



November 22, 2018

Report No. IA180101-02

International Alliance of Theatrical Stage Employees 891  
1640 Boundary Road,  
Burnaby, BC V5K 4V4

## **ADDENDUM – ADDITIONAL HOT-WIRE FOAM CUTTING EXPOSURE ASSESSMENTS**

Further to the request and agreement from the International Alliance of Theatrical Stage Employees (IATSE) on April 13, 2018 in response to the initial report created by Aura Health and Safety Corporation (Aura) titled “Hot-Wire Foam Cutting Exposure Assessment During Theatrical Staging”, dated October 4, 2017, Aura conducted additional measurements of workers performing hot-wire foam cutting to further investigate potential exposures to benzene, toluene, ethyl benzene, xylene (BTEX), and styrene. The field work was conducted by Mr. Matthew Loss of Aura on September 27 (Site 1) and October 30, 2018 (Site 2).

### **BACKGROUND**

Foam is a common medium used to create small or large sculptures for designing sets for film. Styrofoam, also known as Expanded Polystyrene (EPS), is a white foam material which is most popularly used for set design. Hot wire cutting is a common process used to sculpt foam into desired shapes using either a one- or two-person system. As EPS is a light-weight, easily manipulated medium to work with, sculpting EPS via hot-wire cutting will continue for the foreseeable future.

The initial report dated October 4, 2017 detailed personal and area exposures to BTEX and styrene, the foam cutting process, and other background information. Please refer to the previous report for background details on foam cutting.

The purpose of this study, as an addendum to the initial study, was to continue to investigate potential exposures to BTEX and styrene from hot-wire foam cutting.

### **METHODOLOGY**

Two different production sites were visited for sampling, one on September 27, 2018 (Site 1) and the other on October 30, 2018 (Site 2). Personal samples were collected on sculptors performing hot-wire foam cutting and torching. Area samples were collected directly in the plume produced during foam cutting in order to determine potential worst-case exposures and to confirm that the substances of interest are present.

A total of four personal samples were collected from both sites combined. For each of these samples, a pump was pre- and post-calibrated to approximately 0.2 litres per minute (LPM) with a DryCal and sampled for approximately 260 minutes or half the sculptor’s shift. Sampling followed the National Institute of Occupational Safety and Health (NIOSH) Method 1501 using a 226-01 charcoal sorbent tube.

A total of two area samples from the foam cutting plume were collected from Site 1. For these samples, a pump was calibrated to the same flow rate but sampled for approximately 15-30 minutes. All samples were

sent to an accredited laboratory and analyzed following NIOSH Method 1501 (gas chromatography and flame ionization detector) to determine BTEX and styrene concentrations. One field blank sample was collected per day of sampling for quality control purposes. A copy of the analytical laboratory reports is found in Appendix A. Detailed sampling results are found in Appendix B.

In addition to active samples, a photoionization detector (PID), specifically a ppbRAE 3000 (Rae Systems), was used to determine instantaneous total volatile organic compound (VOC) concentrations during the sculpting process. Measurements were taken in the breathing zone of sculptors as they cut foam, in the smoke plume during cuts, and in the general work area after cuts finished.

## OCCUPATIONAL EXPOSURE LIMITS

Occupational exposures are regulated in British Columbia by WorkSafeBC who sets occupational exposure limits (OEL). BTEX and styrene have full-shift time-weighted average (TWA) OELs which are reduced by a multiplicative factor for shifts longer than 8-hours (Table 1). In addition, benzene, xylene, and styrene have short term exposure limits (STEL); these STELs are not to be exceeded over any 15-minute period and occur not more than four times within one hour of each other during an 8-hour shift.

