Update/Addendum to Env-A 1400 Air Toxics Compliance Demonstration Report

University of New Hampshire

Prepared for:
University of New Hampshire
Office of Environmental Health and Safety
11 Leavitt Lane
Durham, NH 03824

April 2013
April 26, 2013

Mr. Brad Manning  
Director, Environmental Health and Safety  
University of New Hampshire  
11 Leavitt Lane  
Durham, NH 03824

Subject: Update to UNH’s Env-A 1400 Air Toxics Compliance Demonstration

Dear Brad:

This summary report updates the University of New Hampshire’s air toxics compliance demonstration required under New Hampshire Air Regulation, Chapter Env-A 1400 that was initially prepared in December 2000 and subsequently updated in September 2003, March 2007, February 2009, October 2010, and March 2011. This compliance demonstration should be kept on file and made available for review by New Hampshire Air Resources Division upon their request.

As part of this updated compliance demonstration, POWER has combined the compliance demonstrations that were previously prepared for the Durham Campus and the Landfill Gas to Energy Facility located in Rochester.

To assess the adequacy of UNH’s most recent compliance demonstrations (October 2010 – Durham Campus, March 2011 – Landfill Gas to Energy Facility) as they compare to current campus activities, POWER Engineers (POWER) conducted the following activities:

- Reviewed current version of Env-A 1400 (revised in February 2011 and June 2012) for any rule changes (i.e. changes to ambient air limits, methodologies, etc.) since the most recent compliance demonstration for potential impacts to UNH’s compliance demonstration;
- Updated inventory of cooling towers at the Durham campus;
- Collected information on types and amounts of water treatment chemicals added to the cooling towers as algaecides, fungicides, biocides, and anti-foaming agents. Documented compliance demonstration for cooling tower regulated toxic air pollutant (RTAP) emissions;
- Updated UNH Printing Services’ products and actual usage rates for calendar year 2012, to identify any new RTAPs not covered by the most recent update, and to assess changes in usage rates; and,
- Reviewed existing activities identified in UNH’s most recent compliance demonstration to identify any significant changes to methods and/or equipment; and
- Reviewed and updated previous Env-A compliance demonstration of the LGTE facility and combined the results with the Durham Campus.

The findings of the update and addendum are summarized below.
Review Current Version of Env-A 1400 for Modifications

NHDES is required by statute to propose changes to the list of RTAPs and their ambient air limits (AALs) based on changes made to the list of chemical substances by the American Conference of Governmental Industrial Hygienists (ACGIH). NHDES also updates the rule relative to changes in applicability, exemptions, and methods of compliance demonstration. POWER reviewed the rule changes and updates to Env-A 1400 promulgated in February 2011 and June 2012 and concludes that other than changes to some Ambient Air Limits (AALs), there are no substantive changes or updates which impact the results of UNH’s air toxics update.

Cooling Tower Assessment

UNH uses water treatment chemicals in campus cooling systems, some of which contain an RTAP component(s). The water treatment chemicals include algaecides, fungicides, biocides, and anti-foaming agents. While there may be some RTAP emissions attributed to evaporation or contained in steam or mist releases, quantifying the amount and preventing their release is difficult. However, following ARD guidance, POWER prepared a campus wide inventory of cooling towers and the annual amount of water treatment chemicals used in the cooling tower systems for calendar year 2012 (CY2012). Based on a review of this inventory the following chemical was identified as a potential RTAP release: 1,3-dichloro-5,5-dimethylhydantoin (118-52-5). The remainder of the chemicals found in the water treatment products in use at UNH are not currently listed as RTAPs under Env-A 1400. Attachment A contains copies of the MSDS for all water treatment products in use at UNH.

The majority of the water treatment chemicals used in non-closed loop systems are released to the POTW during the blowdown process. Attachment A contains the CY2012 annual usage of RTAP containing water treatment chemicals utilized in the cooling tower systems at UNH and an estimate of each product released to the ambient air. The estimates of RTAP released assumes a conservative (i.e., overestimate) 10% of total product use is released through evaporation and drift.

