



October 3, 2018

Report No. IA180101-01

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

ADDENDUM – ADDITIONAL FOG FLUID CALIBRATION FACTORS

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 “Calibration Factors for Haze and Fog in the Film Industry”, dated April 9, 2018, Aura conducted measurements of three different fog and haze fluids commonly used in film to develop calibration factors. Fog simulations were conducted following the same procedures used in the initial study. The field work was conducted by Mr. Matthew Loss of Aura on June 5, 6, and 7, 2018, with assistance from Ms. Carolyn Li.

BACKGROUND

Fogs are frequently used in the entertainment industry to produce atmospheric special effects. With the increased use of fog-based products in the film industry, interest in the potential health effects of exposure to fog has increased. Most fog products are categorized into two types: glycol-based and glycerin-based.

The initial report dated April 9, 2018 developed calibration factors for 10 fluids commonly used. Please refer to the previous report for details on these 10 fluids, their calibration factors, and other background details related to fog and haze exposure.

The purpose of this study, as an addendum to the initial study, was to develop calibration factors for one previously studied and two new fog fluids: C-Beam Regular Haze, Ultratec Regular Haze, and REEL EFX Diffusion Fluid.

Mineral oil is categorized by WorkSafeBC into two categories: Mildly Refined and Severely Refined. The difference between the two types is the amount of impurities present. Solvent extraction and hydro-treatments remove these impurities, most notably polycyclic aromatic hydrocarbons (PAHs). It is these PAHs in mineral oils which are carcinogenic. Mildly refined mineral oil contains a significant level of PAHs, enough for the International Agency for Research on Cancer (IARC) and WorkSafeBC to deem it carcinogenic. Severely refined mineral oil contains significantly less levels of PAHs, at a level that IARC and WorkSafeBC does not deem it carcinogenic. This is reflected in the occupational exposure limits set by WorkSafeBC in Section 5.48 of the Occupational Health and Safety Regulation. In the entertainment industry, only severely refined mineral oil should be considered for use for atmosphere special effects.

METHODOLOGY

Two glycerin-based fog fluids, C-Beam Regular Haze and Ultratec Regular Haze, and one mineral oil-based fog fluid, REEL EFX Diffusion Fluid, were used to generate fog in a closed environment at five different concentrations: 10 mg/m³, 20 mg/m³, 50 mg/m³, 100 mg/m³, and 140 mg/m³. The glycerin-based fog fluids

used a Le Maitre G300 fog machine and the mineral oil-based fog fluid used a REEL EFX Diffusion Fogger Machine; the machines used follow the manufacturer's specifications for the fluids. The simulated fog measurements were conducted in a closed room of approximately 1,290 cubic feet (ft³) at 9790 198b St, Langley, BC V1M 2X5.

The fog machine was turned on until a homogenous atmosphere at the desired concentration was achieved in the space. A direct-reading instrument, a DustTrak DRX Aerosol Monitor 8533, was used to determine the particulate concentration. Once the fog level stabilized at the desired concentration, active sampling began. Sampling for glycerin followed NIOSH Method 0500 - Particles Not Otherwise Specified, and sampling for mineral oil followed NIOSH Method 5026 - Oil Mist, Mineral. The flow rate was set at 3 litres per minute for all samples. Sampling times ranged from 5 minutes to 45 minutes depending on the concentration in the room. In general, for lower the concentrations, a longer sampling time was necessary in order to collect enough analyte. Three samples were taken at each concentration; however, two samples were taken of C-Beam Regular Haze at 10 mg/m³ and 20 mg/m³. Two field blanks for each fog fluid was collected for quality control purposes. Measurements of a particular fluid occurred on the same day. The room was not vented between measurements.

Collected samples were sent to an accredited laboratory for analysis. C-Beam Regular Haze and Ultratec Regular Haze samples were sent to Scientific Analytic Institute (SAI) for analysis following NIOSH Method 0500. REEL EFX Diffusion Fluid samples were sent to Maxxam Laboratories for analysis following NIOSH method 5026.

Bulk samples of glycerin-based fluids were collected in a clean jar and analyzed through Gas Chromatography/Mass Spectrometry by the University of British Columbia Occupational and Environmental Hygiene Laboratory. Additionally, temperature and relative humidity were recorded throughout the sampling period using a hygrometer.

Qualitative observations were collected throughout the sampling period of the fogs. Detailed sample results are found in Appendix C.

OBSERVATIONS

All work was performed in an indoor room. During the calibration factor measurements, the temperature and relative humidity ranged from 22-26°C and 39-48%, respectively.

Theatrically, Ultratec Regular Haze is reportedly similar to C-Beam; however, C-Beam is known to clog machines while Ultratec Regular Haze does not. DF50 is a different fluid altogether which has been marked as a possible replacement for other fluids given its mineral oil composition. There were no clogging issues during the calibration factor measurements for any fluid.

It is difficult to visually distinguish the atmosphere between different fog types. In general, the lower range of concentrations up to 50 mg/m³ were difficult to distinguish, although C-Beam Regular Haze appeared to produce a thicker fog at lower concentrations compared to Ultratec Regular Haze. Concentrations at or above 100 mg/m³ were noticeably different with reduced visibility.

C-Beam Regular Haze produced a white-coloured fog with a blue hue while Ultratec Regular Haze and REEL EFX Diffusion Fluid produced a white-coloured fog. The hang time for all three fogs was noticeably long. The three fogs hung in the air at a consistent concentration for approximately two to three minutes before concentrations started to decline.

C-Beam Regular Haze was the only fog fluid to leave an oil-like residue on surfaces. This residue covered nearly all surfaces and required cleaning of the equipment to remove it. This property of C-Beam Regular Haze may partially contribute to the clogging problem in fog machines.

BULK FOG FLUID COMPOSITION RESULTS

Bulk samples of all glycerin-based fluids were collected to determine the composition of glycerin in the fluid. C-Beam Regular Haze and Ultratec Regular Haze have very similar glycerin compositions at 18.6% and 17.5%, respectively (Table 1). The mineral oil-based fluid, DF50, was not analyzed for composition since mineral oil is a complex mixture of long saturated and aromatic hydrocarbons.

Table 1. Bulk Fog Fluid Composition

Fog Fluid Commercial Name	Glycerin
C-Beam Regular Haze Fluid	18.6%
Ultratec Regular Haze Fluid	17.5%

CALIBRATION FACTOR RESULTS

Twelve samples of C-Beam Regular Haze, 10 samples of Ultratec Regular Haze, and 15 samples of REEL EFX Diffusion Fluid were used to create calibration factors (Table 2). Unfortunately, C-Beam Regular Haze sampling did not produce a viable dataset to which a curve can reasonably be fitted (Figure 1A); therefore, a calibration factor for C-Beam Regular Haze was not achievable. The calibration factor for Ultratec Regular Haze and REEL EFX Diffusion Fluid are 0.04 and 0.83, respectively, as determined by the slope of the linear trendline (Figures 1B-C). All curves are forced through the origin (0,0). The Coefficient of Variation values (R^2) indicate that the trendlines for Ultratec Regular Haze and REEL EFX Diffusion Fluid agrees with their dataset reasonably well.

