REVISED REPORT

Airborne Acetaldehyde Assessment
AHS Southport Office, Calgary, Alberta

Submitted to:
Alberta Health Services
Calgary Southport Tower
8th Floor, Office 8452A
10301 Southport Lane SW
Ph: 587-284-3440
Email: marie.sopko@ahs.ca

Attention: Marie Sopko

Submitted by:
Golder Associates Ltd.
#120, 6815 8th Street NE, Calgary, Canada T2E 7H7

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20146092
June 2020
Distribution List

1 Electronic Copy - Golder Associates Ltd.

1 Copy - Alberta Health Services
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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) was retained by Alberta Health Services (AHS) to conduct an airborne acetaldehyde assessment at the AHS Southport Office located at 10301 Southport Lane SW, in Calgary, Alberta. The assessment was completed on June 3, 2020, by Cory Gray, Occupational Hygiene Technologist under the direction of Dave Ayriss, Senior Occupational Hygienist.

2.0 BACKGROUND AND PROJECT RATIONALE

The request for the assessment was in response to Health Canada recently authorizing the use of “technical-grade” ethanol in hand sanitizer, as opposed to the usual “USP-grade” ethanol that is currently used in hand sanitizer. The switch from USP-grade ethanol is related to the unprecedented demand for hand sanitizer products due to the current COVID-19 pandemic which has created global shortages for USP and food-grade ethanol. Statistics Canada recently reported a seven-fold increase in the sales of hand sanitizer in mid-March compared to the same period last year. These shortages have led to searches of other types of ethanol for the manufacture of hand sanitizers.

The technical-grade ethanol contains acetaldehyde at a concentration up to 800 to 1,000 ppm, whereas the USP-grade ethanol has a maximum allowable concentration of acetaldehyde of 10 ppm. Therefore, the assessment was conducted to determine the airborne acetaldehyde vapour concentration in the breathing zone of an individual who uses hand sanitizer containing technical-grade ethanol through a study of different use scenarios (e.g., “routine” use, “worst case” use).

The new hand sanitizer being used is Microsan® Optidose that comes in a 650 ml cartridge and Microsan Encore that comes in a 400 mL bottle. According to product information provided by AHS, the cartridge dispenses 1.5 ml per pump. The amount of sanitizer provided is specially measured to provide a wet contact time of 20 to 30 seconds, as specified by the World Health Organization. The previous 1 L Microsan cartridge only dispensed approximately half of this amount.

The pump-style dispenser has two chambers: one chamber holds the liquid product and one pumps air into the dispensing unit when the pump is depressed. It is the action of a full depression of the pump that creates enough mechanical aeration required to produce the foam. If the user does not fully press the dispenser handle, it will result in some product being stored within the nozzle of the cartridge and when the next user pushes the handle, they will receive that product left behind, which will be a liquid consistency.

3.0 SCOPE OF WORK

To assess potential worker exposure to acetaldehyde during hand sanitizer use, our scope of work included the following:

- Collecting one occupational (personal) and one area air sample for acetaldehyde during routine hand sanitizer use (e.g., 15 times per hour) while inside a meeting room with normal ventilation. The subject applied a standard volume (one pump) of hand sanitizer to their hands during each use;

- Collecting one occupational and one area air sample for acetaldehyde during routine hand sanitizer use (e.g., 15 times per hour) while inside a small room with no ventilation. The subject applied a standard volume (one pump) of hand sanitizer to their hands during each use;

- Collecting one occupational and one area air sample for acetaldehyde during worst-case hand sanitizer use (e.g., 45 times per hour) while inside a meeting room with normal ventilation. The subject applied a standard volume (one pump) of hand sanitizer to their hands during each use;
Collecting one occupational and one area air sample for acetaldehyde during worst-case hand sanitizer use (e.g., 45 times per hour) while inside a small room with no ventilation. The subject applied a standard volume (one pump) of hand sanitizer to their hands during each use; and

Collecting one area air sample for acetaldehyde while inside a small room with no ventilation during the evaporation of 1 L of hand sanitizer poured into two baking pans.