Using the de minimis emission level method listed in Env-A 1405.03 for demonstrating compliance with the AALs, POWER compared the uncontrolled actual facility-wide RTAP emission levels to established de minimis thresholds for 24-hour average and annual emission rates. Attachment A contains the results of the de minimis emission level method, which indicate that at current water treatment chemical use levels, the RTAP emissions from UNH’s cooling towers are below the applicable de minimis levels listed in Table 1450-01 of Env-A 1400.

Should UNH increase the amount of water treatment chemicals used and/or introduce additional water treatment chemicals, the assessment of RTAP impacts from the cooling towers should be reviewed and updated as necessary. If compliance can not be demonstrated using the de minimis emission level method at modified conditions, POWER is confident that compliance can be demonstrated using the adjusted in-stack concentration method or the air dispersion modeling method (it is unlikely that the modeling method will be necessary given the negligible concentrations and exhaust parameters of the cooling towers).
Review of Printing Services Raw Materials List and Corresponding Usage Rates

POWER reviewed a list of products and their usage rates for CY2012 for UNH Printing Services. One new product was added since the most recent compliance demonstration was prepared. Tower Lo-Vo Washer CA-100 replaced Wash V-60 and does not contain any RTAPs.

For consistency with the March 2010 compliance demonstration and to be conservative in estimating RTAP impacts (i.e. overestimate), for each volatile RTAP, POWER calculated the adjusted in-stack concentration as outlined in Env-A 1405.05 for the 24-hour average and annual average AALs, based on CY2012 usage amounts. In order to calculate the 24-hour average AAL, POWER based its calculation on an operations schedule of 2,210 hours per year (8.5 hours/day, 5 days per week and 52 weeks/year). Because POWER calculated the adjusted in-stack concentrations using actual emissions rates, Env-A 1405.05(a)(2) requires compliance be demonstrated by comparing the concentrations to 50% of the respective AAL. The results of the adjusted in-stack concentration method of RTAPs released from UNH Printing Services in CY2012 are included in Attachment B.

Based on the methodology described above, the current operations at UNH Printing Services are in compliance with Env-A 1400. As new or reformulated products are brought into use, compliance with Env-A 1400 should be reassessed and findings updated.

Review of RTAP emissions from the Rochester Landfill Gas to Energy Facility

**SulfaTreat Vessel Re-Filling**

POWER reviewed UNH’s March 24, 2011 air toxic compliance demonstration that was prepared to address silica dust emission impacts during the re-filling of the SulfaTreat media vessels. The AERMOD model was previously used to determine the Landfill Gas to Energy (LGTE) facility’s silica impacts and the silica emission rate was previously based on an emission factor, maximum equipment capacities and maximum operating conditions. This update includes a revision to the silica emission rate determination and the method for demonstrating compliance.

During the filling of the vessels with SulfaTreat media, negligible amounts of silica may be released to the ambient air. The process of filling a vessel consists of using a boom lift to raise a 2,000 pound canvas tote of the SulfaTreat media to a height above the vessel. There is an 8 inch fill pipe located on top of the tank (16’ agl) and a three foot long “elephant” hose attached to the bottom of the canvas tote which is inserted into the fill pipe. When the hose is opened, the media flows into the vessel and there is a potential for some dust to be released when the bag’s elephant hose is removed from the fill pipe (there is a pull cord at the end of the hose that is closed as much as possible when the hose is removed from the fill pipe). The canvas tote itself functions as a fabric filter while its contents are emptied into the vessel.

Cathy Beahm of the New Hampshire Department of Environmental Services visited the site on April 10, 2013 to observe the filling process and provide recommendations on emission rate estimation. Based on her observations, she concluded that the canvas tote and elephant hose serve the same purpose as a fabric filter with a typical control efficiency of 99%.
However, they are not considered control equipment since they are part of the refilling process.