Table 2. Calibration Factor for Glycerin and Mineral Oil-Based Fog Fluids

Fog Manufacturer	Machine	Fluid Name	Fluid Type	Calibration Factor	R^2 Value
Le Maitre	G300 (Le Maitre)	C-Beam Regular Haze	Glycerin	Not Achievable	-
Ultratec Special Effects	G300 (Le Maitre)	Ultratec Regular Haze	Glycerin	0.04	0.72
REEL EFX	Reef EFX Diffusion Fogger	REEL EFX Diffusion Fluid	Mineral Oil	0.83	0.97

Note:

- 1) R^2 = Coefficient of Variation

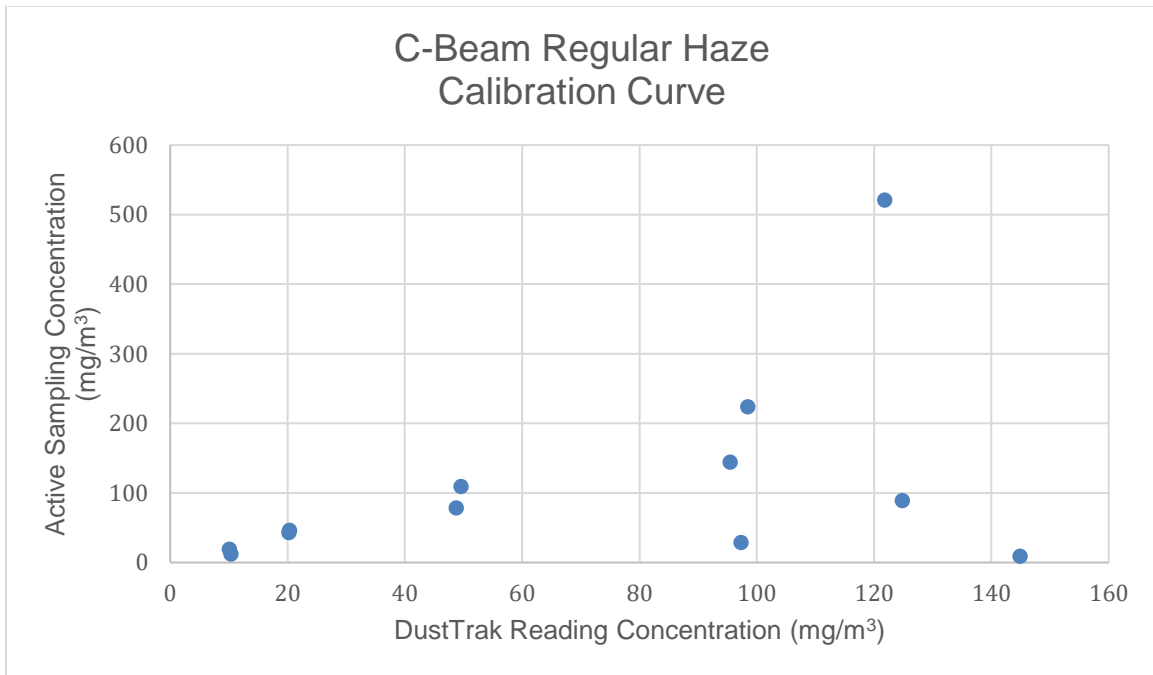


Figure 1A. Active sampling concentrations compared to DustTrak concentrations for C-Beam Regular Haze using La Maitre G300 machine (CF = N/A). A linear trendline was not able to be created for this dataset due to the amount of variability.

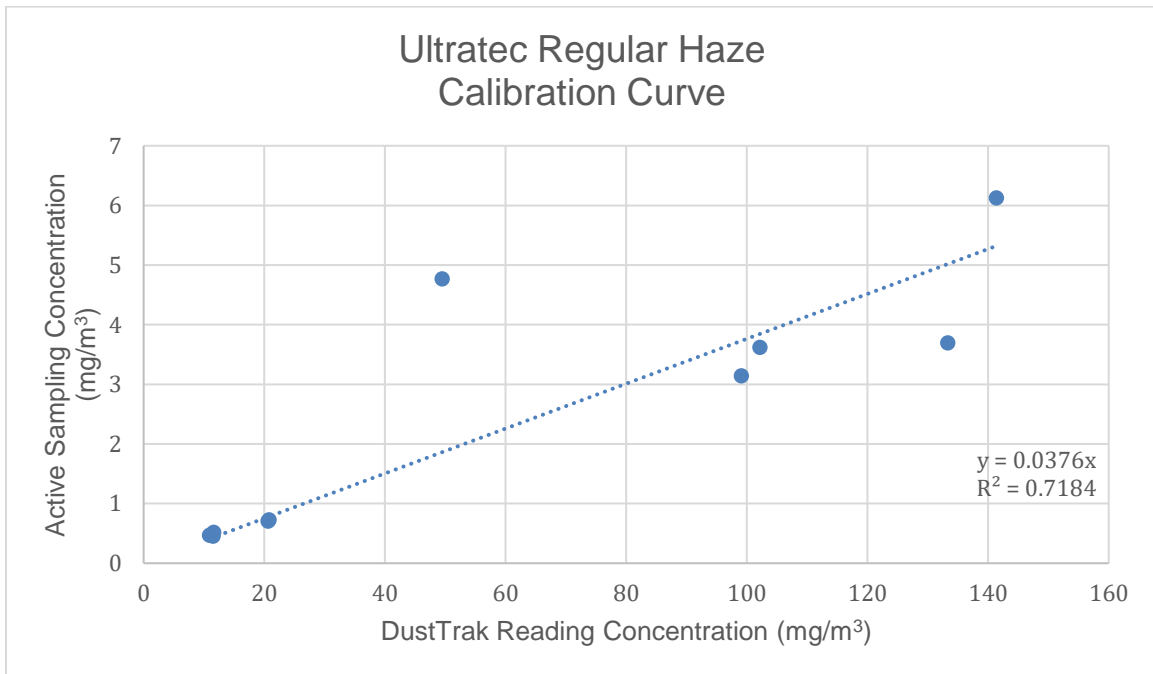


Figure 1B. Active sampling concentrations compared to DustTrak concentrations for Ultratec Regular Haze using La Maitre G300 machine (CF = 0.04).

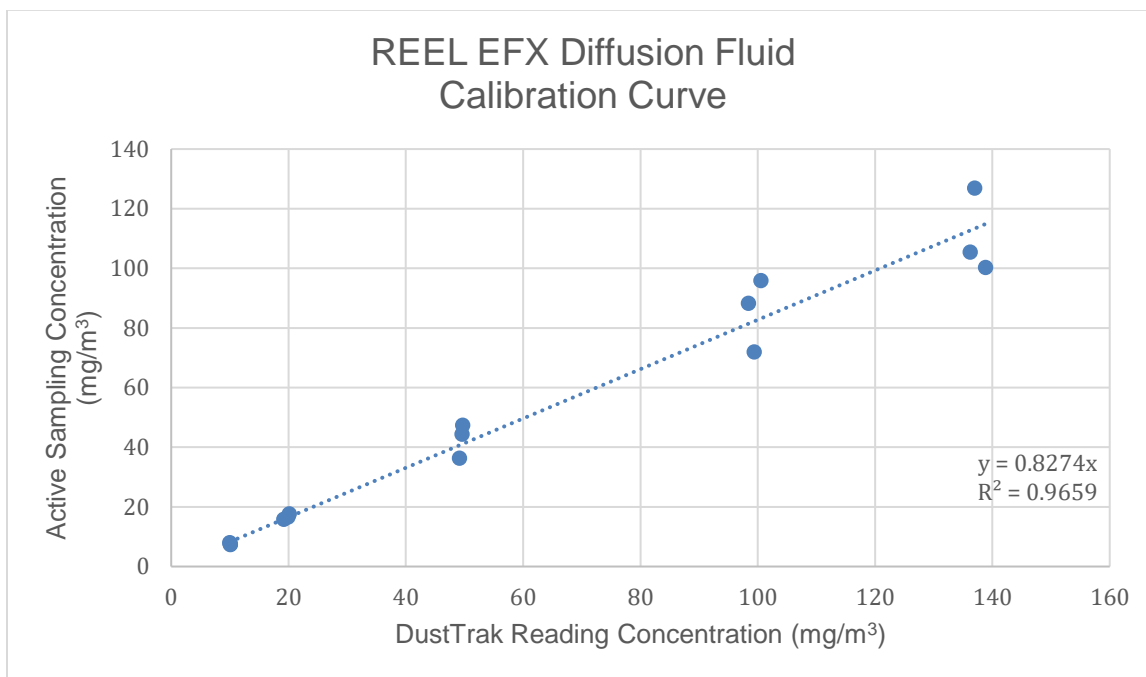


Figure 1C. Active sampling concentrations compared to DustTrak concentrations for REEL EFX Diffusion Fluid using REEL EFX Diffusion Fogger (CF = 0.83).