The majority of the samples were collected over an approximate 1-hour sampling period. The area air sample collected to assess the evaporation of the hand sanitizer was collected over a 30-minute sampling period.

4.0 METHODOLOGY

Occupational and area air samples for acetaldehyde were collected and analyzed according to the National Institute for Occupational Safety and Health (NIOSH) method 2016. Air samples were collected by drawing air at 0.2 litres per minute through an ORBO 555 cartridge containing silica gel coated with 2,4-dinitrophenylhydrazine. Each tube was attached to a battery-powered personal air sampling pump using Tygon tubing. The air sampling pumps for the personal air samples were worn on the belt of the wearer with the sampling tube clipped to the shirt collar of the individual applying the hand sanitizer. The pumps were calibrated prior to and following sample collection using a DryCal primary calibrator. One field blank sample was submitted for analysis for quality assurance purposes.

Upon completion of the testing, the occupational and area air samples were sent to SGS-Golson Laboratory, an independent American Industrial Hygiene Association (AIHA) accredited laboratory for rush (within 2 business days) turnaround analysis under chain-of-custody.

5.0 REGULATIONS

5.1 Assessment and Notification of Workers

Workplace Health and Safety Legislation in Alberta is set by the Alberta Occupational Health and Safety Act (Revised Statutes of Alberta 2000, Chapter O-2, with amendments up to and including Alberta Regulation 51/2018), the Occupational Health and Safety Regulation (Alberta Regulation 62/2003), and the Occupational Health and Safety Code (2019). Part 21 of the Alberta OHS Code requires that, if a worker may be exposed to a harmful substance at a work site, the employer must identify the health hazards associated with the exposure and assess the worker’s exposure. Similarly, if a worker may be exposed to a harmful substance at a work site, the following requirements apply:

- the worker must be informed of the health hazards associated with exposure to the substance;
- the worker is informed of the measurements made of the airborne concentrations of the harmful substance(s) at the work site; and
- the worker is trained in the procedures developed by the employer to minimize the worker’s exposure to the harmful substance(s) and understands the procedures.

5.2 Occupational Exposure Limits

The Alberta Occupational Health and Safety Code, Part 4, Chemical Hazards, Biological Hazards and Harmful Substances, stipulates the requirements for worker exposure to harmful substances. Schedule 1, Table 2, Occupational Exposure Limits for Chemical Substances, establishes occupational exposure limits (OEL) for a variety of airborne contaminants.
The OEL for a particular contaminant represents conditions to which it is believed that nearly all workers may be exposed, day after day, without suffering from adverse health effects.

Due to variations expected in both measurements and the susceptibility of workers, the law in Alberta requires that exposures be lowered to levels as low as reasonably practicable. Exposures should be reduced to a fraction of the OEL using ventilation or other control measures.

Currently, only a ceiling limit of 25 ppm is regulated in Alberta for acetaldehyde. A ceiling exposure limit is a regulated concentration which cannot be exceeded for any length of time during the work shift.

6.0 SITE DESCRIPTION AND OBSERVATIONS

Microsan® Encore hand sanitizer was used for the assessment. Microsan® Encore is a non-aerosol foaming alcohol hand sanitizer and according to product information provided by AHS, contains 72% ethanol and 228 parts per million (ppm) of acetaldehyde. The lot number on the side of the 400 ml bottle used for the assessment was 4795-01.

Two separate rooms on the 8th floor of the AHS Southport Tower were used for the assessment. Dr. Stephen Tsekrekos applied the hand sanitizer in all scenarios. The time it took to rub the hands to dryness after each hand sanitizer application ranged from 25 seconds to 45 seconds.

Room 8113 was used for the assessment to simulate a room with limited or no ventilation. Normally used as a private phone call room, the room is small, approximately 504 ft³ or 14.3 m³, with floor dimensions of approximately 7 feet (2.1 m) x 8 feet (2.4 m), and a ceiling height of 9 feet (2.7 m). The room has one air diffuser that had been sealed with tape and a plastic bag. The room was made up of partition and drywall walls, with a lay-in ceiling tile ceiling. The sampling conducted inside of the room was conducted with the door closed.

