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SOW Ref: 16.C.5.c.1

# **QA/QC PLAN FOR BERM WATER SAMPLING AT CAM-M, CAM-3, FOX-M, FOX-3, DYE-M AND BAF-3**

Contract # W8485-100224/001/NX

SOW Ref: 16.C.5.c.1

Document Number

PLN-EHS-13, Rev 2, 16-Jul-2021

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## CHANGE HISTORY

This sheet is a record of each issue of this document. When the revised document is issued, the previous issue is automatically superseded.

Revision	Date	Author	Pages Changed	Reason for Change
1	15-Oct-2018	W. Wyman	All	New Document
2	15-Jul-2021	A. Leslie	All	General updates. Additional of dissolved lead and pH to criteria in accordance with most recent licences.



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## 1.0 INTRODUCTION

The North Warning System consists of a sequence of radar sites operating across the northern and eastern coasts of Canada from the Yukon in the west to the southern Labrador coast in the east. The North Warning System (NWS) is linked to the North Warning System Control Centre (NWSCC) located in Canadian Forces Base (CFB) North Bay, Ontario via the Long Haul Communications Network (LHCN), a satellite communications network.

There are a total of eleven (11) Long Range Radar (LRR) sites in the Canadian NWS. They are situated in the arctic region of Canada extending from Shingle Point, Yukon on the west to Cartwright, Labrador on the east coast and provide high level radar coverage. Two of these sites, located at (Cambridge Bay and Sanirajak, Nunavut), have radar and support sites combined in one facility. These sites are referred to as LRR/LSS stations and are each staffed by approximately ten people. The remaining nine sites are currently not permanently staffed, they are operated via remote monitor & control and local automation. However, staffing levels at all LRR sites are planned to increase beginning April 1st 2022. Plans include gradually increasing staffing levels to year-round attendance of at least nine staff members as of October 1st 2023.

The LRR site facilities consist of building groups which include: accommodations, technical services, power generation system, fuel tank farms, radar towers, satellite ground terminals, weather compounds, helipads, roads, and beach fuel tanks.

There are six LRR sites located in Nunavut that have Nunavut Water Board (NWB) licences. Some bulk fuel storage tanks at the six sites are surrounded by berms. Water from precipitation accumulates in the berms and must be pumped out to prevent damage to the fuel tanks. The berms around the bulk fuel storage at BAF-3 have been removed and therefore the monitoring program for berm water at that site is inactive.

Water samples are taken from within each berm. The sampling point is inside the berm and the final discharge point of the bermed fuel storage facility is just outside of the berm.

Berm locations listed are in

Table 1-1 and are shown in maps included in Appendix A.

**Table 1-1: NWS Berms on NWB Sites, including location**

NWS Site	NWB Licence	Monitoring Station <sup>1</sup>	Berm	Berm Location on-site	Berm coordinates	
					North	West
CAM-M	8BC-CAM1929	CDL-3	CAM W22A	Summit	69°07'02.76"N	105°07'2.69"W
			CAM W20B & W20C	Airstrip	69°06'12.01"N	105°07'36.60"W
			CAM W22C & W20D	Beach	69°06'11.41"N	105°05'50.26"W
CAM-3	8BC-	SHE-3	SHE W22A	Summit	68°47'42.00"N	93°26'19.58"W