DISCUSSION

Ultratec Regular Haze has a very low calibration factor at 0.04 while REEL EFX Diffusion Fluid had a higher calibration factor at 0.83. Compared to calibration factors summarized by ENVIRON International Corporation, the values obtained through this study are in good agreement (Table 3). The ENVIRON study used a pDR 1000 AN Monitor (ThermoFisher) and different methodology than our current study and may contribute to some of the differences in values obtained. This other device, pDR 1000 AN Monitor, is a viable option for monitoring fog concentrations on set when used in conjunction with applicable calibration factors developed by ENVIRON International Corporation. This instrument has been preferred by some productions, because it is quieter than the DustTrak.

Table 3. Comparison of Calibration Factors to Previous Studies

Fog Fluid	Current Study	ENVIRON
Ultratec Regular Haze	0.04	0.09 ¹
REEL EFX Diffusion Fluid	0.83	0.78 ²

Note:

- 1) ENVIRON 2003
- 2) ENVIRON 2001

Glycerin generated by C-Beam Regular Haze and Ultratec Regular Haze, in conjunction with the La Maitre G300 machine, produces particulate matter primarily in the size range of less than or equal to 1 micrometer (um) in aerodynamic diameter (PM1). This size of particulate matter travels deep into the lungs and is

considered respirable. The same is true with mineral oil particulate matter generated by REEL EFX Diffusion Fluid in conjunction with the REEL EFX Diffusion Fogger.

When comparing exposures to the occupational exposure limit, the occupational exposure limit denoting the respirable size fraction should be used when available (Table 4). For glycerin mist in the respirable size fraction, the WorkSafeBC exposure limit for an 8-hour shift is 3 mg/m³. On many film sets, however, work shifts are extended to over 12 hours which reduces the exposure limit according to predetermined factors (Table 5). Due to the low calibration factor for Ultratec Regular Haze (0.04), fog concentrations (as determined by a DustTrak) can reach higher levels than other fog fluids like REEL EFX Diffusion Fluid which has a calibration factor of 0.83.

In addition to occupational exposure limits, excursion limits must be considered when developing exposure profiles. Excursion limits are higher concentrations of a substance that cannot be exceeded for a shorter amount of time. Specifically, there are two limits which must be considered. An exposure of three times the 8-hour time-weighted average cannot be exceeded for more than a total of 30 minutes during the work period. An exposure of five times the 8-hour time-weighted average cannot be exceeded at any time during the work shift. These excursion limits are important to consider when using high concentrations of fog for short amounts of time.

The low calibration factor for Ultratec Regular Haze allows it to be used at a greater range of concentrations without overexposing workers and is a viable option for film productions. The calibration factor around 1.0 for REEL EFX Diffusion Fluid, combined with the low exposure limit, greatly restricts the level of fog that can be used and maintained; therefore, use of REEL EFX Diffusion Fluid may not be a practicable option for film productions wanting fog effects for extended periods of time.

Table 4. Occupational Exposure Limits for Regulatory Agencies

Compound Name	CAS #	WorkSafeBC*	ACGIH	ANSI E1.5-2009
Glycerin Mist, Respirable	56-81-5	3 mg/m ³ (TWA) 9 mg/m ³ (3xTWA) 15 mg/m ³ (5xTWA)	-	10 mg/m ³ (TWA) 50 mg/m ³ (C)
Glycerin Mist, Total	56-81-5	10 mg/m ³ (TWA) 30 mg/m ³ (3xTWA) 50 mg/m ³ (5xTWA)	-	-
Oil Mist, Mineral (severely refined)	-	1 mg/m ³ (TWA) 3 mg/m ³ (3xTWA) 5 mg/m ³ (5xTWA)	5 mg/m ³	-

Note:

- 1) * = WorkSafeBC is proposing to remove the OEL for glycerin mist
- 2) ACGIH = American Conference of Governmental Industrial Hygienists
- 3) ANSI = American National Standards Institute
- 4) TWA = time-weighted average
- 5) C = ceiling
- 6) mg/m³ = milligrams per cubic metre
- 7) 3xTWA = Three times the time-weighted average, not to be exceeded for 30 minutes during a work shift
- 8) 5xTWA = Five times the time-weighted average, not to be exceeded at any time during the work shift

Table 5. WorkSafeBC Extended Work Shift Exposure Limits Adjusted Based on a Factor.

Fog Fluid	Work Shift (in hours)	Adjusted TWA Exposure Limits
Ultratec Regular Haze	8 – 10	2.1 mg/m ³
	10 – 12	1.5 mg/m ³
	12 - 16	0.75 mg/m ³
REEL EFX Diffusion Fluid	8 – 10	0.7 mg/m ³
	10 – 12	0.5 mg/m ³
	12 - 16	0.25 mg/m ³

Note:

1) mg/m³ = milligrams per cubic metre

As with other studies, C-Beam Regular Haze was difficult to accurately sample despite that the glycerin composition is similar to Ultratec Regular Haze. The cause for this difficulty is largely unknown. Some difficulty may be attributed to the components of the fluid not disclosed in the Safety Data Sheet (SDS). These components may be affecting the DustTrak’s measurement instrument or altering the way in which filters capture the particulate matter. More effort is required to produce a viable correction factor should C-Beam Regular Haze continue to be a preferred fog fluid.

CONCLUSION AND RECOMMENDATIONS

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

- Calibration factors developed for the DustTrak Model DRX 8533 can be used to approximate glycerin and mineral oil particulate matter exposure for those fluids analyzed in this study;
- The calibration factor for Ultratec Regular Haze and REEL EFX Diffusion Fluid is 0.04 and 0.83, respectively;
- To obtain a more accurate glycerin or mineral oil concentration, multiply the total airborne concentration from the DustTrak by the calibration factor. For example for Ultratec Regular Haze, when the DustTrak is reading 50 mg/m³, the actual concentration of glycerin particulate matter is 2 mg/m³;
- A calibration factor for C-Beam Regular Haze was not achievable due to variability within the dataset;
- Ultratec Regular Haze is a viable fog fluid option available for film productions due to its low calibration factor;
- REEL EFX Diffusion Fluid may not be a practical option for long-term use as a fog fluid due to its low exposure limit and calibration factor;
- If C-Beam Regular Haze continues to be used by film productions, additional sampling should be conducted in order to develop a calibration factor;
- When working with fog fluids over an extended work shift above 8 hours, care must be taken to ensure exposure does not exceed adjusted occupational exposure limits;

- The pDR 1000 AN Monitor (ThermoFisher) is a viable option, in addition to the DustTrak, to monitor fog levels on set when used in conjunction with applicable calibration factors developed by ENVIRON International Corporation or others.

LIMITATIONS

The following limitations should be noted when interpreting conclusions and recommendations respective of calibration factors and typical fog levels:

- Measurements for developing the calibration factors occurred in a semi-controlled environment not necessarily representative of regular working conditions;
- The calibration factors are only applicable for the specific fog fluids and machines used; other fog fluids and/or machines must be evaluated to determine their own unique calibration factor;
- Maintaining a constant concentration in the room during the sampling period was difficult due to operating the fog machine, dispersing the fog evenly throughout the room, and walking around the room;
- Short peaks of particulate matter measurements were created when starting the fog machine and using the machine intermittently to maintain concentrations, adding to slight variations in fog concentrations;
- The tube attached to the DustTrak potentially created a slight delay in concentration measurements compared to that captured on the filter;
- Deposition of particulate matter on the DustTrak tube and inlet may have reduced concentrations measured;
- The glycerin NIOSH method is gravimetric and non-specific to glycerin; however, as the only particulate matter that was added into the air was the glycerin-based fog products, it can be assumed that the concentrations attained through laboratory analytical results were from glycerin;
- The G300 machine used for C-Beam measurements was first used with Ultratec Regular Haze. The machine and lines were cleared out prior to using Ultratec Regular Haze or C-Beam, however, residual fluid may have possibly remained in the lines;
- Environmental factors may slightly alter the calibration factor if drastically different from that present during sampling; and,
- Identifying the concentration of fog on set by visual evaluation is not recommended because fog may look different depending on the room size, lighting, temperature, relative humidity, etc.
- There may be minor differences in using different DustTrak devices in the future; however, proper calibration and maintenance of these monitors is expected to minimize the intermachine variability.

REFERENCES

ENVIRON International Corporation. (2001). Equipment-Based Guidelines for the Use of Theatrical Smoke and Haze. Prepared for: Equity-League Pension and Health Trust Funds, June 2001.