Room 8340 was used for the assessment to simulate a well-ventilated room. Normally used as a meeting room, the room is larger, approximately 1,900 ft³ or 53.8 m³, with floor dimensions of approximately 13.5 feet (4.1 m) x 16 feet (4.9 m), and a ceiling height of 9 feet (2.7 m). The room has slot ventilation running the length and width of the room. The room has exterior window walls along the north and west walls. The south and east walls are partition walls. The ceiling is a lay-in ceiling tile ceiling. The sampling inside of the room was conducted with the door open.

The area air samples were setup approximately three feet from Dr. Tsekrekos’ hands.

The hand sanitizer evaporation area air sample was collected inside Room 8113 with the door open. Approximately 1 L of hand sanitizer was poured over two baking pans (approximately 1,935 cm² together). The area sample was setup approximately 1 foot above the baking pans to simulate typically evaporation of the product.

Site photographs taken at the time of the assessment are provided in Appendix A.

7.0 RESULTS

The results of the acetaldehyde personal and area air samples collected on June 3, 2020 are presented in Table 1: Acetaldehyde Air Sample Results, June 3, 2020. The laboratory report is provided in Appendix B.
### Table 1: Acetaldehyde Air Sample Results, June 3, 2020

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Sample Type</th>
<th>Total Time (min)</th>
<th>Dosage</th>
<th>Sample Location</th>
<th>Acetaldehyde Concentration (ppm)</th>
<th>Alberta OEL (ppm) (^{(1)})</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Personal</td>
<td>60</td>
<td>Average Dose (15 pumps/hr)</td>
<td>Room 8113 – No Ventilation/Use of Hand Sanitizer Every 4 Minutes</td>
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<td>25 (ceiling)</td>
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<td>2</td>
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<td>60</td>
<td>Average Dose (15 pumps/hr)</td>
<td>Room 8113 – No Ventilation/ Use of Hand Sanitizer Every 4 Minutes</td>
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</tr>
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<td>3</td>
<td>Personal</td>
<td>60</td>
<td>Average Dose (15 pumps/hr)</td>
<td>Room 8340 – Ventilation/Use of Hand Sanitizer Every 4 Minutes</td>
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<td>Area</td>
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<td>Average Dose (15 pumps/hr)</td>
<td>Room 8340 – Ventilation/ Use of Hand Sanitizer Every 4 Minutes</td>
<td>0.007</td>
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<tr>
<td>5</td>
<td>Personal</td>
<td>60</td>
<td>Heavy Dose (45 pumps/hr)</td>
<td>Room 8113 – No Ventilation/Use of Hand Sanitizer Every 1 Minute and 20 Seconds</td>
<td>0.13</td>
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</tr>
<tr>
<td>6</td>
<td>Area</td>
<td>60</td>
<td>Heavy Dose (45 pumps/hr)</td>
<td>Room 8113 – No Ventilation</td>
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**Notes:**

1) parts per million
2) An 8-hour exposure limit for the contaminant is not regulated in Alberta. A ceiling exposure limit is regulated, which is a concentration which cannot be exceeded for any length of time.

### 8.0 DISCUSSION AND CONCLUSIONS

All of the personal and area air samples collected for acetaldehyde were low and were well below the Alberta ceiling limit of 25 ppm.

The results of the personal air samples for acetaldehyde measured during the assessment ranged from 0.02 ppm to 0.13 ppm. The highest concentration of acetaldehyde (0.13 ppm) measured from the personal air samples was collected in the non-ventilated room during heavy hand sanitizer dosage (45 doses per hour). The lowest concentration of acetaldehyde (0.02 ppm) measured from the personal air samples was collected in the ventilated room during normal hand sanitizer dosage (15 doses per hour).

The results of the area air samples for acetaldehyde measured during the assessment ranged from 0.007 ppm to 0.11 ppm. The highest concentration of acetaldehyde (0.11 ppm) measured from the area air samples was collected in the non-ventilated room during heavy hand sanitizer dosage (45 doses per hour). The lowest area air...
concentration of acetaldehyde (0.007 ppm) was collected in the ventilated room during heavy hand sanitizer dosage (45 doses per hour).