<sup>1</sup> Final Discharge Point of Bermed Fuel Storage Facility



NWS Site	NWB Licence	Monitoring Station <sup>1</sup>	Berm	Berm Location on-site	Berm coordinates	
					North	West
	SHE1929		SHE W22C & W22D	Beach	68°48'07.82"N	93°36'50.12"W
FOX-M	8BC-FOH1929	FOH-3	HAL W22A	Summit	68°45'42.24"N	81°13'25.04"W
			HAL W22B	Summit	68°45'43.00"N	81°13'27.27"W
			HAL W20D & W20E	Airstrip	68°46'15.85"N	81°13'58.33"W
			HAL W20B	Beach	68°46'23.93"N	81°12'51.11"W
			HAL W20F	Beach	68°46'23.75"N	81°12'46.12"W
FOX-3	8BC-FOD1828	FOD-3	DEW W20D & W20E	Airstrip	68°37'24.90"N	71° 8'05.62"W
			DEW W22A & W22B	Summit	68°39'05.43"N	71°14'03.23"W
			DEW W22C & W22D	Summit	68°39'03.67"N	71°13'49.97"W
			Former DEW W22E <sup>2</sup>	Airstrip	68°37'26.59"N	71°08'23.67"W
DYE-M	8BC-DYE1929	DYE-3	DYE W20A	Summit	66°40'00.13"N	61°21'25.76"W
			DYE W22K, W22J, W22I & W20B	Summit	66°39'53.59"N	61°21'23.78"W
BAF-3	8BC-BAF1929	BAF-4	Discontinued			

## 1.1 Purpose

This QA/QC plan applies to the first five sites listed in

Table 1-1 at the monitoring stations for the final discharge point of each bermed fuel storage facility. It has been prepared to ensure that discharged water is not impacted by hydrocarbons. If required, sampling, sample preservation, and analyses are done in accordance with methods in the current edition of the Standard Methods for the Examination of Water and Wastewater as required by the Nunavut Water Board Water Licences listed above.

See Appendix B for a decision tree on the type of sampling that will be conducted. See Appendix C for the Discharge Criteria that the lab will be analyzing to.

<sup>2</sup> Tank W22E was demolished in 2012 and the berm was left intact.



## 1.2 Review

This plan shall be reviewed annually by Raytheon Canada (RC) and will be updated as required. Updated plans will be submitted to the NWB with an approval letter from a laboratory accredited to ISO/IEC Standard 17025.

## 2.0 EQUIPMENT

Equipment is listed below. The Berm Water Testing Kit is only needed if laboratory analysis is required (for more details on these requirements see Section 3.2).

### 2.1 Personal Protective Equipment (PPE):

- eye protection (safety glasses or goggles)
- nitrile gloves
- filled portable eye wash or source of water to flush eyes

### 2.2 General Equipment:

- Water Sampling Form (FM-EHS-67)
- Permanent marker and pen
- Plastic bag (e.g. New garbage bag)
- Camera

### 2.3 Field Screening Equipment:

- Hydrocarbon Test Strips
- Test Strip Card (printed out from Appendix D and laminated)

### 2.4 Berm Water Testing Kit (cooler):

- Chain of Custody form;
- Cold packs; and
- Item 3002568: Berm Water Test Kit. The sample bottles required from the kit are listed in Table 3-1 below.
- Item 3002570: Disposable Filter (0.45 um pore size)
- Item 3002575: Disposable Syringe (to be used with filter)
- pH test strips (i.e. Litmus strips).

Note: The sample bottles are provided from the laboratory clean and free of contaminants. Bottles may contain preservatives; the type of preservative will be marked on the bottle by the lab. Preservatives can include acid (such as nitric acid) or tablets (such as sodium bicarbonate).

## 3.0 PROCEDURE

### 3.1 Health and Safety

Prior to sampling review any Safety Data Sheets associated with the preservatives in the Berm Water Testing Kit. Preservatives may include acid which is corrosive. Ensure proper PPE is worn prior to opening any sample bottles.



### 3.2 Field Screening

If there has not been a spill in the berm since the last lab sample, and there is no visible indication of fuel, the water can be tested in the field with hydrocarbon test strips.

1. Fill out the Water Sampling Form with your observations (e.g. “No visible sheen”).
2. Don nitrile gloves.
3. Wet a test strip in each corner of the berm.
4. Place each test strip on the laminated “Test Strip Card”, See Appendix D for card template.
5. With all of the test strips in place, take a photo of the Test Strip Card with the tank and LOCID in the background. Use a camera that date stamps its photos.
6. Email the photo and scanned copy of the Water Sampling Form to [NWS\\_Results@raytheon.com](mailto:NWS_Results@raytheon.com) and to [IIS-NWS-Environment@raytheon.com](mailto:IIS-NWS-Environment@raytheon.com).
7. Await authorization to discharge.

