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Zr-95 | 2510 | Bq/smp | 200 | 16.8 | | 26-Mar-18 | Gamma Spectrometry* |
| Pu-238 | 0.166 | Bq/smp | 0.06 | 0.044 | | 10-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Pu-239+240 | 0.109 | Bq/smp | 0.048 | 0.041 | | 10-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Am-241 | <0.367 | Bq/smp | NA | 0.367 | | 10-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Elevated MDA due to interference from Cm-244. | | | | | | | |
| Cm-242 | 1.1 | Bq/smp | 0.257 | 0.055 | | 10-Apr-18 | Chemical Separation/ Alpha Spectrometry* |
| Cm-243+244 | 41 | Bq/smp | 5.13 | 0.025 | | 10-Apr-18 | Chemical Separation/ Alpha Spectrometry* |



Analytical and Environmental Services Laboratory

Test Report

Report Number: 18-10425

Version: 1

Report Date: 25-Apr-2018

| Parameter / Analyte | Result | Units | Uncert. | DL | Spec. Limit | Analyzed On dd-mmm-yy | Technique |
|---------------------|---|--------|---------|--------|-------------|-----------------------|------------------------------------|
| Fe-55 | 19300 | Bq/smp | 2100 | 3.7 | | 11-Apr-18 | Chemical Separation/LSC* |
| Ni-63 | 391 | Bq/smp | 43 | 0.9 | | 10-Apr-18 | Chemical Separation/LSC* |
| Sr-90 | 14.6 | Bq/smp | 2 | 0.5 | | 04-Apr-18 | Chemical Separation & GFPC or LSC* |
| Pu-241 | 17.6 | Bq/smp | 2.2 | 3.4 | | 13-Apr-18 | Chemical Separation/LSC |
| U-234 | <0.0006 | Bq/smp | NA | 0.0006 | | 27-Mar-18 | ICPMS* |
| U-235 | <0.00006 | Bq/smp | NA | 6E-5 | | 27-Mar-18 | ICPMS* |
| U-238 | 0.000169 | Bq/smp | 3E-5 | 6E-5 | | 27-Mar-18 | ICPMS* |
| Y-91 | <10 | Bq/smp | NA | 10 | | 18-Apr-18 | Chemical Separation/LSC |
| Comments | Direct Gross Alpha and Beta could not be completed on sample 1 and 10 due to loose particulate on the smear which would contaminate the instrument and cause cross-contamination between samples. | | | | | | |

Instruments Used

| Name | Serial Number | Last Calibration | Calibration Due |
|--|---------------|-----------------------|-----------------|
| Alpha Spectrometer 516-10 | 10224476 | 06-Dec-2016 | 06-Dec-2018 |
| Alpha Spectrometer 516-3 | 10224474 | 22-Mar-2018 | 22-Mar-2020 |
| Alpha Spectrometer 516-4 | 10224474 | 22-Mar-2018 | 22-Mar-2020 |
| Alpha Spectrometer 516-5 | 10222516 | 22-Mar-2018 | 22-Mar-2020 |
| Alpha Spectrometer 516-6 | 10222516 | 22-Mar-2018 | 22-Mar-2020 |
| Alpha Spectrometer 516-9 | 10224476 | 06-Dec-2016 | 06-Dec-2018 |
| ENV-GAMMA-DET#1 | 53098 | 01-Aug-2016 | 01-Aug-2018 |
| ENV-GAMMA-DET#2 | 1953466 | 01-Aug-2016 | 01-Aug-2018 |
| Gross Alpha/Beta Counter | 527860 | 06-Oct-2016 | 06-Oct-2018 |
| Gas Flow Proportional Counter for Sr-90 | 527860 | 13-Feb-2017 | 13-Feb-2019 |
| Varian 820 ICPMS | IP0810M006 | Calibrated Before Use | |
| Perkin Elmer Tri-Carb 2900TR (LSC for Fe-55) | DG11061765 | 14-Dec-2016 | 14-Dec-2018 |
| Perkin Elmer Tri-Carb 2900TR (LSC for Ni-63) | DG11061765 | 21-Nov-2016 | 21-Nov-2018 |



Analytical and Environmental Services Laboratory

Test Report

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Version: 1

Report Date: 25-Apr-2018

The Analytical and Environmental Services Laboratory of Kinectrics is accredited by the Standards Council of Canada as conforming with ISO 17025.

The DL is the reported detection limit. All analytical data is subject to uncertainty, and is a function of the sample matrix, method and instrumental variations. As a general guideline, it can be expressed as +/-50% of the result at the detection limit (RDL) and approximately +/-10% of the result at greater than 10 times the RDL. Results in this report relate only to the items/samples tested and to all the items tested, as received. All tests are as defined by our understanding of customer requirements.

TECHNIQUE '*' = ISO 17025 accredited

TECHNIQUE 'x' = Indicates a modified test method

TECHNIQUE '+' = Indicates a sub-contracted analysis

All deliverables are provided as per our standard terms which can be found at the Terms of Business at:
<http://www.kinectrics.com/SiteCollectionDocuments/KinectricsStandardTCs.pdf>