The result of the area air sample collected over the hand sanitizer poured into the two baking pans in the non-ventilated room was 0.17 ppm and represented the highest concentration of acetaldehyde measured during the assessment.

The concentration of acetaldehyde measured in the personal air sample collected in the non-ventilated room during heavy hand sanitizer usage was approximately 6.5 times higher than the acetaldehyde measured in the ventilated room during normal hand sanitizer usage.

The concentration of acetaldehyde measured in the area air sample collected in the non-ventilated room during heavy hand sanitizer usage was approximately 15.7 times higher than the acetaldehyde measured in the ventilated room during normal hand sanitizer usage.

9.0 RECOMMENDATIONS

Based on the results and observations made during the assessment, Golder provides the following recommendations:

- Even though the results of the personal and area air samples were low in concentration, the use of the technical grade ethanol-based hand sanitizer should be used in well-ventilated areas.
- AHS personnel required to use hand sanitizer should be made aware of the importance of hand sanitizer frequency and the dosage amounts (one pump per dose). Higher frequency of hand sanitizer usage or increased number of hand pumps per dose could result in higher worker exposures to airborne acetaldehyde.
- AHS should consider collecting full-shift personal air samples for acetaldehyde to verify that worker exposures are being adequately controlled during typical hand sanitizer usage.

10.0 LIMITATIONS

This report was prepared for the exclusive use of the Alberta Health Services. This report is based on data and information collected during the site visit conducted by Golder Associates Ltd. on June 03, 2020 and is based solely on-site conditions encountered at the time of the site visit.

The conclusions and recommendations contained in this report are based upon professional opinions with regard to the subject matter. These opinions are in accordance with currently accepted environmental assessment standards and practices applicable to this location and are subject to the following inherent limitations.

The data and findings presented in this report are valid as of the date of the investigation. The passage of time, manifestation of latent conditions or occurrence of future events may warrant further exploration at the properties, analysis of the data, and re-evaluation of the findings, observations, and conclusions expressed in this report.

The findings, observations and conclusions expressed by Golder Associates Ltd. in this report are not, and should not be considered, an opinion concerning compliance of any past or present owner or operator of the site with any federal, provincial or local laws or regulations.
11.0 CLOSURE

If you have any questions or require further information, please feel free to contact the undersigned at (403) 299-5600. Thank you for the opportunity to be of service. We look forward to working with you again.

Golder Associates Ltd.

![Signature]

Dave Ayriss, B.Sc., CIH, CRSP
Associate, Senior Occupational Hygienist

CG/DA/pls

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https://golderassociates.sharepoint.com/sites/129224/project files/6 deliverables/20146092_revised_ahs_acetaldehydeassess_june2020.docx
APPENDIX A

Select Photographs
Photograph 1: 400 ml Microsan™ Encore Hand Sanitizer

Photograph 2: Microsan™ Encore Lot # 4795-01 (Exp. April 24) Used for the Assessment
Photograph 3: An Example of the Amount of Hand Sanitizer Dispensed into Dr. Tsekrekos Palm

Photograph 4: An Example of Dr. Tsekrekos Palms following the First Few Rubs of Hand Sanitizer
Photograph 5: Room 8113 (Non-Ventilated Room)

Photograph 6: Air Diffuser Taped Over in Room 8113
Photograph 7: Room 8340 (Ventilated Room)

Photograph 8: Slot Ventilation in Room 8340
Photograph 9: Room 8113 (No Ventilation) and Location of Evaporation Area Air Sample
APPENDIX B

Laboratory Report
Dear Dave Ayriss:

Enclosed are the analytical results for the samples received by our laboratory on June 05, 2020. All samples on the chain of custody were received in good condition unless otherwise noted. Any additional observations will be noted on the chain of custody.

Please contact client services at (888) 432-5227 if you would like any additional information regarding this report. Thank you for using SGS Galson.