**Table 1. Occupational Exposure Limits for WorkSafeBC**

Compound Name	8-hour TWA OEL	10-hour TWA OEL	STEL
Benzene	0.5 ppm	0.35 ppm	2.5 ppm
Toluene	20 ppm	14 ppm	-
Ethyl Benzene	20 ppm	14 ppm	-
Xylene	100 ppm	70 ppm	150 ppm
Styrene	50 ppm	35 ppm	75 ppm

**Note:**

- 1) TWA OEL = time-weighted average occupational exposure limit
- 2) STEL = short-term exposure limit

## OBSERVATIONS

All work was performed in indoor work environments. Approximately 5-8 people comprised the foam sculpting team for each production. At any one time, 1-3 sculptors may be conducting hot-wire foam cutting in the work area while others sculpt or glue foam with hand tools. At the first production assessed on September 27<sup>th</sup> (Site 1), one sculptor performed foam cutting for the entire day using a bow cutter (Table 2). Additionally, one worker performed torching on freshly-cut EPS; this procedure used a propane torch to quickly heat and melt the porous foam surfaces in preparation for painting. At the second production assessed on October 30<sup>th</sup> (Site 2), two sculptors performed hot-wire foam cutting together using a long wire between two handles. During both assessments, foam cutting occurred intermittently with other tasks including moving foam, gluing foam, cutting wood, and communicating with other workers.

All foam cutting was performed in warehouses not meant to house this activity. In Site 1, there was a fan placed within a door used to draw air out from the building to the outdoors, acting as a pseudo-local exhaust

ventilation system. In Site 2, there were no make-shift controls in place but only two small ceiling fans operating above the work station.

**Table 2. Site Observations during Foam Cutting Assessments**

	<b>Site 1 September 27, 2018</b>	<b>Site 2 October 30, 2018</b>
<b>Site Features</b>		
Ventilation	Natural Ventilation Make-shift fan venting to the outdoors Door open periodically	Natural Ventilation Ceiling fans Door open periodically
Proximity to other workers	Close proximity to other sculptors	Close proximity to other sculptors
Proximity to other material	HILTI foam	HILTI foam
<b>Hot-Wire Cutting</b>		
Foam Type	EPS	EPS
Set-Up	1 x bow cutter 1 x propane torch	2 x two-person long wire
Visual	Smoke released during cutting and when separating two pieces	Smoke released during cutting and when separating two pieces
Odour	Smoke released evident smell	Smoke released evident smell
<b>Worker</b>		
Personal Protective Equipment (PPE)	Foam Cutting – None Torching – ½ face elastomeric respirator with Organic Vapour cartridges	None

**MONITORING RESULTS**

All personal samples collected from both sites were below the limit of detection for BTEX and styrene (Table 3). The area samples collected from the smoke plume during foam cutting in Site 1 returned measurable amounts of styrene; however, BTEX still remained below the limit of detection for these samples as well. One personal sample in Site 2 returned measurable amounts of ethylbenzene and styrene. This result may be confounded by the fact the worker sampled smokes cigarettes and took three smoke breaks during the sampling period despite the charcoal tube being removed from the worker during the smoke breaks.

**Table 3. BTEX and Styrene Results from Personal and Area Samples**

Sample	Analyte Concentration (ppm)				
	Benzene	Toluene	Ethylbenzene	Xylene	Styrene
F-01 Personal – Foam Cutting	<0.01	<0.01	<0.01	<0.02	<0.04
F-02 Field Blank	ND	ND	ND	ND	ND
F-03 Personal - Torch	<0.01	<0.02	<0.02	<0.04	<0.10
<b>F-04</b> <b>Area – Smoke plume</b>	<0.10	<0.17	<0.14	<0.29	<b>1.0</b>
<b>F-05</b> <b>Area – Smoke plume</b>	<0.05	<0.09	<0.07	<0.15	<b>0.42</b>
<b>IA-01 *</b> <b>Personal – Foam cutting</b>	<0.01	<0.01	<b>0.04</b>	<0.02	<b>0.31</b>
IA-02 Personal – Foam cutting	<0.01	<0.01	<0.01	<0.02	<0.04
IA-03 Field Blank	ND	ND	ND	ND	ND

**Note:**

- 1) **Bold** = samples with analyte concentrations above the limit of detection
- 2) ppm = parts per million
- 3) ND = none detected
- 4) \* = worker sampled smoked cigarettes during breaks throughout the monitoring campaign; sampling train was removed during smoke breaks then reattached afterwards.