Since potential silica emission rate estimates are significantly lower using the methodology summarized above than the estimates provided in the March 2011 compliance demonstration, UNH is able to demonstrate compliance with the silica AALs using the de minimis emission level method. Attachment C contains emission rate information and the results of the de minimis emission level method which indicates that silica emissions from re-filling the SulfaTreat vessels are below the de minimis levels listed in Table 1450-01 of Env-A 1400.

**Landfill Gas Combustion**

Previous Env-A 1400 compliance demonstrations of the LGTE facility have considered RTAP emissions from the combustion of landfill gas. Compliance was demonstrated using the AERMOD model and landfill gas concentrations based on actual analysis of the gas. The ambient impacts of methane, hydrogen sulfide and hydrogen chloride were assessed using the AERMOD model. All other RTAP impacts were estimated by pro-rating the modeled methane impacts using the ratios of molecular weights and concentrations in landfill gas.

The modeling demonstration has been updated to include the most current meteorological data set and model version. Five years of meteorological data, covering the period from 2006 to 2010 collected at the Skyhaven Airport in Rochester, New Hampshire (surface data station 54791) and the Gray National Weather Service Station (upper air station #74389), was used. The meteorological data sets used for this modeling analysis were processed and approved for use by NHDES.

A program generated Cartesian receptor grid was used around the UNH LGTE facility, consisting of the following nested grids:

- 20 meter spacing along the fenceline;
- 20 meter spacing from the center of the facility out to 80 meters in each direction; and
- 50 meter spacing from 100 meters to 200 meters, centered around the facility.

All other receptors used in the modeling analysis were obtained from the UNHLEFGTE_fix.BST file provided by the NHDES. The receptor elevations were determined in AERMAP using a U.S. Geological Survey (USGS) NED file (1-183119546.tif).

A summary of the updated impacts in included in Attachment D.
Combined Impacts

There is one RTAP (1,2,4-trimethylbenzene – CAS# 95-63-6) which is emitted from both the printing services and the LGTE facility. The combined impacts from this RTAP are summarized in the table below. Since actual emissions are used for the printing services RTAP, the combined impacts are compared to 50% of the corresponding AALs. Based on this assessment, UNH is in compliance with Env-A for this RTAP.

<table>
<thead>
<tr>
<th>24-hour Impacts</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Chemical</td>
<td>CAS #</td>
<td>Printing Service Impact (ug/m³)</td>
<td>LGTE facility Impact (ug/m³)</td>
<td>Combined Impact (ug/m³)</td>
</tr>
<tr>
<td>1,2,4-trimethylbenzene</td>
<td>95-63-6</td>
<td>0.09</td>
<td>0.006</td>
<td>0.096</td>
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<table>
<thead>
<tr>
<th>Annual Impacts</th>
<th></th>
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<tbody>
<tr>
<td>Chemical</td>
<td>CAS #</td>
<td>Printing Service Impact (ug/m³)</td>
<td>LGTE facility Impact (ug/m³)</td>
<td>Combined Impact (ug/m³)</td>
</tr>
<tr>
<td>1,2,4-trimethylbenzene</td>
<td>95-63-6</td>
<td>0.01</td>
<td>0.0005</td>
<td>0.0105</td>
</tr>
</tbody>
</table>

Review of Campus Activities Previously Assessed

POWER confirmed that the activities that underwent an assessment of compliance in the most recent demonstration completed in March 2010 did not undergo significant modifications or additions in the interim period. Specifically, the following activities were reviewed:

**Vehicle Maintenance Shop**

UNH personnel report that very little touch-up painting occurs at this location, estimating the use of paint at less than one case of spray paint in CY2012, therefore this activity remains exempt from an RTAP compliance demonstration per Env-A 609.03(c)(15) and Env-A 1402.02(k), as a use of consumer products in a manner consistent with how the general public would use the product.

As noted in the original compliance demonstration, UNH operates a solvent degreaser at the vehicle maintenance shop and a similar unit at the Grounds and Roads Garage. Both units use a solvent bath for parts cleaning which does not contain a listed RTAP and, therefore, Env-A 1400 is not applicable.