ENVIRON International Corporation. (2003). Theatrical Smoke and Haze Testing for The Phantom of the Opera, Forrest Theatre. Prepared for: Alan Wasser Associates, January 2003.

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 D.

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 – Photographs
 Appendix B – Laboratory Results
 Appendix C – Sampling Results
 Appendix D – Statement of Limitations



Appendix A Photographs



Photo 1. Office room used to conduct fog measurements to develop calibration curves.



Photo 2. Equipment set-up used to create and measure fog concentration in the room. Sampling equipment were approximately 3.5 feet away from the fog machine.



Photo 3. Active sampling cassette located next to the DustTrak tube in the same air space.



Photo 4. Ultratec Regular Haze fluid container used.



Photo 5. Ultratec Regular Haze – 10 mg/m³ concentration of fog in the room.



Photo 6. Ultratec Regular Haze – 20 mg/m³ concentration of fog in the room.



Photo 7. Ultratec Regular Haze – 50 mg/m³ concentration of fog in the room.



Photo 8. Ultratec Regular Haze – 100 mg/m³ concentration of fog in the room.



Photo 9. Ultratec Regular Haze – 140 mg/m³ concentration of fog in the room.

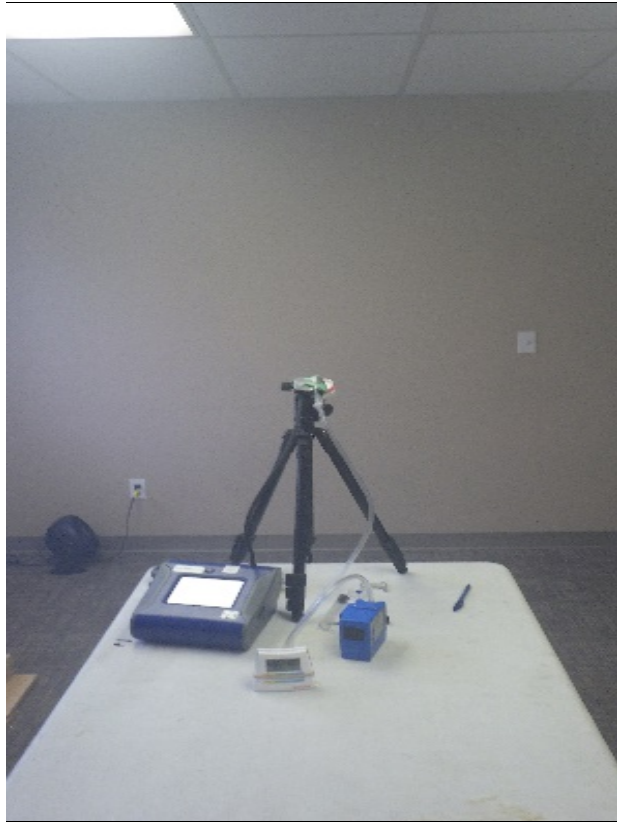


Photo 10. C-Beam Regular Haze – 10 mg/m³ concentration of fog in the room.



Photo 11. C-Beam Regular Haze – 20 mg/m³ concentration of fog in the room.



Photo 12. C-Beam Regular Haze – 50 mg/m³ concentration of fog in the room.



Photo 13. C-Beam Regular Haze – 100 mg/m³ concentration of fog in the room.



Photo 14. C-Beam Regular Haze – 130 mg/m³ concentration of fog in the room.



Photo 15. REEL EFX Diffusion Fluid – 10 mg/m³ concentration of fog in the room.



Photo 16. REEL EFX Diffusion Fluid – 20 mg/m³ concentration of fog in the room.



Photo 17. REEL EFX Diffusion Fluid – 50 mg/m³ concentration of fog in the room.

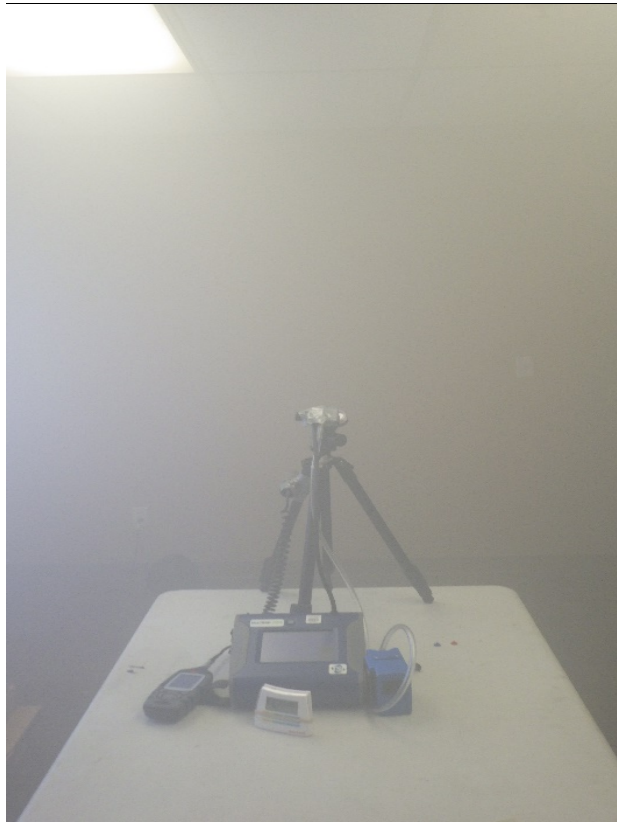


Photo 18. REEL EFX Diffusion Fluid – 100 mg/m³ concentration of fog in the room.



Photo 19. REEL EFX Diffusion Fluid – 130 mg/m³ concentration of fog in the room.

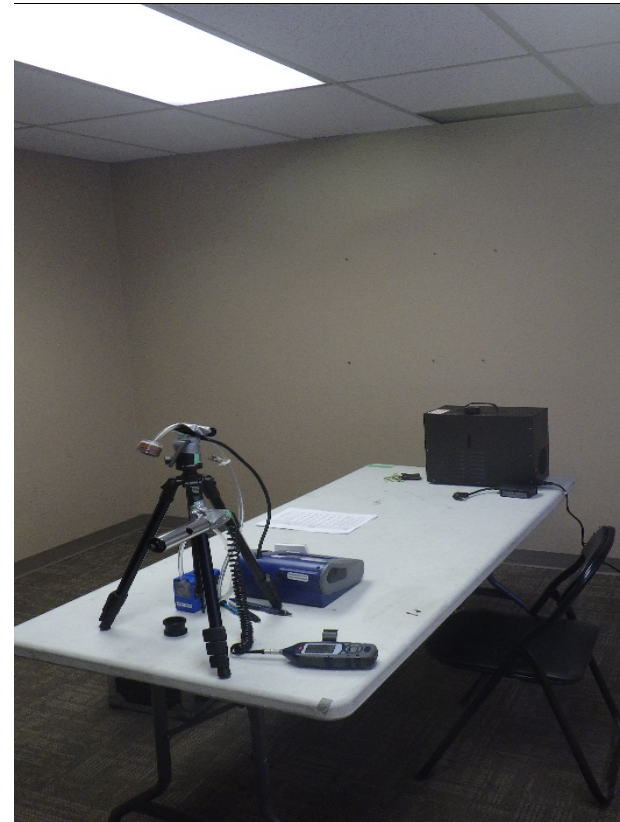


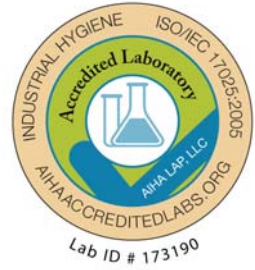
Photo 20. REEL EFX Diffusion Fluid – Sampling set up with the Diffusion Fogger.