Despite the low concentrations captured on the personal and area samples using active methods, the PID instrument captured transient spikes in total VOCs during and after foam cutting activities (Table 4). The highest concentrations of total VOCs were identified within the smoke plume generated during foam cutting with a hot wire. Within the general work area after performing a cut, the total VOC concentration can remain elevated with a distinct odour for at least 3 minutes. While cutting foam, a worker's exposure to total VOCs can be impacted by the presence of ventilation, even make-shift ventilation.

**Table 4. Total VOC Concentrations During Foam Cutting Activities**

Activity	Total VOC (ppm) *
<b>Foam Cutting with Bow Cutter (with make-shift ventilation)</b>	
Downwind during cut (~1 – 2 m)	0.1 – 60.0
Upwind during cut (~1 m)	0.0 – 0.6
Smoke plume (~0.5 m)	25.0 – 100
<b>Foam Cutting with Two-Person Hot-Wire (no ventilation)</b>	
Next to Sculptor	0.0 – 1.0
By foam during cut	0.0 – 0.5
By foam after cut (split pieces)	0.0 – 7.0
HILTI foam being cut	10.0 – 20.0
Smoke Plume	5.0 – 10.0
<b>Torching Foam</b>	
Next to Sculptor	0.0 – 1.0
<b>Work Area</b>	
Residual after cut	0.0 – 3.0
<b>Spray Foam (HILTI Foam)</b>	
Initial spray	50.0 – 1000
5 minutes after initial spray, foam hardened	1.0 – 25.0
25 minutes after initial spray	1.0 – 25.0

**Note:**

- 1) \* = total VOCs are measured in isobutylene equivalents at 10.6 eV
- 2) ppm = parts per million
- 3) Results are combined from both Sites in the table

**DISCUSSION**

BTEX and styrene released from EPS when cut with hot-wire equipment appears to be transient and disperses quickly as indicated by the PID measurements; exposures are limited mainly to the sculptor operating the equipment or those downwind of the activity. Although they may be transient, total VOCs can reach high levels, especially when trapped between two large pieces of foam.

Worker exposures to BTEX and styrene from hot-wire foam cutting are likely low because the activity is performed intermittently with other tasks and the task itself is quick; therefore, the total amount of time spent cutting foam during a normal 10-hour shift may be only five hours.

The personal sample with measured ethylbenzene and styrene concentrations (IA-01) were sampled from a worker who took three cigarette smoke breaks during the sampling period. It is known that ethylbenzene and styrene, along with benzene and xylene, are components of cigarette smoke and may remain in the smoker's breath or on their clothes. The concentrations captured in the sample may be confounded by

secondary exposure to cigarette smoke despite minimizing the impact from direct cigarette smoke during the sampling period.

When comparing exposures to the occupational exposure limit (OEL), all substance concentrations are below full-shift time-weighted average (TWA) OELs. If the total VOC measurements were assumed to be only benzene, then the STEL could be exceeded during cutting. However, this is unlikely because the composition of vapours released are likely a mixture dominated by styrene, and benzene has yet to be identified at measurable amounts from active samples.

## **CONCLUSION AND RECOMMENDATIONS**

Based on the observations and results above, Aura makes the following conclusions and recommendations:

- Cutting foam with hot-wire equipment can release significant amounts of VOCs;
- Personal exposures to workers for BTEX and styrene during hot-wire foam cutting are below applicable occupational exposure limits;
- Styrene was confirmed to be released during hot-wire cutting of EPS; BTEX was expected to be released as well but has yet to be captured at any significant concentration;
- Using spray foam to glue pieces together releases significant amounts of total VOCs, which persist even after the foam has cured;
- Additional sampling at different productions may be performed to gather further evidence for the types of exposures foam sculptors may experience;
- Additional engineering controls, such a fans for ventilation, should be used to reduce exposures to fumes and minimize the accumulation of substances in the work space; and,
- Half-face elastomeric respirators with P100/Organic Vapour cartridges, along with proper fit testing and training, should be made available to workers should they be requested.