**Mechanical/Electrical Maintenance Shop**

RTAP emissions from the spray paint hood are exempt under Env-A 609.03(c)(15) as a use of consumer products in a manner consistent with how the general public would use the product. The welding operation at the mechanical maintenance shop is classified as exempt pursuant to Env-A 609.03(c)(5), thus RTAP emissions are not regulated from this activity.
Carpentry Shop

Based on the level of control and the fact that the dust handling system is vented internally, the carpentry shop at UNH is exempt under Env-A 609.03(c)(14). In addition, pursuant to Env-A 1402.02(d) any sander dust collection device that uses a baghouse that is maintained and operated in accordance with the manufacturer’s specifications is exempt from the requirements of Env-A 1400.

Architectural Coating

This activity is exempt from an RTAP compliance demonstration per Env-A 609.03(c)(15), as a use of consumer products in a manner consistent with how the general public would use the product.

Memorial Union Building Copy Center

All activity at the MUB Copy Center is exempt from an RTAP compliance demonstration under Env-A 609.03(c)(2). There are no printing or gluing operations at the MUB copy center.

Service Building

The woodworking operation housed in the Service Building is exempt from an RTAP compliance demonstration per Env-A 609.03(c)(15), as a use of consumer products in a manner consistent with how the general public would use the product.

A paint booth is located in the lower level of the woodworking area. The booth is used primarily for very small amounts of spray paint cans on an intermittent basis. Occasionally, a high volume low pressure (HVLP) nozzle is used to apply paints and varnishes, in the amount of less than three gallons per year. However, most varnishes are applied using a brush-on finish. Based on the very small usage amounts and high volume air exchange flow, it is the judgment of POWER that any RTAPs emitted from the paint booth meet de minimis levels and/or AISC/ISC concentrations for RTAPs typically found in paints and varnishes.

The Service Building also contains natural gas fired and electric kilns, which are used on an infrequent basis. Previous Env-A 1400 compliance demonstrations did not identify any RTAP emissions from the kilns located in the Service Building. Based on discussions in March 2013 with UNH Art Department personnel, the water based glazes contain metallic components. The metallic components that are listed RTAPs are iron oxide and copper oxide. UNH Art Department personnel purchase raw materials and mix the glazes in the Art Studio. Iron oxide and copper oxide are purchased in powder form. Very small amounts of these RTAPs are used in the formulation of glazes. According to UNH Art Department personnel, little or no dust is generated during mixing. Glazes are applied to clay pots that have been bisque fired (bisque firing is the first time pots are heated to high temperatures and is done to vitrify the clay pots so that glazes can adhere to the surface). After glaze is applied, pots are fired in a kiln at temperatures between 2200° and 2300° F to bring the clay and glaze to maturity. The kiln is natural gas fired and is located outside of the art studio. Since metal oxides are colorants and are used to modify the visual appearance of the fired
glaze, metal oxides remain on the pot during firing and there are no emissions. Therefore, POWER concludes that there are no RTAP emissions from activities in UNH’s Art Department.

Manchester Campus

POWER also reviewed activities at UNH’s Manchester campus for applicability and compliance with Env-A 1400. Similar to the Durham campus, the Manchester campus uses water treatment chemicals for cooling systems. None of the water treatment chemicals used in calendar year 2012 contains listed RTAPs.

No other activities, devices, or practices at the Manchester campus have been identified as potential RTAP emitting sources.

Summary

As outlined above, POWER has completed a review of current Env-A 1400 requirements, UNH’s Durham campus activities combined with the Rochester LGTE facility, as well as an assessment of RTAP emissions from UNH’s Manchester campus. This summary report serves as an update and addendum to UNH’s October 2010 and March 2011 air toxics compliance demonstration. In completing this review, POWER has updated UNH’s compliance demonstration to accurately characterize estimated ambient impacts of individual RTAPs. The results indicate that UNH is in compliance with the ambient air limits listed in Chapter 1400 based on uncontrolled emissions, and that a permit for controlling RTAP emissions is not required.