### 3.3 Laboratory Analysis

Laboratory analysis is completed under the following circumstances:

1. There has been a spill in a berm since the last lab analysis, RC Environmental Services will raise a Work Order to have the berm water sampled and analysed by a lab; and/or,
2. The field screening indicates the presence of hydrocarbons.

The table below provides an overview of the sampling requirements. Detailed instructions are outlined in Section 3.2.1.

Table 3-1: Sample bottle requirements

Parameters	Bottle	Preservative	Sampling	Hold Time
Dissolved Metals (dissolved lead)	125 ml plastic	nitric acid (may be marked as HNO <sub>3</sub> )*	Field filtered. No rinse (do not discard the preservative*)  Note: Cross out “Metals” and write “Lead”	28 Days
BTE	2 x 40 ml VOC glass vials	May contain a preservative tablet such as sodium bicarbonate	Fill slowly and completely – no headspace. No rinse (do not discard the preservative tablet).	7 Days
pH	250-1000 ml	None	Grab, fill bottle to top with water.	14 Days
Oil & Grease (total)	1 litre amber glass bottle	None	Grab, Fill bottle to the top with water.	14 Days

\*If the preservative is supplied in a separate vial carefully add it to the sample after the sample is collected (while wearing PPE). The appropriate preservative will be colour-coded to match the colour of the bottle lid.



### 3.3.1 Sampling Instructions

#### 1. Preparation

- Co-ordinate taking the samples with the air cargo flight schedule to minimize sample storage time.
- Gather the equipment listed in Section 2.
- The day before sampling, get the cold packs from the berm water testing kit and place in freezer overnight. If cold packs were not included in the cooler then a Ziploc bag of ice can be used. Double-bag the Ziploc of ice before placing it in the cooler for shipment.
- Read the label of each bottle to determine which contain acid. Acid may be indicated by "H<sub>2</sub>SO<sub>4</sub>", "HCl", or "HNO<sub>3</sub>".
- With permanent marker, mark each bottle with site, unique sample # (include tank ID), time, and date.

#### 2. Assess the area for any signs of fuel

- Fill out the Water Sampling Form with your initial observations (note any sheens or odours).
- Don the PPE.

#### 3. Collect the Dissolved Metals sample (filtered)

- Locate the bottle for Dissolved Metals (125 ml with acid preservative) and have it within arms reach.
- Use the Oil and Grease bottle to collect 1L of water to be decanted into the syringe. Attempt to collect water without suspended solids (try not to disturb the sediment, as a lot of sediment will make the filtering process slower).
- Assemble the filter and syringe.
- Fill the syringe with water from the Oil & Grease bottle.
- Gently push the syringe plunger down forcing the water through the filter, collect the filtered water into the Dissolved Metals bottle.
- If the water does not come through the filter, be patient and slowly push on the plunger without forcing. If water is still not coming through disassemble the filter and syringe and use a new filter.
- After you have collected the sample discard the filter and syringe (a new filter and syringe should be used for each sample).
- Write "Filtered" on the bottle (or check off the "filtered?" Checkbox).

#### 4. Collect the BTE sample (unfiltered)

- Locate the BTE vials (2 x 40 ml) and have them within reach.
- Use the Oil and Grease bottle to collect 1L of water to be decanted into the vials.
- Slowly pour water from the Oil and Grease bottle into the vials until a meniscus forms at the top. Cap the vials and place in a bubble wrap pouch.

#### 5. Collect the pH and Oil and Grease sample (unfiltered)

- Use the Oil and Grease bottle to pour water on to a pH test strip to obtain an approximate pH reading. Note this on the sampling form.
- Simply fill the Oil and Grease bottle and the pH bottle to the top.