## **LIMITATIONS**

The following limitations should be noted when referring to the addendum report:

- The number of personal samples collected were limited based on the available foam cutting activities occurring; this limited the number of samples able to be collected; and,
- Measurements made by the PID instrument (ppbRAE 3000) were for total VOCs only and did not identify the specific substance in the air.

## CLOSURE

This study and report were independently funded by IATSE Local 891, who provided no oversight or input. Any use that a third party makes of this report, or any reliance on or decisions to be made based upon it, are the responsibility of such third parties. Aura accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. Please see Aura's Statement of Limitations included in Appendix C.

We trust that this information is sufficient for your requirements at the present time. Should you have any questions, please do not hesitate to contact the undersigned.

Respectfully,

**Aura Health & Safety Corp.**

**Prepared by:**



Matthew Loss, MSc.  
Industrial Hygienist

**Reviewed by:**



Mona Shum, MSc., CIH.  
Principal Industrial Hygienist

Appendices:   Appendix A – Laboratory Results  
                  Appendix B – Sampling Results  
                  Appendix C – Statement of Limitations



**Appendix A**  
**Laboratory Analytical Results**





October 03, 2018

Shanaz Akbar  
MAXXAM ANALYTICS, INC.  
4606 Canada Way  
Burnaby, BC V5G 1K5

Maxxam Analytics Work Order 18100006

Reference: B884110

Dear Shanaz Akbar:

Maxxam Analytics received 5 samples on October 01, 2018 for the analyses presented in the following report.

Enclosed is a copy of the Chain-of-Custody record, acknowledging receipt of these samples. Please note that any unused portion of the samples will be discarded 30 days after the date of this report, unless you have requested otherwise.

This material is confidential and is intended solely for the person to whom it is addressed. If this is received in error, please contact the number provided below.

We appreciate the opportunity to assist you. If you have any questions concerning this report, please contact a Client Services Representative at (800) 806-5887.

Sincerely,

A handwritten signature in black ink that reads "Daniel Elliott". The signature is written in a cursive, slightly slanted style.

Daniel Elliott

Client Services Representative

Electronic signature authorized through password protection

cc: Enviro  
Customer Service BC

**Maxxam Analytics**  
22345 Roethel Drive  
Novi, MI 48375

Toll Free: 800.806.5887  
Lab Main: 248.344.2652  
Fax: 248.344.2655  
[www.maxxamlabs.com](http://www.maxxamlabs.com)

## CASE NARRATIVE

**Date:** 03-Oct-18

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**CLIENT:** MAXXAM ANALYTICS, INC.

**Project:** B884110

**Work Order No** 18100006

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The results of this report relate only to the samples listed in the body of this report.

Unless otherwise noted below, the following statements apply: 1) all samples were received in acceptable condition, 2) all quality control results associated with this sample set were within acceptable limits and/or do not adversely affect the reported results, and 3) the industrial hygiene results have not been blank corrected.

Analytical Comments for Method SOP-5, sample -004A: Note that this sample appears to have been collected backwards. However, since all positive results are confined to the back section of the tube, there is no evidence of breakthrough.

# ANALYTICAL RESULTS

Date: 03-Oct-18

**Client:** MAXXAM ANALYTICS, INC.

**Project:** B884110

**Work Order No:** 18100006

**Sample Identification:** UK7368-F-01-FOAM HOT WIRE CUTTING

**Lab Number:** 001A

**Date Sampled:** 9/27/2018

**Sample Type:** Charcoal Tube

**Date Received:** 10/1/2018

**Analyst:** CAW

**Air Volume (L):** 56.2

Analyte	Analytical Results			Reporting Limit (µg)	Test Method	Date Analyzed
	(µg)	(mg/m <sup>3</sup> )	(ppm)			
Benzene	<1	<0.018	<0.0056	1	NIOSH 1501	10/02/2018
Ethylbenzene	<2	<0.036	<0.0082	2	NIOSH 1501	10/02/2018
Styrene	<10	<0.18	<0.042	10	SOP-5, GC-FID	10/02/2018
Toluene	<2	<0.036	<0.0094	2	NIOSH 1501	10/02/2018
Xylene, Total	<4	<0.071	<0.016	4	NIOSH 1501	10/02/2018