Brad, please keep this updated compliance demonstration on-file with the original report and I recommend conducting annual reviews to ensure that it remains up-to-date with existing campus conditions. Also, should there be changes at your facility, compliance with Env-A 1400 must be demonstrated prior to the change taking effect. Please call me with any questions.

Sincerely,

Amy Austin

Attachment A: Durham Cooling Tower Data
Attachment B: Printing Services Data
Attachment C: LGTE SulfäTreat Data
Attachment D: LGTE Combustion Data
### Durham Campus

<table>
<thead>
<tr>
<th>Product</th>
<th>RTAP</th>
<th>CAS</th>
<th>% by WT</th>
<th>Annual Product Usage (lbs)</th>
<th>RTAP (lb/yr)</th>
<th>RTAP Emission Factor(^1) (%)</th>
<th>RTAP Emitted (lb/day)</th>
<th>24-hr deminimus (lb)</th>
<th>RTAP Emitted (lb/year)</th>
<th>Annual deminimus (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dantobrom RW</td>
<td>1,3-Dichloro-5,5-dimethylhydantoin</td>
<td>118-52-5</td>
<td>28</td>
<td></td>
<td>5</td>
<td>1.3</td>
<td>10.0</td>
<td>0.0009</td>
<td>0.017</td>
<td>1.3</td>
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</table>

\(^1\)Conservative estimate accounting for losses to evaporation and drift.

### Manchester Campus

<table>
<thead>
<tr>
<th>Product</th>
<th>RTAP</th>
<th>CAS</th>
<th>% by WT</th>
<th>Annual Product Usage (lbs)</th>
<th>RTAP (lb/yr)</th>
<th>RTAP Emission Factor(^1) (%)</th>
<th>RTAP Emitted (lb/day)</th>
<th>24-hr deminimus (lb)</th>
<th>RTAP Emitted (lb/year)</th>
<th>Annual deminimus (lb)</th>
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<tr>
<td>WCT-250</td>
<td>NONE</td>
<td>31</td>
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<td>10.0</td>
<td>0.0000</td>
<td>0.0</td>
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<td>0.0</td>
</tr>
<tr>
<td>Purobrom Tablets</td>
<td>NONE</td>
<td>100</td>
<td>0.0</td>
<td></td>
<td>0.0</td>
<td>10.0</td>
<td>0.0000</td>
<td>0.0</td>
<td>0.0</td>
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</tbody>
</table>
MATERIAL SAFETY DATA SHEET

1. PRODUCT NAME AND COMPANY IDENTIFICATION

Product Name: C22M-C, Chemical Name: Proprietary Blend, Chemical Family: Mixture, Formula: Not Applicable, Mixture, CAS Registry Number: Not Applicable, Mixture.

Manufacturer: APTechgroup, Inc., P.O. Box 62302, Cincinnati, OH 45262.

Telephone Numbers: Product Information: (866) 489-9831

2. COMPOSITION/INFORMATION ON INGREDIENTS

<table>
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<tr>
<th>Components</th>
<th>CAS#</th>
<th>% by Wt</th>
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<tbody>
<tr>
<td>Sodium Salt of Hydroxy-ethylidenediphosphonic Acid</td>
<td>3794-83-0</td>
<td>1 - 15</td>
<td>Yes</td>
</tr>
<tr>
<td>Sodium Salt of Phosphono-butanetricarboxylic Acid</td>
<td>40372-66-5</td>
<td>1 - 10</td>
<td>Yes</td>
</tr>
<tr>
<td>Sodium Tolytriazole</td>
<td>64665-57-2</td>
<td>5 - 10</td>
<td>Yes</td>
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<tr>
<td>Polymer/Solid</td>
<td>151006-66-5</td>
<td>10 - 20</td>
<td>Yes</td>
</tr>
<tr>
<td>Sodium Salt of HPA</td>
<td>23783-26-8</td>
<td>10 - 20</td>
<td>Yes</td>
</tr>
<tr>
<td>Sodium Salt of POCA</td>
<td>156105-39-4</td>
<td>10 - 20</td>
<td>Yes</td>
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<tr>
<td>Sodium Polyacrylate</td>
<td>9003-04-07</td>
<td>10 - 15</td>
<td>Yes</td>
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<tr>
<td>Sodium Moybdate Dihydrate</td>
<td>10102-40-6</td>
<td>10 - 15</td>
<td>Yes</td>
</tr>
</tbody>
</table>