Sincerely,

SGS Galson

Lisa Swab
Laboratory Director

Enclosure(s)
**Terms and Conditions & General Disclaimers**


- Any holder of this document is advised that information contained herein reflects the Company’s findings at the time of its intervention only and within the limits of Client’s instructions, if any. The Company’s sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

**Analytical Disclaimers**

- Unless otherwise noted within the report, all quality control results associated with the samples were within established control limits or did not impact reported results.

- Note: The findings recorded within this report were drawn from analysis of the sample(s) provided to the laboratory by the Client (or a third party acting at the Client’s direction). The laboratory does not have control over the sampling process, including but not limited to the use of field equipment and collection media, as well as the sampling duration, collection volume or any other collection parameter used by the Client. The findings herein constitute no warranty of the sample’s representativeness of any sampled environment, and strictly relate to the samples as they were presented to the laboratory. For recommended sampling collection parameters, please refer to the Sampling and Analysis Guide at [www.sgsgalson.com](http://www.sgsgalson.com).

- Unrounded results are carried through the calculations that yield the final result and the final result is rounded to the number of significant figures appropriate to the accuracy of the analytical method. Please note that results appearing in the columns preceding the final result column may have been rounded and therefore, if carried through the calculations, may not yield an identical final result to the one reported.

- The stated LOQs for each analyte represent the demonstrated LOQ concentrations prior to correction for desorption efficiency (if applicable).

- Unless otherwise noted within the report, results have not been blank corrected for any field blank or method blank data.

**Accreditations** SGS Galson holds a variety of accreditations and recognitions. Our quality management system conforms with the requirements of ISO/IEC 17025. Where applicable, samples may also be analyzed in accordance with the requirements of ELAP, NELAC, or LELAP under one of the state accrediting bodies listed below. Current Scopes of Accreditation can be viewed at [http://www.sgsgalson.com](http://www.sgsgalson.com) in the accreditations section of the "About" page. To determine if the analyte tested falls under our scope of accreditation, please visit our website or call Client Services at (888) 432-5227.

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<th>Program/Sector</th>
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<td>Air Analysis, Solid and Hazardous Waste</td>
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<td>NELAC (TNI)</td>
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<td>Texas</td>
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<td>Lab ID: 1042</td>
<td>Mold Analysis Laboratory license</td>
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**Legend**

- `<` - Less than
- `>` - Greater than
- `L` - Liters
- `LOQ` - Limit of Quantitation
- `ft²` - Square Feet
- `< - Less than` to `ppm - Parts per Million`
- `mg - Milligrams` to `ppbv - ppb Volume`
- `ND - Not Detected` to `ng - Nanograms`
# LABORATORY ANALYSIS REPORT

**Client:** Golder Associates-CALGARY  
**Account No.:** 13405  
**Site:** SOUTHPORT TOWER  
**Login No.:** L513072  
**Project No.:** 20146092  
**Date Sampled:** 03-JUN-20  
**Date Analyzed:** 05-JUN-20 - 08-JUN-20  
**Date Received:** 05-JUN-20  
**Report ID:** 1199234

## Acetaldehyde

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<th>Sample ID</th>
<th>Lab ID</th>
<th>Air Vol liter</th>
<th>Front ug</th>
<th>Back ug</th>
<th>Total ug</th>
<th>Conc mg/m3</th>
<th>Conc ppm</th>
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**COMMENTS:** Please see attached lab footnote report for any applicable footnotes.

---

**Level of Quantitation:** 0.1 ug  
**Submitted by:** EAW  
**Approved by:** NKP  
**Analytical Method:** mod. NIOSH 2016; HPLC/UV  
**Date:** 08-JUN-20  
**Collection Media:** ORBO555  
**Supervisor:** MWJ
Total ug corrected for a desorption efficiency of 100%.

ACETALDEHYDE results have been corrected for the average background found on the media:
front section only = 0.0176 ug for lot #125897 (samples 1-10).

SOPs: LC-SOP-4(23)

Accuracy and mean recovery data presented below is based on a 95% confidence interval (k=2). The estimated accuracy applies to the media, technology, and SOP referenced in this report and does not account for the uncertainty associated with the sampling process. The accuracy is based solely on spike recovery data from internal quality control samples. Where N/A appears below, insufficient data is available to provide statistical accuracy and mean recovery values for the associated analyte.