**Sample Identification:** UK7369-F-02-BLANK

**Lab Number:** 002A

**Date Sampled:** 9/27/2018

**Sample Type:** Charcoal Tube

**Date Received:** 10/1/2018

**Analyst:** CAW

**Air Volume (L):** NA

Analyte	Analytical Results			Reporting Limit (µg)	Test Method	Date Analyzed
	(µg)	(mg/m <sup>3</sup> )	(ppm)			
Benzene	<1	--	--	1	NIOSH 1501	10/02/2018
Ethylbenzene	<2	--	--	2	NIOSH 1501	10/02/2018
Styrene	<10	--	--	10	SOP-5, GC-FID	10/02/2018
Toluene	<2	--	--	2	NIOSH 1501	10/02/2018
Xylene, Total	<4	--	--	4	NIOSH 1501	10/02/2018

# ANALYTICAL RESULTS

Date: 03-Oct-18

**Client:** MAXXAM ANALYTICS, INC.

**Project:** B884110

**Work Order No:** 18100006

**Sample Identification:** UK7370-F-03-TORCHING FOAM

**Lab Number:** 003A

**Date Sampled:** 9/27/2018

**Sample Type:** Charcoal Tube

**Date Received:** 10/1/2018

**Analyst:** CAW

**Air Volume (L):** 24.6

Analyte	Analytical Results			Reporting Limit (µg)	Test Method	Date Analyzed
	(µg)	(mg/m <sup>3</sup> )	(ppm)			
Benzene	<1	<0.041	<0.013	1	NIOSH 1501	10/02/2018
Ethylbenzene	<2	<0.081	<0.019	2	NIOSH 1501	10/02/2018
Styrene	<10	<0.41	<0.095	10	SOP-5, GC-FID	10/02/2018
Toluene	<2	<0.081	<0.022	2	NIOSH 1501	10/02/2018
Xylene, Total	<4	<0.16	<0.037	4	NIOSH 1501	10/02/2018

**Sample Identification:** UK7371-F-04-AMB AT WIRE CUTTING FUME

**Lab Number:** 004A

**Date Sampled:** 9/27/2018

**Sample Type:** Charcoal Tube

**Date Received:** 10/1/2018

**Analyst:** CAW

**Air Volume (L):** 3.18

Analyte	Analytical Results			Reporting Limit (µg)	Test Method	Date Analyzed
	(µg)	(mg/m <sup>3</sup> )	(ppm)			
Benzene	<1	<0.31	<0.098	1	NIOSH 1501	10/02/2018
Ethylbenzene	<2	<0.63	<0.14	2	NIOSH 1501	10/02/2018
Styrene	Total 14	4.3	1.0	10	SOP-5, GC-FID	10/02/2018
	Back Section 14	(a) See Case Narrative for Explanation				
Toluene	<2	<0.63	<0.17	2	NIOSH 1501	10/02/2018
Xylene, Total	<4	<1.3	<0.29	4	NIOSH 1501	10/02/2018

(a) Analysis indicates possible breakthrough; back section result is greater than 10% of the front section result.

## ANALYTICAL RESULTS

Date: 03-Oct-18

**Client:** MAXXAM ANALYTICS, INC.

**Project:** B884110

**Work Order No:** 18100006

**Sample Identification:** UK7372-F-05-AMB AT WIRE CUTTING FUME

**Lab Number:** 005A

**Date Sampled:** 9/27/2018

**Sample Type:** Charcoal Tube

**Date Received:** 10/1/2018

**Analyst:** CAW

**Air Volume (L):** 6.2

Analyte	Analytical Results			Reporting Limit (µg)	Test Method	Date Analyzed
	(µg)	(mg/m <sup>3</sup> )	(ppm)			
Benzene	<1	<0.16	<0.050	1	NIOSH 1501	10/02/2018
Ethylbenzene	<2	<0.32	<0.074	2	NIOSH 1501	10/02/2018
Styrene	11	1.7	0.41	10	SOP-5, GC-FID	10/02/2018
Toluene	<2	<0.32	<0.086	2	NIOSH 1501	10/02/2018
Xylene, Total	<4	<0.65	<0.15	4	NIOSH 1501	10/02/2018

**General Notes:**

<: Less than the indicated reporting limit (RL).