* By OSHA definition, 29 CFR 1910.1200 (See Section 3 for Hazard Identification and Section 8 for Exposure Guidelines)

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Can cause irritation or damage to eyes and skin. Harmful if swallowed.

Routes of Exposure: Contact, ingestion. Target Organ Effects: Eyes: Causes irritation and, with extended contact, burns. Can result in severe damage. Skin: Causes irritation with reddening and itching. Ingestion: Causes irritation to the mucous membranes or other tissues contacted. Inhalation: Irritating to the respiratory tract. Carcinogenicity: Contains no listed carcinogens.

4. FIRST AID MEASURES

Eyes: Flush with clean cool water for 15 minutes holding eyelids open. See a physician immediately. Skin: Immediately flush skin with plenty of water while removing contaminated clothing and boots. See a physician. Ingestion: Drink plenty of water or milk. Do not induce vomiting. See a physician immediately. Inhalation: Remove to fresh air. If not breathing give artificial respiration. See a physician.

5. FIRE FIGHTING MEASURES


6. ACCIDENTAL RELEASE (SPILL MEASURES)

Confine large spills. Do not flush with water. Collect spilled material into approved hazardous waste container. Residue may be cleaned up with water but rinse water may require collection and treatment prior to disposal. Spray residue of small spills with plenty of water.
7. HANDLING AND STORAGE

Handling: Avoid contact. Do not touch face or eyes when handling. **Storage:** When not in use keep container closed. Store in a cool dry location.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

**Engineering Controls:** Good general ventilation. **Eye Protection:** Chemical goggles with face shield. **Skin Protection:** Neoprene or natural rubber gloves. **Respiratory Protection:** Use only NIOSH/MSHA approved respiratory protection if exposure guideline might be exceeded. **Other Protective Equipment:** As required to minimize skin contact. Eye wash, safety shower. **Exposure Guidelines:** None established.

9. PHYSICAL AND CHEMICAL PROPERTIES (Typical)

**Softening Point:** 120 to 130°F. **Appearance and Odor:** Tan to brown amorphous solid, slight characteristic odor. **Bulk Density:** Approx. 11 lbs/gal. **Solubility in H₂O:** Complete but dissolve slowly. **pH (1% solution):** 8 - 9.

10. STABILITY AND REACTIVITY

**Chemical Stability:** Stable. **Conditions to Avoid:** Contact with strong acids or caustic, oxidizers. **Hazardous Decomposition Products:** By fire: oxides of carbon, nitrogen and phosphorous. **Hazardous Polymerization:** Will not occur.

11. TOXICOLOGICAL INFORMATION

Toxicology of this product has not been established.

12. ECOLOGICAL INFORMATION

Environmental effects of this product have not been established.

13. DISPOSAL CONSIDERATIONS

Dispose of in an approved hazardous waste container. Disposer must comply with local state and federal regulations with respect to disposal or discharge.

14. TRANSPORT INFORMATION

**DOT Description:** Not regulated.

15. REGULATORY INFORMATION

All components are listed on the TSCA Inventory.

16. OTHER INFORMATION

**Hazard Ratings:** **HMIS:** Health - 2, Flammability - 0, Reactivity - 0, Protective Equipment: C. **NFPA:** Health - 2, Flammability - 0, Reactivity - 0.