Appendix B
Laboratory Analytical Results



Gravimetric Determination of Total Dust NIOSH 0500



Client: Aura Health & Safety
3981 Kingsway - Unit B
Burnaby, BC V5H 1Y7

Attn: Matthew Loss

Lab Order ID: 51814477
Date Received: 06/11/2018
Date Reported: 06/18/2018
Page: 1 of 8

Project:

Sample ID	Description	Air Volume (m ³)	Analyte LOD (mg)	Analyte Mass (mg)	CONCENTRATION mg/m ³
Lab Sample ID	Lab Notes				
IA-G-01	Field blank SN:521852	0	0.05	<0.05	N/A
5181447GTD_1					
IA-G-02	Field blank SN:521894	0	0.05	<0.05	N/A
5181447GTD_2					
IA-G-03	SN:521898	0.135	0.05	0.070	0.52
5181447GTD_3					
IA-G-04	SN:521904	0.136	0.05	0.064	0.42
5181447GTD_4					
IA-G-05	SN:521923	0.136	0.05	0.062	0.46
5181447GTD_5					

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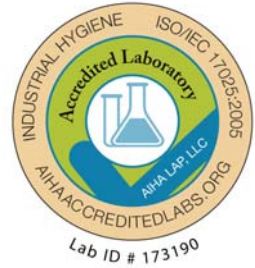
Analyst

Lab Director

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Page: 2 of 8

Project:

Sample ID	Description	Air Volume (m ³)	Analyte LOD (mg)	Analyte Mass (mg)	CONCENTRATION mg/m ³
Lab Sample ID	Lab Notes				
IA-G-06	SN:521903	0.075	0.05	0.053	0.71
5181447GTD_6					
IA-G-07	SN:521909	0.075	0.05	<0.05	<0.66
5181447GTD_7					
IA-G-08	SN:521902	0.076	0.05	0.055	0.73
5181447GTD_8					
IA-G-09	SN:521924	0.061	0.05	<0.05	<0.82
5181447GTD_9					
IA-G-10	SN:521907	0.061	0.05	<0.05	<0.82
5181447GTD_10					

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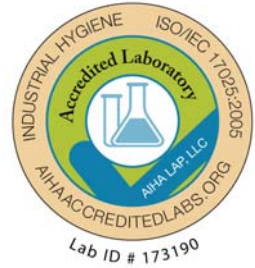
Analyst

Lab Director

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Page: 3 of 8

Project:

Sample ID	Description	Air Volume (m ³)	Analyte LOD (mg)	Analyte Mass (mg)	CONCENTRATION mg/m ³
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IA-G-11	SN:521882	0.061	0.05	0.29	<4.7
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IA-G-12	SN:521922	0.030	0.05	0.11	3.7
5181447GTD_12					
IA-G-13	SN:521844	0.030	0.05	0.095	3.1
5181447GTD_13					
IA-G-14	SN:521836	0.030	0.05	<0.05	<1.7
5181447GTD_14					
IA-G-15	SN:521881	0.015	0.05	<0.3	<3.3
5181447GTD_15					

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Gravimetric Determination of Total Dust NIOSH 0500



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Attn: Matthew Loss

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Date Reported: 06/18/2018
Page: 4 of 8

Project:

Sample ID	Description	Air Volume (m ³)	Analyte LOD (mg)	Analyte Mass (mg)	CONCENTRATION mg/m ³
Lab Sample ID	Lab Notes				
IA-G-16	SN:521869	0.015	0.05	0.056	3.7
5181447GTD_16					
IA-G-17	SN:521915	0.015	0.05	0.093	6.1
5181447GTD_17					
IA-G-18	SN:521876	0.075	0.05	0.29	3.9
5181447GTD_18					
IA-G-19	SN:521911	0.059	0.05	5.0	83
5181447GTD_19					
IA-G-20	SN:521880	0.030	0.05	3.0	100
5181447GTD_20					

Ired Gulley

Analyst

Lab Director

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Gravimetric Determination of Total Dust NIOSH 0500



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Page: 5 of 8

Project:

Sample ID	Description	Air Volume (m ³)	Analyte LOD (mg)	Analyte Mass (mg)	CONCENTRATION mg/m ³
Lab Sample ID	Lab Notes				
IA-G-21	SN:521855 Field blank	0	0.05	<0.05	N/A
5181447GTD_21					
IA-C-01	SN:521925 Field blank	0	0.05	<0.05	N/A
5181447GTD_22					
IA-C-02	SN:521858 Field blank	0	0.05	<0.05	N/A
5181447GTD_23					
IA-C-03	SN:521892	0.137	0.05	2.6	19
5181447GTD_24					
IA-C-04	SN:521905	0.135	0.05	1.6	12
5181447GTD_25					

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Analyst

Lab Director

Unless otherwise noted blank sample correction was not performed on analytical results. Scientific Analytical Institute participates in the AIHA IHPAT program. IHPAT Laboratory ID: 173190. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. Analytical uncertainty available upon request. Time-weighted average (TWA) calculations are based on customer supplied data and valid only for samples included in the specified TWA group. Reporting limit is Limit of Detection (LOD) above.



Gravimetric Determination of Total Dust NIOSH 0500



Client: Aura Health & Safety
3981 Kingsway - Unit B
Burnaby, BC V5H 1Y7

Attn: Matthew Loss

Lab Order ID: 51814477
Date Received: 06/11/2018
Date Reported: 06/18/2018
Page: 6 of 8

Project:

Sample ID	Description	Air Volume (m ³)	Analyte LOD (mg)	Analyte Mass (mg)	CONCENTRATION mg/m ³
Lab Sample ID	Lab Notes				
IA-C-05	SN:521839	0.075	0.05	3.2	42
5181447GTD_26					
IA-C-06	SN:521916	0.075	0.05	3.5	46
5181447GTD_27					
IA-C-07	SN:521906	0.060	0.05	4.7	78
5181447GTD_28					
IA-C-08	SN:521883	0.060	0.05	6.5	110
5181447GTD_29					
IA-C-09	SN:521879	0.060	0.05	<0.05	<0.84
5181447GTD_30					

Ired Gulley

Analyst

Lab Director

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Gravimetric Determination of Total Dust NIOSH 0500



Client: Aura Health & Safety
3981 Kingsway - Unit B
Burnaby, BC V5H 1Y7

Attn: Matthew Loss

Lab Order ID: 51814477
Date Received: 06/11/2018
Date Reported: 06/18/2018
Page: 7 of 8

Project:

Sample ID	Description	Air Volume (m ³)	Analyte LOD (mg)	Analyte Mass (mg)	CONCENTRATION mg/m ³
Lab Sample ID	Lab Notes				
IA-C-10	SN:521860	0.030	0.05	4.3	140
5181447GTD_31					
IA-C-11	SN:521885	0.030	0.05	6.6	220
5181447GTD_32					
IA-C-12	SN:521886	0.030	0.05	0.86	29
5181447GTD_33					
IA-C-13	SN:521884	0.015	0.05	0.13	8.5
5181447GTD_34					
IA-C-14	SN:521901	0.016	0.05	1.4	87
5181447GTD_35					

Ired Gulley

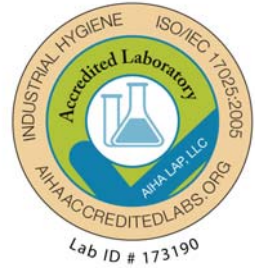
Analyst

Lab Director

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Gravimetric Determination of Total Dust NIOSH 0500



Client: Aura Health & Safety
3981 Kingsway - Unit B
Burnaby, BC V5H 1Y7

Attn: Matthew Loss

Lab Order ID: 51814477
Date Received: 06/11/2018
Date Reported: 06/18/2018
Page: 8 of 8

Project:

Sample ID	Description	Air Volume (m ³)	Analyte LOD (mg)	Analyte Mass (mg)	CONCENTRATION mg/m ³
Lab Sample ID	Lab Notes				
IA-C-15	SN:521927	0.015	0.05	7.7	180
5181447GTD_36					

Ired Gulley

Analyst

Lab Director

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Scientific Analytical Institute, Inc.
 4604 Dundas Dr. Greensboro, NC 27407
 Phone: 336.292.3888 Fax: 336.292.3313
 www.sailab.com lab@sailab.com

Lab Use Only
 Lab Order ID: 51814477
 Client Code: _____

Company Contact Information	
Company: Aura Health and Safety	Contact: Matthew Loss
Address: 3981 Kingsway (Unit B)	Phone: 604 307 2990
Burnaby, BC, Canada	Fax: _____
V5H 1P7	Email: matthew.loss@aurahealthandsafety.com