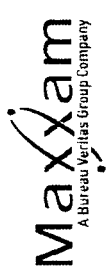
--: Information not available or not applicable.

Back sections (if applicable) were checked and showed no significant breakthrough unless otherwise noted.

18100006

CHAIN OF CUSTODY RECORD FOR SUBCONTRACTED WORK

Sent To: BV North America, Inc. (Novi)  
22345 Roethel Drive  
Novi, MI, 48375  
Tel: (248) 344-1770



REPORT INFORMATION				ANALYSIS REQUESTED				ADDITIONAL SAMPLE INFORMATION							
Company: Maxxam		Address: 4606 Canada Way, Burnaby, British Columbia, V5G 1K5		Contact Name: BC Env Customer Service		Email: Enviro.CS.BC@maxxam.ca, customerservicebc@maxxamanalytics.com		Phone:		Maxxam Project #: B884110					
#	SAMPLE ID	MATRIX	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	SAMPLER INITIALS	# CONT									
1	UK7368-F-01-FOAM HOT WIRE CUTTING	AIR	2018/09/27		ML	1	X								(P: 01)
2	UK7369-F-02-BLANK	AIR	2018/09/27		ML	1	X								(P: 01)
3	UK7370-F-03-TORCHING FOAM	AIR	2018/09/27		ML	1	X								(P: 01)
4	UK7371-F-04-AMB AT WIRE CUTTING FUME	AIR	2018/09/27		ML	1	X								(P: 01)
5	UK7372-F-05-AMB AT WIRE CUTTING FUME	AIR	2018/09/27		ML	1	X								(P: 01)
6															
7															
8															
9															
10															
REGULATORY CRITERIA				SPECIAL INSTRUCTIONS				TURNAROUND TIME							
				Please inform Maxxam immediately if you are not accredited for the requested test(s). **Please return a copy of this form with the report.** BTEX and STYRENE				<input checked="" type="checkbox"/> Rush Required <b>2018/10/03</b> Date Required Please inform us if rush charges will be incurred.							
COOLER ID:		COOLER ID:		COOLER ID:		COOLER ID:		COOLER ID:		COOLER ID:		COOLER ID:		COOLER ID:	
Custody Seal Present	YES	NO	Temp: (°C)	Custody Seal Present	YES	NO	Temp: (°C)	Custody Seal Present	YES	NO	Temp: (°C)	Custody Seal Present	YES	NO	Temp: (°C)
Custody Seal Intact				Custody Seal Intact				Custody Seal Intact				Custody Seal Intact			
Cooling Media Present				Cooling Media Present				Cooling Media Present				Cooling Media Present			
RELINQUISHED BY: (SIGN & PRINT)		DATE: (YYYY/MM/DD)		TIME: (HH:MM)		RECEIVED BY: (SIGN & PRINT)		DATE: (YYYY/MM/DD)		TIME: (HH:MM)		RELINQUISHED BY: (SIGN & PRINT)		DATE: (YYYY/MM/DD)	
1. <i>[Signature]</i>		2018/09/28		15:00		1.									
2.						2.									





November 09, 2018

Shanaz Akbar  
MAXXAM ANALYTICS, INC.  
4606 Canada Way  
Burnaby, BC V5G 1K5

Maxxam Analytics Work Order 18110017

Reference: B895350

Dear Shanaz Akbar:

Maxxam Analytics received 3 samples on November 01, 2018 for the analyses presented in the following report.

Enclosed is a copy of the Chain-of-Custody record, acknowledging receipt of these samples. Please note that any unused portion of the samples will be discarded 30 days after the date of this report, unless you have requested otherwise.

This material is confidential and is intended solely for the person to whom it is addressed. If this is received in error, please contact the number provided below.

We appreciate the opportunity to assist you. If you have any questions concerning this report, please contact a Client Services Representative at (800) 806-5887.