The above information is based on data available to us and is believed to be correct. However, no warranty, merchantability, fitness for any use or any other warranty is expressed or to be implied regarding the accuracy of these data, the result to be obtained from the use thereof, the hazards connected with the use of the material, or that any such use will not infringe any patent. Since the information contained herein may be applied under conditions beyond our control and with which we may be unfamiliar, we do not assume any responsibility resulting from its use. This information is furnished upon the condition that the person receiving it shall make his own determination for the suitability of the material for his particular purpose. MSDS C22-C 2-1-09
**MATERIAL SAFETY DATA SHEET**

**EMERGENCY TELEPHONE:** 800-424-9300 (Chemtrec)

Lonza Inc.
90 Borolive Road  Allendale, NJ 07401
800-777-1875 (9am – 5pm)  309-697-7200 (After 5pm)

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**98297  Dantobrom RW Granular**

**MATERIAL**  Dantobrom RW Granular  
**DATE ISSUED**  09/12/07 - Rev.  
**DOT HAZARD CLASSIFICATION**  5.1, PG III  
**DOT SHIPPING NAME**  Oxidizing Solid, N.O.S.  
**DOT LABEL**  Oxidizer  
**IMO SHIPPING NAME**  Oxidizing Solid, Corrosive, N.O.S.  
**IMO Label**  Marine Pollutant

**CAS NO.** Mixture  
**FORMULA** Mixture  
**SUPERCEDES**  06/29/07

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### I - INGREDIENTS

<table>
<thead>
<tr>
<th>APPROXIMATE WEIGHT %</th>
<th>TWA/TLV</th>
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<tbody>
<tr>
<td>3-Bromo-1-chloro-5,5-dimethylhydantoin (CAS No. 126-06-7)</td>
<td>*</td>
</tr>
<tr>
<td>1-Bromo-3-chloro-5,5-dimethylhydantoin (CAS No. 16079-88-2)</td>
<td>*</td>
</tr>
</tbody>
</table>
| 1,3-Dichloro-5,5-dimethylhydantoin (CAS No. 118-52-5) | 28 | 0.2 mg/m³ (OSHA PEL)  
| | | 0.4 mg/m³ (OSHA STEL)  
| | | 0.2 mg/m³ (ACGIH TLV) |
| 1,3-Dichloro-5-ethyl-5-methylhydantoin (CAS No. 89415-87-2) | 11 | 0.2 mg/m³ (Lonza Internal Standard) |
| Sodium chloride (CAS No. 7647-14-5) | 1 | None established |

*The sum of the two asterisked components is approximately 60%.

### II - PHYSICAL AND CHEMICAL PROPERTIES

**APPEARANCE** Fine white granule  
**PH** 3.6 (10 g/l @ 25°C)  
**ODOR** Very slight pungent  
**BOILING POINT** Not applicable  
**MELTING OR FREEZING POINT** 120-148°C  
**VAPOUR DENSITY (Air=1)** Not applicable  
**VAPOR PRESSURE (mm Hg)** Not applicable  
**PERCENT VOLATILE (by volume)** <0.5  
**SOLUBILITY IN WATER** 5 g/l @ 25°C  
**SPECIFIC GRAVITY** (WATER = 1) Not known

### III - FIRE AND EXPLOSION INFORMATION

**FLASH POINT** 287°F (COC)  
**AUTO IGNITION TEMPERATURE** Not known  
**LOWER EXPLOSION LIMIT (%)** Not applicable  
**UPPER EXPLOSION LIMIT (%)** Not applicable  
**EXTINGUISHING MEDIA**  
| FOAM X | ALCOHOL FOAM |
| DRY CHEMICAL X | CO₂ |
| WATER X | OTHER |
98297 Dantobrom RW Granular

*** III - FIRE AND EXPLOSION INFORMATION (continued) ***

SPECIAL FIRE FIGHTING PROCEDURES:
To minimize the progressive generation of noxious gases, flood burning material with large quantities of water. Must wear NIOSH approved self-contained breathing apparatus and protective clothing. Cool fire-exposed containers with water spray.