#### 6. Take photos

- Take a close up photo of all the bottles with the sample ID visible.
- Take a wide angle with the bottles and the tank berm in the background.

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## 7. Paperwork

- a. Complete the Chain of Custody form and the Water Sampling Form, a sample Chain of Custody is included in Appendix E.
  - i. On the chain of custody include the following parameters
    1. Diss. Lead (filtered)
    2. BTE
    3. pH
    4. Oil & Grease
- b. Scan a copy of both forms and email to [nws\\_results@raytheon.com](mailto:nws_results@raytheon.com)

## 8. Storage and shipping

- a. Wrap glass bottles with bubble pack from kit.
- b. Place in cooler and add cold packs. Add additional bubble wrap so bottles don't move in shipment.
- c. Seal cooler with packing tape and ship the cooler to the laboratory. If any delay, keep samples cool but not frozen (4 to 10 °C).

## 9. Await permission to discharge from Environmental Services.

### 4.0 ANALYSIS AND RESULTS

The laboratory is accredited to ISO/IEC Standard 17025. The laboratory has an established QA/QC program for the analyses required under this water licence.

Results are emailed to [nws\\_results@raytheon.com](mailto:nws_results@raytheon.com). Environmental Services will evaluate the results for compliance with the Nunavut Water Board licence. If the results are in compliance they will give the permission to discharge.



## 5.0 ACRONYMS

Table 5-1: Acronyms

Acronym	Definition
BTE	Benzene, Toluene, and Ethylbenzene
CFB	Canadian Forces Base
DND	Department of National Defence
HNO <sub>3</sub>	Nitric acid
IEC	International Electrotechnical Commission
ISO	International Standards Organization
LRR	Long Range Radar
LSS	Logistics Support Site
NWB	Nunavut Water Board
NWS	North Warning System
NWSCC	North Warning System Control Centre
PCBs	Polychlorinated Biphenyls
pH	power of Hydrogen
PPE	Personal Protective Equipment
QA/QC	Quality Assurance / Quality Control
RC	Raytheon Canada
VOC	Volatile Organic Compound

## APPENDIX A: BERM LOCATION MAPS



Figure 1: CAM-M Berm Locations



Figure 2: CAM-3 Berm Locations

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Figure 3: FOX-M Berm Locations