Sincerely,

A handwritten signature in black ink that reads "Daniel Elliott". The signature is written in a cursive, slightly slanted style.

Daniel Elliott

Client Services Representative

Electronic signature authorized through password protection

cc: Enviro  
Customer Service BC

**Maxxam Analytics**  
22345 Roethel Drive  
Novi, MI 48375

Toll Free: 800.806.5887  
Lab Main: 248.344.2652  
Fax: 248.344.2655  
[www.maxxamlabs.com](http://www.maxxamlabs.com)



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**CASE NARRATIVE**

**Date:** 09-Nov-18

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**CLIENT:** MAXXAM ANALYTICS, INC.

**Project:** B895350

**Work Order No** 18110017

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The results of this report relate only to the samples listed in the body of this report.

Unless otherwise noted below, the following statements apply: 1) all samples were received in acceptable condition, 2) all quality control results associated with this sample set were within acceptable limits and/or do not adversely affect the reported results, and 3) the industrial hygiene results have not been blank corrected.

## ANALYTICAL RESULTS

Date: 09-Nov-18

**Client:** MAXXAM ANALYTICS, INC.

**Project:** B895350

**Work Order No:** 18110017

**Sample Identification:** UR1969-IA-01-OCC-HOT WIRE FOAM

**Lab Number:** 001A

**Date Sampled:** 10/30/2018

**Sample Type:** Charcoal Tube

**Date Received:** 11/1/2018

**Analyst:** CAW

**Air Volume (L):** 48.3

Analyte	Analytical Results			Reporting Limit (µg)	Test Method	Date Analyzed
	(µg)	(mg/m <sup>3</sup> )	(ppm)			
Benzene	<1	<0.021	<0.0065	1	NIOSH 1501	11/06/2018
Ethylbenzene	8.5	0.18	0.041	2	NIOSH 1501	11/06/2018
Styrene	64	1.3	0.31	10	NIOSH 1501	11/06/2018
Toluene	<2	<0.041	<0.011	2	NIOSH 1501	11/06/2018
Xylene, Total	<4	<0.083	<0.019	4	NIOSH 1501	11/06/2018

**Sample Identification:** UR1970-IA-02-OCC-HOT WIRE FOAM

**Lab Number:** 002A

**Date Sampled:** 10/30/2018

**Sample Type:** Charcoal Tube

**Date Received:** 11/1/2018

**Analyst:** CAW

**Air Volume (L):** 55.4

Analyte	Analytical Results			Reporting Limit (µg)	Test Method	Date Analyzed
	(µg)	(mg/m <sup>3</sup> )	(ppm)			
Benzene	<1	<0.018	<0.0057	1	NIOSH 1501	11/06/2018
Ethylbenzene	<2	<0.036	<0.0083	2	NIOSH 1501	11/06/2018
Styrene	<10	<0.18	<0.042	10	NIOSH 1501	11/06/2018
Toluene	<2	<0.036	<0.0096	2	NIOSH 1501	11/06/2018
Xylene, Total	<4	<0.072	<0.017	4	NIOSH 1501	11/06/2018

## ANALYTICAL RESULTS

Date: 09-Nov-18

**Client:** MAXXAM ANALYTICS, INC.

**Project:** B895350

**Work Order No:** 18110017

**Sample Identification:** UR1971-IA-03-FIELD BLANK

**Lab Number:** 003A

**Date Sampled:** 10/30/2018

**Sample Type:** Charcoal Tube

**Date Received:** 11/1/2018

**Analyst:** CAW

**Air Volume (L):** NA

Analyte	Analytical Results			Reporting Limit (µg)	Test Method	Date Analyzed
	(µg)	(mg/m <sup>3</sup> )	(ppm)			
Benzene	<1	--	--	1	NIOSH 1501	11/06/2018
Ethylbenzene	<2	--	--	2	NIOSH 1501	11/06/2018
Styrene	<10	--	--	10	NIOSH 1501	11/06/2018
Toluene	<2	--	--	2	NIOSH 1501	11/06/2018
Xylene, Total	<4	--	--	4	NIOSH 1501	11/06/2018

**General Notes:**

<: Less than the indicated reporting limit (RL).