Billing/Invoice Information	Turn Around Times [^]	
SAME <input checked="" type="checkbox"/>	90 Min. <input type="checkbox"/>	48 Hours <input type="checkbox"/>
Company:	3 Hours <input type="checkbox"/>	72 Hours <input type="checkbox"/>
Contact: Levi Kimble	6 Hours <input type="checkbox"/>	96 Hours <input type="checkbox"/>
Address:	12 Hours <input type="checkbox"/>	120 Hours <input checked="" type="checkbox"/>
	24 Hours <input type="checkbox"/>	144 [^] Hours <input type="checkbox"/>
[^] TATs not available for certain test		

PO Number: IA180101
 Project Name/Number: _____

Industrial Hygiene Test Types	
<small>* Modified NIOSH 7500/OSHA ID 142</small>	
Silica as Alpha Quartz (XSZ)* <input type="checkbox"/>	With Respirable Dust (XDZ) <input type="checkbox"/>
Silica as Cristobalite (XSC)* <input type="checkbox"/>	With Respirable Dust (XDC) <input type="checkbox"/>
Silica as Tridymite (XST)* <input type="checkbox"/>	With Respirable Dust (XDT) <input type="checkbox"/>
Silica as Alpha Quartz, Cristobalite, Tridymite (XSA)* <input type="checkbox"/>	With Respirable Dust (XDA) <input type="checkbox"/>
Silica Bulk (XS)* <input type="checkbox"/>	
Bulk Phase ID/Whole Rock (XUK) <input type="checkbox"/>	
Total Dust NIOSH Method 0500 (GTD) <input checked="" type="checkbox"/>	
Respirable Dust NIOSH Method 0600 (GRD) <input type="checkbox"/>	
PCM NIOSH 7400-A Rules (PCM) <input type="checkbox"/>	
B Rules (PCB) <input type="checkbox"/>	TWA (PTA) <input type="checkbox"/>
TEM NIOSH 7402 (Asbestos) (TNI) <input type="checkbox"/>	
Hexavalent Chromium (OSHA ID-215) (Note if from spray paint operations) (CIC) <input type="checkbox"/>	
Metals-Air (NIOSH 7300/OSHA ID-125) (Specify Metals Under Comments) (IPA) <input type="checkbox"/>	
Welding Profile - 18 (NIOSH 7300/OSHA ID-125) (IPA or IPM) <input type="checkbox"/>	
Soldering Metals-9 (OSHA ID-206) (IPA or IPM) <input type="checkbox"/>	
Metal-Bulk (Modified OSHA ID-125G) (IPB) <input type="checkbox"/>	
Hg Bulk (SW-846 7471B/ASTM D3624-85a) <input type="checkbox"/>	
Hg Air (NIOSH 6009/OSHA ID-140) <input type="checkbox"/>	
Other <input type="checkbox"/>	

Sample ID #	Description/Location	Volume/Area	Comments
IA-G-01	Field blank SN: 521852		
IA-G-02	Field blank SN: 521894		
IA-G-03	SN: 521898	135.02475 L	
IA-G-04	SN: 521904	135.531 L	
IA-G-05	SN: 521923	136.044 L	
IA-G-06	SN: 521903	75.16125 L	
IA-G-07	SN: 521909	75.2975 L	Accepted <input checked="" type="checkbox"/>
IA-G-08	SN: 521902	75.565 L	
IA-G-09	SN: 521924	61.107 L	Rejected <input type="checkbox"/>
IA-G-10	SN: 521907	60.66 L	
IA-G-11	SN: 521882	60.833 L	

Total # of Samples

Relinquished by	Date/Time	Received by	Date/Time
Matthew Loss / Carolyn Li	Jun 8, 18 4:00	P. Shulley	6/11 10:30 AM



Scientific Analytical Institute, Inc.
 4604 Dundas Dr. Greensboro, NC 27407
 Phone: 336.292.3888 Fax: 336.292.3313
 www.sailab.com lab@sailab.com

Lab Use Only
 Lab Order ID: 5181447
 Client Code:

Sample ID #	Description/Location	Volume/Area	Comments
IA-G-12	SN: 521922	30.387 L	
IA-G-13	SN: 521844	30.2345 L	
IA-G-14	SN: 521836	30.2435 L	
IA-G-15	SN: 521881	15.242 L	
IA-G-16	SN: 521869	15.14425 L	
IA-G-17	SN: 521915	15.17575 L	
IA-G-18	SN: 521876	74.60375 L	
IA-G-19	SN: 521911	59.394 L	
IA-G-20	SN: 521880	29.7425 L	
IA-G-21	SN: 521855 Field blank		
IA-C-01	SN: 521925 Field blank		
IA-C-02	SN: 521858 Field blank		
IA-C-03	SN: 521892	137.359485 L	
IA-C-04	SN: 521905	134.90775 L	
IA-C-05	SN: 521839	75.09875 L	
IA-C-06	SN: 521916	75.69125 L	
IA-C-07	SN: 521906	59.993 L	
IA-C-08	SN: 521883	59.567 L	
IA-C-09	SN: 521879	59.59 L	
IA-C-10	SN: 521866	29.879 L	
IA-C-11	SN: 521885	29.514 L	
IA-C-12	SN: 521880	30.0625 L	
IA-C-13	SN: 521884	14.8645 L	
IA-C-14	SN: 521901	15.728025 L	
IA-C-15	SN: 521927	14.79 L	



June 27, 2018

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

Maxxam Analytics Work Order 18060345

Reference: B845407

Dear Shanaz Akbar:

Maxxam Analytics received 17 samples on June 13, 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: Customer Service BC
Enviro

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

CASE NARRATIVE

Date: 27-Jun-18

CLIENT: MAXXAM ANALYTICS, INC.

Project: B845407

Work Order No 18060345

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.

Please note that a field blank was not identified by the client for this sample set.

ANALYTICAL RESULTS

Date: 27-Jun-18

Client: MAXXAM ANALYTICS, INC.

Project: B845407

Work Order No: 18060345

Client ID: TP4171-IA-M-01

Date Sampled: 6/6/2018

Lab ID: 001A

Date Received: 6/13/2018

Matrix: PVC 5 Filter, Tared

Air Vol.(L): NA

Analyte	Concentration		Reporting Limit (µg)	Test Method	Date Analyzed / Analyst
	(µg)	(mg/m ³)			
Oil Mist, Mineral	<50	--	50	NIOSH 5026	06/26/2018 PTV

Client ID: TP4172-IA-M-02

Date Sampled: 6/6/2018

Lab ID: 002A

Date Received: 6/13/2018

Matrix: PVC 5 Filter, Tared

Air Vol.(L): NA

Analyte	Concentration		Reporting Limit (µg)	Test Method	Date Analyzed / Analyst
	(µg)	(mg/m ³)			
Oil Mist, Mineral	<50	--	50	NIOSH 5026	06/26/2018 PTV

Client ID: TP4173-IA-M-03

Date Sampled: 6/6/2018

Lab ID: 003A

Date Received: 6/13/2018

Matrix: PVC 5 Filter, Tared

Air Vol.(L): NA

Analyte	Concentration		Reporting Limit (µg)	Test Method	Date Analyzed / Analyst
	(µg)	(mg/m ³)			
Oil Mist, Mineral	480	--	50	NIOSH 5026	06/26/2018 PTV

Client ID: TP4174-IA-M-04

Date Sampled: 6/6/2018

Lab ID: 004A

Date Received: 6/13/2018

Matrix: PVC 5 Filter, Tared

Air Vol.(L): NA

Analyte	Concentration		Reporting Limit (µg)	Test Method	Date Analyzed / Analyst
	(µg)	(mg/m ³)			
Oil Mist, Mineral	450	--	50	NIOSH 5026	06/26/2018 PTV

General Notes:

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

--: Information not available or not applicable.

ANALYTICAL RESULTS

Date: 27-Jun-18

Client: MAXXAM ANALYTICS, INC.