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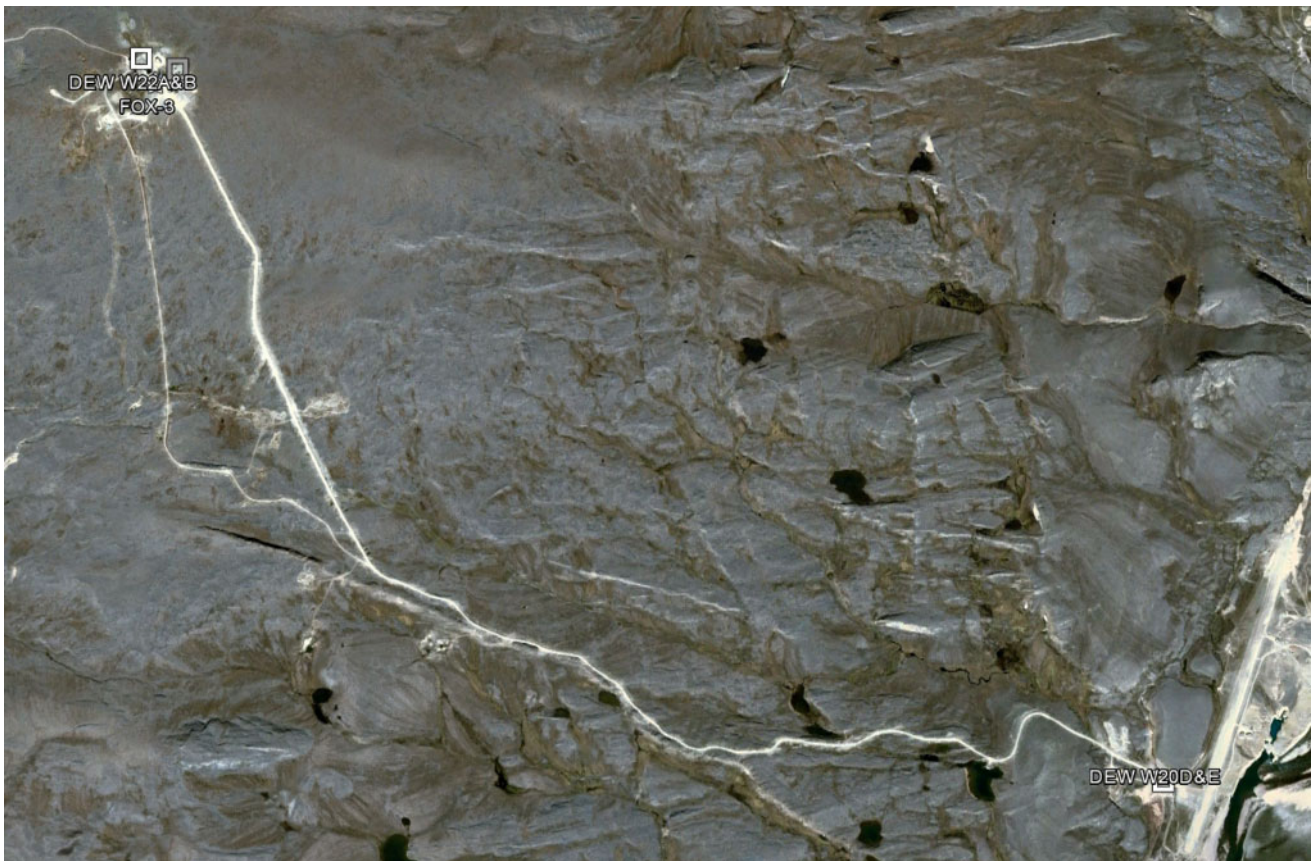