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<thead>
<tr>
<th>Parameter</th>
<th>Accuracy</th>
<th>Mean Recovery</th>
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<tr>
<td>Acetaldehyde</td>
<td>+/-6.1%</td>
<td>99.3%</td>
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</table>
**GALSON**

**CHAIN OF CUSTODY**

You may edit and complete this COC electronically by logging in to your Client Portal account at [https://portal.gelsonlabs.com](https://portal.gelsonlabs.com/)

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<td>4 Business Days</td>
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<td>3 Business Days</td>
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<td>Next Day by 6pm</td>
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<td>Same Day</td>
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- **Client Acct No.** 13405
- **Report To:** Mr. Dave Ayris
- **Company Name:** Golder Associates, Ltd.
- **Address 1:** 8610 36th Street NE
- **Address 2:** Unit 120
- **City, State Zip:** Calgary, AB T3J 2K1
- **Country:** Canada
- **Phone No:** 403 - 299 - 5600
- **Cell No:** 403 - 260 - 2281
- **Email reports to:** dayriss@golder.com
- **Email EDD to:** dayriss@golder.com
- **Comments:**

<table>
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<tr>
<th>Comments:</th>
<th>State Sampled: Please indicate which OEL(s) this data will be used for:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL ☐ ACGIH TLV ☐ MSHA ☐ Cal OSHA ☐ IAQ ☐ Other ☐ Specify Limit(s) ☐ Specify Other</td>
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- **Site Name:** Southport Tower
- **Project:** 20146092
- **Sampled By:** Cory Gray
- **List description of industry or Process Interferences present in sampling area:**

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<tr>
<th>Sample ID (Maximum of 20 Characters)</th>
<th>Date Sampled</th>
<th>Collection Medium</th>
<th>Sample Volume</th>
<th>Liters</th>
<th>Analysis Requested</th>
<th>Method Reference</th>
<th>Hexavalent Chromium Process (e.g., welding, plating, painting, etc.)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Jun 3/20</td>
<td>ORBO SSS, DPWH-treated silica gel</td>
<td>12.51 L</td>
<td></td>
<td>Acetaldehyde</td>
<td>mod. NIOSH 2016; HPLC/UV</td>
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</tbody>
</table>

- **If the method(s) indicated on the COC are not our routine/preferred method(s), we will substitute our routine/preferred methods. If this is not acceptable, check here to have us contact you.**

- **Chain of Custody:**
  - **Print Name / Signature:** Cory Gray
  - **Date:** Jun 04/20
  - **Time:** 8:45
  - **Received By:**
  - **Print Name / Signature:** Michelle Krause
  - **Date:** 05/10/20
  - **Time:** 09:45

* You must fill in these columns for any samples which you are submitting.

Samples received after 3pm will be considered as next day's business.

All services are rendered in accordance with the applicable SGS General Conditions of Service available via: [http://www.sgs.com/sgc/Terms-and-Conditions.aspx](http://www.sgs.com/sgc/Terms-and-Conditions.aspx)

**SGS North America**

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E. Syracuse, NY 13057, USA
1 +1 888 432 5227 | +1 315 432 5227
www.gelsonlabs.com | www.sgs.com

Page 5 of 7 Report Reference: 1 Generated: 08-JUN-20 15:14

Member of the SGS Group (SGS SA)
**Comments:** Sample #10 is a field blank.

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<th>Analysis Requested</th>
<th>Method Reference ^</th>
<th>Hexavalent Chromium Process (e.g., welding, plating, painting, etc.)</th>
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</thead>
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<td>Acetaldehyde</td>
<td>mod. NIOSH 2016; HPLC/UV</td>
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</tr>
</tbody>
</table>

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---

Chain of Custody

Relinquished By: Cory Gray  Date: Jun 04/20  Time: 8:45

Received By: Michelle Krause  Date: Apr 15/20  Time: 1:35 PM

Online COC No.: 207253
Prep No.: PSY574827
Account No.: 13405
Draft: 6/1/2020 1:13:50 PM

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