Project: B845407

Work Order No: 18060345

Client ID: TP4175-IA-M-05

Date Sampled: 6/6/2018

Lab ID: 005A

Date Received: 6/13/2018

Matrix: PVC 5 Filter, Tared

Air Vol.(L): NA

Analyte	Concentration		Reporting Limit (µg)	Test Method	Date Analyzed / Analyst
	(µg)	(mg/m ³)			
Oil Mist, Mineral	440	--	50	NIOSH 5026	06/26/2018 PTV

Client ID: TP4176-IA-M-06

Date Sampled: 6/6/2018

Lab ID: 006A

Date Received: 6/13/2018

Matrix: PVC 5 Filter, Tared

Air Vol.(L): NA

Analyte	Concentration		Reporting Limit (µg)	Test Method	Date Analyzed / Analyst
	(µg)	(mg/m ³)			
Oil Mist, Mineral	800	--	50	NIOSH 5026	06/26/2018 PTV

Client ID: TP4177-IA-M-07

Date Sampled: 6/6/2018

Lab ID: 007A

Date Received: 6/13/2018

Matrix: PVC 5 Filter, Tared

Air Vol.(L): NA

Analyte	Concentration		Reporting Limit (µg)	Test Method	Date Analyzed / Analyst
	(µg)	(mg/m ³)			
Oil Mist, Mineral	760	--	50	NIOSH 5026	06/26/2018 PTV

Client ID: TP4178-IA-M-08

Date Sampled: 6/6/2018

Lab ID: 008A

Date Received: 6/13/2018

Matrix: PVC 5 Filter, Tared

Air Vol.(L): NA

Analyte	Concentration		Reporting Limit (µg)	Test Method	Date Analyzed / Analyst
	(µg)	(mg/m ³)			
Oil Mist, Mineral	710	--	50	NIOSH 5026	06/26/2018 PTV

General Notes:

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

--: Information not available or not applicable.

ANALYTICAL RESULTS

Date: 27-Jun-18

Client: MAXXAM ANALYTICS, INC.

Project: B845407

Work Order No: 18060345

Client ID: TP4179-IA-M-09

Date Sampled: 6/6/2018

Lab ID: 009A

Date Received: 6/13/2018

Matrix: PVC 5 Filter, Tared

Air Vol.(L): NA

Analyte	Concentration		Reporting Limit (µg)	Test Method	Date Analyzed / Analyst	
	(µg)	(mg/m ³)				
Oil Mist, Mineral	1,300	--	50	NIOSH 5026	06/26/2018	PTV

Client ID: TP4180-IA-M-10

Date Sampled: 6/6/2018

Lab ID: 010A

Date Received: 6/13/2018

Matrix: PVC 5 Filter, Tared

Air Vol.(L): NA

Analyte	Concentration		Reporting Limit (µg)	Test Method	Date Analyzed / Analyst	
	(µg)	(mg/m ³)				
Oil Mist, Mineral	1,700	--	50	NIOSH 5026	06/26/2018	PTV

Client ID: TP4181-IA-M-11

Date Sampled: 6/6/2018

Lab ID: 011A

Date Received: 6/13/2018

Matrix: PVC 5 Filter, Tared

Air Vol.(L): NA

Analyte	Concentration		Reporting Limit (µg)	Test Method	Date Analyzed / Analyst	
	(µg)	(mg/m ³)				
Oil Mist, Mineral	1,600	--	50	NIOSH 5026	06/26/2018	PTV

Client ID: TP4182-IA-M-12

Date Sampled: 6/6/2018

Lab ID: 012A

Date Received: 6/13/2018

Matrix: PVC 5 Filter, Tared

Air Vol.(L): NA

Analyte	Concentration		Reporting Limit (µg)	Test Method	Date Analyzed / Analyst	
	(µg)	(mg/m ³)				
Oil Mist, Mineral	1,300	--	50	NIOSH 5026	06/26/2018	PTV

General Notes:

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

--: Information not available or not applicable.

ANALYTICAL RESULTS

Date: 27-Jun-18

Client: MAXXAM ANALYTICS, INC.

Project: B845407

Work Order No: 18060345

Client ID: TP4183-IA-M-13

Date Sampled: 6/6/2018

Lab ID: 013A

Date Received: 6/13/2018

Matrix: PVC 5 Filter, Tared

Air Vol.(L): NA

Analyte	Concentration		Reporting Limit (µg)	Test Method	Date Analyzed / Analyst	
	(µg)	(mg/m ³)				
Oil Mist, Mineral	1,600	--	50	NIOSH 5026	06/26/2018	PTV

Client ID: TP4184-IA-M-14

Date Sampled: 6/6/2018

Lab ID: 014A

Date Received: 6/13/2018

Matrix: PVC 5 Filter, Tared

Air Vol.(L): NA

Analyte	Concentration		Reporting Limit (µg)	Test Method	Date Analyzed / Analyst	
	(µg)	(mg/m ³)				
Oil Mist, Mineral	1,700	--	50	NIOSH 5026	06/26/2018	PTV

Client ID: TP4185-IA-M-15

Date Sampled: 6/6/2018

Lab ID: 015A

Date Received: 6/13/2018

Matrix: PVC 5 Filter, Tared

Air Vol.(L): NA

Analyte	Concentration		Reporting Limit (µg)	Test Method	Date Analyzed / Analyst	
	(µg)	(mg/m ³)				
Oil Mist, Mineral	1,900	--	50	NIOSH 5026	06/26/2018	PTV

Client ID: TP4186-IA-M-16

Date Sampled: 6/6/2018

Lab ID: 016A

Date Received: 6/13/2018

Matrix: PVC 5 Filter, Tared

Air Vol.(L): NA

Analyte	Concentration		Reporting Limit (µg)	Test Method	Date Analyzed / Analyst	
	(µg)	(mg/m ³)				
Oil Mist, Mineral	1,500	--	50	NIOSH 5026	06/26/2018	PTV

General Notes:

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

--: Information not available or not applicable.

ANALYTICAL RESULTS

Date: 27-Jun-18

Client: MAXXAM ANALYTICS, INC.

Project: B845407

Work Order No: 18060345

Client ID: TP4187-IA-M-17

Date Sampled: 6/6/2018

Lab ID: 017A

Date Received: 6/13/2018

Matrix: PVC 5 Filter, Tared

Air Vol.(L): NA

Analyte	Concentration		Reporting Limit (µg)	Test Method	Date Analyzed / Analyst
	(µg)	(mg/m ³)			
Oil Mist, Mineral	1,600	--	50	NIOSH 5026	06/26/2018 PTV

General Notes:

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

--: Information not available or not applicable.

180660345

CHAIN OF CUSTODY RECORD FOR SUBCONTRACTED WORK



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 #: B845407											
#	SAMPLE ID	MATRIX	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	SAMPLER INITIALS	# CONT.					
1	TP4171-IA-M-01 ✓	AIR	2018/06/06		ML	1	X				(P: 01)
2	TP4172-IA-M-02 ✓	AIR	2018/06/06		ML	1	X				(P: 01)
3	TP4173-IA-M-03 ✓	AIR	2018/06/06		ML	1	X				(P: 01)
4	TP4174-IA-M-04 ✓	AIR	2018/06/06		ML	1	X				(P: 01)
5	TP4175-IA-M-05 ✓	AIR	2018/06/06		ML	1	X				(P: 01)
6	TP4176-IA-M-06 ✓	AIR	2018/06/06		ML	1	X				(P: 01)
7	TP4177-IA-M-07 ✓	AIR	2018/06/06		ML	1	X				(P: 01)
8	TP4178-IA-M-08 ✓	AIR	2018/06/06		ML	1	X				(P: 01)
9	TP4179-IA-M-09 ✓	AIR	2018/06/06		ML	1	X				(P: 01)
10	TP4180-IA-M-10 ✓	AIR	2018/06/06		ML	1	X				(P: 01)
<p style="text-align: center;">Oil Mist by NIOSH 5524 in Air Subc</p>											
REGULATORY CRITERIA											
<p>Please inform Maxxam immediately if you are not accredited for the requested test(s). **Please return a copy of this form with the report.**</p>											
REGULATORY CRITERIA				SPECIAL INSTRUCTIONS				TURNAROUND TIME			
<input type="checkbox"/> Rush Required Date Required: 2018/06/14 Please inform us if rush charges will be incurred.											
COOLING MEDIA				COOLING MEDIA				COOLING MEDIA			
COOLING MEDIA	YES	NO	Temp (°C)	COOLING MEDIA	YES	NO	Temp (°C)	COOLING MEDIA	YES	NO	Temp (°C)
Custody Seal Present				Custody Seal Present				Custody Seal Present			
Custody Seal Intact				Custody Seal Intact				Custody Seal Intact			
Cooling Media Present				Cooling Media Present				Cooling Media Present			
RELINQUISHED BY: (SIGN & PRINT)				RECEIVED BY: (SIGN & PRINT)				DATE: (YYYY/MM/DD)			
1. Ryan Mara				1. Steve Gish				2018/06/12			
2.				2.				2018/06/14			