Figure 4: FOX-3 Berm Locations





Figure 5: DYE-M Berm Locations

## APPENDIX B: SAMPLING DECISION TREE

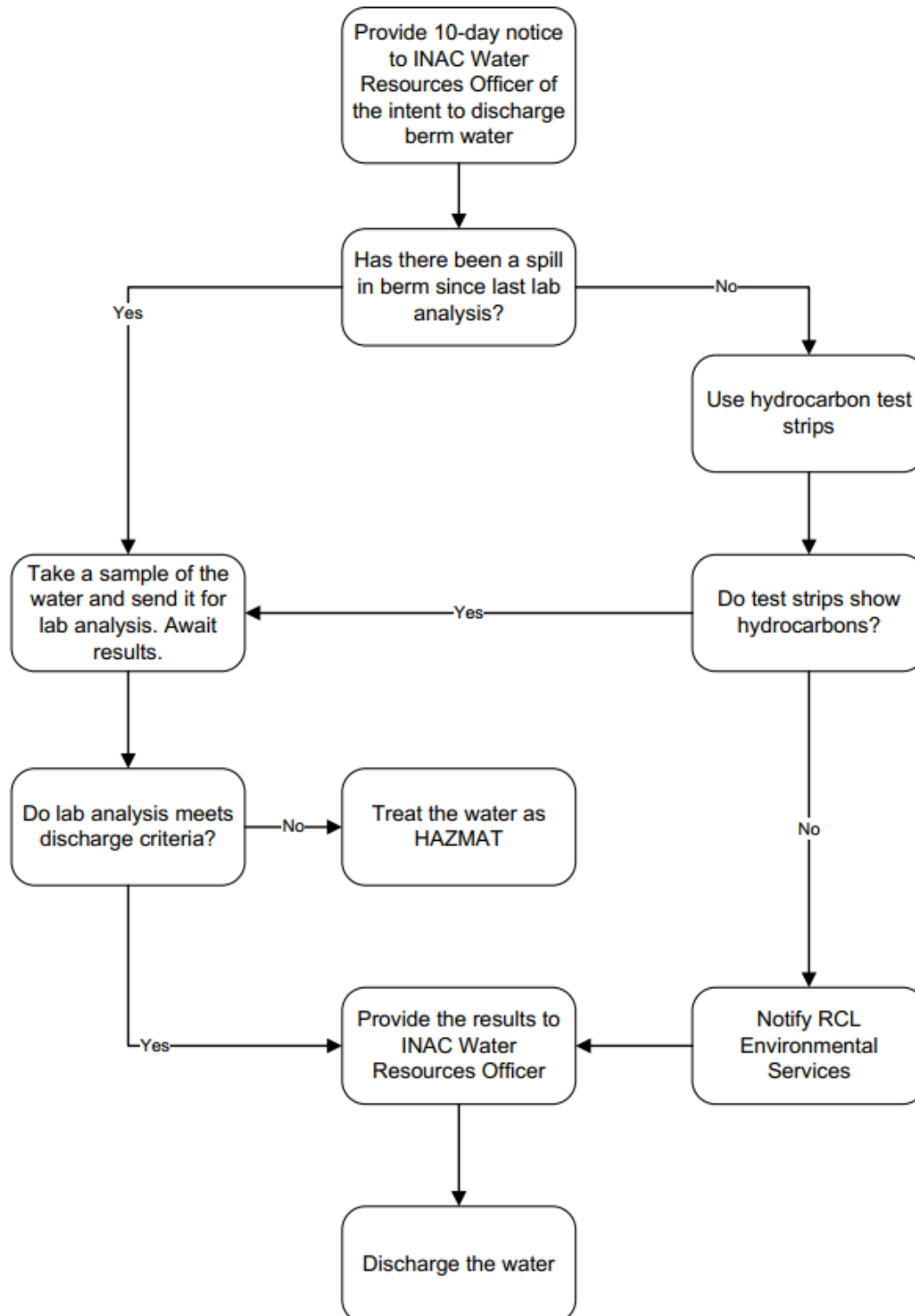


Figure 6: Berm water sampling decision tree

**APPENDIX C: WATER DISCHARGE CRITERIA**

Table C-1: Wastewater Discharge Criteria

Parameter	Maximum Concentration of any Grab Sample (µg/L)
pH	6.0 to 9.5 (pH units)
Oil and Grease	5000
Benzene	370
Toluene	2
Ethylbenzene	90
Lead (dissolved)	50



**APPENDIX D: HYDROCARBON TEST STRIP CARD**Site:  

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Test strip 1	Test strip 2	Test strip 3	Test strip 4
Colour Key from test strip kit			

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## APPENDIX E: EXAMPLE COMPLETED CHAIN OF CUSTODY FORM

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Copies: White - Laboratory, Yellow - Sampler

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**APPENDIX F: LETTER OF APPROVAL FROM ACCREDITED LABORATORY****Environment Testing**

October 15, 2018

Mr. Will Wyman  
Raytheon Canada Limited  
Suite 3000  
400 Cooper St.  
Ottawa, ON K2P 2H8

Re: PLN-EHS-13 Berm Water Sampling QAQC Plan

Dear Mr. Wyman,

Please note that we have reviewed Raytheon's QAQC plan, dated October 4, 2018, for the program noted above and accept it as written.

Through the Canadian Association of Laboratory Accreditation (CALA), Eurofins Environment Testing Canada is accredited to ISO 17025 specific parameters. From a laboratory standpoint, we are committed to fulfill the QAQC requirements as outlined in your plan.

Let me know if you require any additional input or need copies of our accreditation certificates.

Regards,

Scott Clark B.A Hon  
Project Manager  
Eurofins Environment Testing Canada

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Note: The draft document submitted to the laboratory for review and approval was dated 04-Oct-2018.

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