--: Information not available or not applicable.

Back sections (if applicable) were checked and showed no significant breakthrough unless otherwise noted.

18/10017

REPORT INFORMATION			ANALYSIS REQUESTED				ADDITIONAL SAMPLE INFORMATION																																					
Company: Maxxam																																												
Address: 4606 Canada Way, Burnaby, British Columbia, V5G 1K5																																												
Contact Name: BC Env Customer Service																																												
Email: Enviro.CS.BC@maxxam.ca, customerservicebc@maxxamanalytics.com																																												
Phone:																																												
Maxxam Project #: B895350																																												
#	SAMPLE ID	MATRIX	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	SAMPLER INITIALS	# CONT.																																						
1	UR1969-IA-01-OCC-HOT WIRE FOAM	AIR	2018/10/30		ML	1	X	(P: 01)																																				
2	UR1970-IA-02-OCC-HOT WIRE FOAM	AIR	2018/10/30		ML	1	X	(P: 01)																																				
3	UR1971-IA-03-FIELD BLANK	AIR	2018/10/30		ML	1	X	(P: 01)																																				
4																																												
5																																												
6																																												
7																																												
8																																												
9																																												
10																																												
REGULATORY CRITERIA			SPECIAL INSTRUCTIONS				TURNAROUND TIME																																					
			Please inform Maxxam immediately if you are not accredited for the requested test(s). **Please return a copy of this form with the report.** SUBC COMMENT=BTEX and Styrene by NIOSH 1501				<input type="checkbox"/> Rush Required 2018/11/07 Date Required Please inform us if rush charges will be incurred.																																					
COOLER ID:			COOLER ID:			COOLER ID:																																						
<table border="1"> <tr><td>YES</td><td>NO</td><td>Temp: (°C)</td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> </table>			YES	NO	Temp: (°C)										<table border="1"> <tr><td>YES</td><td>NO</td><td>Temp: (°C)</td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> </table>			YES	NO	Temp: (°C)										<table border="1"> <tr><td>YES</td><td>NO</td><td>Temp: (°C)</td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> </table>			YES	NO	Temp: (°C)									
YES	NO	Temp: (°C)																																										
YES	NO	Temp: (°C)																																										
YES	NO	Temp: (°C)																																										
RELINQUISHED BY: (SIGN & PRINT)			RECEIVED BY: (SIGN & PRINT)			DATE: (YYYY/MM/DD)																																						
1. Maxxam			1. J. Smith			11/1/18																																						
2.			2.			10:50																																						





# **Appendix B**

## **Sampling Results**

**TABLE B-1**  
**Sampling Results for BTEX and Styrene**

Sample ID	Average Flow Rate (L/min)	Sample Duration (min)	Sample Volume (L)	BTEX Mass (µg)	Styrene Mass (µg)
F-01	0.203	277	26.2	< LOD	< LOD
F-02	N/A	N/A	N/A	< LOD	< LOD
F-03	00.202	122	24.6	< LOD	< LOD
F-04	0.199	16	3.2	< LOD	14
F-05	0.200	31	6.2	< LOD	11
IA-01	0.210	230	48.3	< LOD	< LOD
IA-02	0.210	264	55.4	< LOD	< LOD
IA-03	N/A	N/A	N/A	< LOD	< LOD

**Notes:** < - less than  
 N/A – Not applicable



**Appendix C**  
**Statement of Limitations**



## **STATEMENT OF LIMITATIONS**

The work performed in this report was carried out in accordance with the Standard Terms of Conditions made part of our contract. The conclusions presented herein are based solely upon the scope of services and time and budgetary limitations described by this contract.

The report has been prepared in accordance with generally accepted industrial hygiene and/or health and safety practices. No other warranties, either expressed or implied, are made as to the professional services provided under the terms of our contract and included in this report.

The calibration factors and other results presented here are based on the experimental work under the conditions described in this study. Results may vary under different experimental conditions, which should be considered when applying the calibration factors reported here to estimate glycerin/mineral oil aerosol concentrations.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it are the responsibility of such third parties. Aura Health and Safety accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.