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

CHAIN OF CUSTODY RECORD FOR SUBCONTRACTED WORK

COC # B845407-V8VN-02-01

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 #: B845407													
#	SAMPLE ID	MATRIX	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	SAMPLER INITIALS	# CONT	Subc						
1	TP4181-IA-M-11	AIR	2018/06/05		ML	1	X						(P: 01)
2	TP4182-IA-M-12	AIR	2018/06/05		ML	1	X						(P: 01)
3	TP4183-IA-M-13	AIR	2018/06/05		ML	1	X						(P: 01)
4	TP4184-IA-M-14	AIR	2018/06/05		ML	1	X						(P: 01)
5	TP4185-IA-M-15	AIR	2018/06/05		ML	1	X						(P: 01)
6	TP4186-IA-M-16	AIR	2018/06/05		ML	1	X						(P: 01)
7	TP4187-IA-M-17	AIR	2018/06/05		ML	1	X						(P: 01)
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.**		<input type="checkbox"/> Rush Required 2018/06/14 Date Required	

COOLER ID:		COOLER ID:		COOLER ID:	
YES	NO	Temp: (°C)	Temp: (°C)	YES	NO

RELINQUISHED BY: (SIGN & PRINT)		RECEIVED BY: (SIGN & PRINT)		DATE: (YYYY/MM/DD)		TIME: (HH:MM)	
1. <i>[Signature]</i>		1. <i>[Signature]</i>		2018/06/02		15:00	
2.		2.				11:30a	

UBC OEH Laboratory
Analyst: Matty Jeronimo
July 13, 2018
Method: GC/MS

Product	mg product used (in 10mL MeOH)	ng glycerol/uL diluted sample	total mg glycerol in diluted sample	percent (by mass) glycerol in product
CBeam Haze	22.3	415.278	4.153	18.6%
Ultratec Regular Haze	26	453.783	4.538	17.5%



Appendix C

Sampling Results

TABLE C-1
Sampling Results for Ultratec Regular Haze

Sample ID	Average Flow Rate (L/min)	Sample Duration (min)	Sample Volume (m ³)	Analyte Mass (mg)	Analyte Concentration (mg/m ³)	DustTrak Concentration (mg/m ³)
IA-G-01	N/A	N/A	N/A	<0.05	N/A	N/A
IA-G-02	N/A	N/A	N/A	<0.05	N/A	N/A
IA-G-03	3.00	45	0.135	0.070	0.52	11.6
IA-G-04	3.01	45	0.136	0.064	0.47	10.9
IA-G-05	3.02	45	0.136	0.062	0.46	11.5
IA-G-06	3.01	25	0.075	0.053	0.71	20.6
IA-G-07	3.01	25	0.075	<0.05	<0.66	21.8
IA-G-08	3.02	25	0.076	0.055	0.73	20.8
IA-G-09	3.05	20	0.061	<0.05	<0.82	50.9
IA-G-10	3.03	20	0.061	<0.05	<0.82	50.1
IA-G-11	3.04	20	0.061	0.29	4.8	49.5

Sample ID	Average Flow Rate (L/min)	Sample Duration (min)	Sample Volume (m ³)	Analyte Mass (mg)	Analyte Concentration (mg/m ³)	DustTrak Concentration (mg/m ³)
IA-G-12	3.04	10	0.030	0.11	3.6	102.2
IA-G-13	3.02	10	0.030	0.095	3.1	99.1
IA-G-14	3.02	10	0.030	<0.05	<1.7	98.7
IA-G-15	3.05	5	0.015	<0.3	<19.7	143.7
IA-G-16	3.03	5	0.015	0.056	3.7	133.3
IA-G-17	3.04	5	0.015	0.093	6.1	141.4
IA-G-18	N/A	N/A	N/A	<0.05	N/A	N/A
IA-G-19	2.98	25	0.075	0.29	3.9	21.1
IA-G-20	2.97	20	0.059	5.0	84.2	47.8
IA-G-21	2.97	10	0.30	3.0	100.9	86.8

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

TABLE C-2
Sampling Results for C-Beam Regular Haze

Sample ID	Average Flow Rate (L/min)	Sample Duration (min)	Sample Volume (m ³)	Analyte Mass (mg)	Analyte Concentration (mg/m ³)	DustTrak Concentration (mg/m ³)
IA-C-01	N/A	N/A	N/A	<0.05	N/A	N/A
IA-C-02	N/A	N/A	N/A	<0.05	N/A	N/A
IA-C-03	2.97	46.5	0.137	2.6	18.9	10.1
IA-C-04	2.99	45	0.135	1.6	11.9	1.03
IA-C-05	3.00	25	0.075	3.2	42.6	20.2
IA-C-06	3.03	25	0.076	3.5	46.2	20.3
IA-C-07	2.99	20	0.059	4.7	78.3	48.8
IA-C-08	2.98	20	0.059	6.5	109.1	49.6
IA-C-09	2.98	20	0.059	<0.05	<0.84	50.6
IA-C-10	2.99	10	0.029	4.3	143.9	95.4
IA-C-11	2.95	10	0.029	6.6	223.6	98.5

Sample ID	Average Flow Rate (L/min)	Sample Duration (min)	Sample Volume (m ³)	Analyte Mass (mg)	Analyte Concentration (mg/m ³)	DustTrak Concentration (mg/m ³)
IA-C-12	3.00	10	0.030	0.86	28.6	97.3
IA-C-13	2.97	5	0.015	0.13	8.7	144.9
IA-C-14	2.95	5	0.016	1.4	89.0	124.8
IA-C-15	2.96	5	0.015	7.7	520.6	121.8

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

TABLE C-3
Sampling Results for REEL EFX Diffusion Fluid (DF50)

Sample ID	Average Flow Rate (L/min)	Sample Duration (min)	Sample Volume (m ³)	Analyte Mass (mg)	Analyte Concentration (mg/m ³)	DustTrak Concentration (mg/m ³)
IA-M-01	N/A	N/A	N/A	<0.05	N/A	N/A
IA-M-02	N/A	N/A	N/A	<0.05	N/A	N/A
IA-M-03	3.01	20	0.060	0.48	1.9	9.98
IA-M-04	3.01	20	0.060	0.45	7.5	10.1
IA-M-05	3.02	20	0.060	0.44	7.3	10.1
IA-M-06	3.02	15	0.045	0.8	17.6	20.1
IA-M-07	3.05	15	0.046	0.76	16.6	19.9
IA-M-08	2.99	15	0.045	0.71	15.8	19.2
IA-M-09	2.99	12	0.036	1.3	36.3	49.2
IA-M-10	2.99	12	0.036	1.7	47.3	49.7
IA-M-11	3.01	12	0.036	1.6	44.3	49.6

Sample ID	Average Flow Rate (L/min)	Sample Duration (min)	Sample Volume (m ³)	Analyte Mass (mg)	Analyte Concentration (mg/m ³)	DustTrak Concentration (mg/m ³)
IA-M-12	3.01	6	0.018	1.3	71.9	99.4
IA-M-13	3.03	6	0.018	1.6	88.2	98.4
IA-M-14	2.96	6	0.018	1.7	95.8	100.5
IA-M-15	2.99	5	0.015	1.+	126.9	137.0
IA-M-16	2.99	5	0.015	1.5	100.3	138.8
IA-M-17	3.04	5	0.015	1.6	105.4	136.2

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



Appendix D
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.