UNUSUAL FIRE AND EXPLOSION HAZARDS:
Material is a strong oxidizer. May ignite combustible materials and may produce noxious gases. Products of combustion are toxic.
This product is classified as an ST-1 dust explosive hazard (ASTM E-1226-88). Airborne dusts of this product in an enclosed space and in the presence of an ignition source may constitute an explosion hazard. Use adequate explosion-proof ventilation systems to control dust at the source. Avoid generating product dust near sources of ignition, including static electricity. Use safety measures in accordance with the 1988 edition of NFPA 654 (Standard for the Prevention of Dust Explosions in the Chemical, Dye, Pharmaceutical and Plastic Industries).

*** IV - HEALTH EFFECTS INFORMATION ***

 ROUTES OF ENTRY - SKIN CONTACT X   EYE CONTACT X   INHALATION X   INGESTION

EFFECTS OF OVEREXPOSURE
Based upon the available toxicity information for this, and for closely related materials, it is anticipated that this material will be harmful if swallowed, and direct skin and eye contact can result in severe skin and eye irritation and/or chemical burns with potential irreversible tissue damage. Inhalation of dust or aerosols can be severely irritating to the lung with potential systemic absorption and tissue damage. Repeated skin exposure may induce sensitization.
OVEREXPOSURE MAY AGGRAVATE EXISTING CONDITIONS:
No effects indicated.

EMERGENCY AND FIRST AID PROCEDURES:
Eyes: Flush eyes with large amounts of running water for at least 15 minutes. Hold eyelids apart to ensure rinsing of the entire surface of the eye and lids with water. Get immediate medical attention. If physician not available, flush for additional 15 minutes and then transport victim to medical care.

Skin: Immediately wipe away excess material with a dry cloth while removing contaminated clothing and shoes. Under safety shower, wash affected areas thoroughly with large amounts of water, and soap if available, for at least 15 minutes. Get immediate medical attention. Discard or decontaminate clothing and shoes.

Ingestion: If swallowed, immediately give 3-4 glasses of water. DO NOT induce vomiting. If vomiting occurs, give fluids again. Get immediate medical attention. Have physician determine if patient's condition allows induction of vomiting or evacuation of stomach. Do not give anything by mouth to an unconscious or convulsing person.
HEALTH EFFECTS INFORMATION (continued)

Inhalation: Remove from area to fresh air. If not breathing, clear airway and start
artificial respiration. If victim is having trouble breathing, give supplemental
oxygen, if available. Get immediate medical attention.

CHEMICALS LISTED AS CARCINOGEN BY:

- NATIONAL TOXICOLOGY PROGRAM - No
- I.A.R.C. MONOGRAPHS - No
- OSHA - No

REACTIVITY INFORMATION

STABILITY: STABLE X CONDITIONS TO AVOID
          UNSTABLE None known (Decomposes at 165°C)

HAZARDOUS DECOMPOSITION PRODUCTS

Thermal decomposition may produce toxic vapors/fumes of chlorine, bromine, organic
materials and oxides of carbon and nitrogen.

HAZARDOUS POLYMERIZATION CONDITIONS TO AVOID

MAY WILL NOT X None known
          OCCUR OCCUR

INCOMPATIBILITY (MATERIALS TO AVOID)

WATER OTHER X Strong acids and alkalis, high storage temperatures, moisture
          and readily oxidizable material.

SPILL AND DISPOSAL INFORMATION

STEPS TO BE TAKEN IN CASE OF MATERIAL SPILL OR RELEASE

DANGER! Oxidizing material. Possible dust explosion hazard. Do not get in eyes or
on skin. Repeated or prolonged contact can result in sensitization and/or
irreversible tissue damage. Do not breathe dust. For spills, wear appropriate
protective equipment, and respiratory protection. Where dust may be generated, wear
full-face respiratory protection, and remove all sources of ignition. For large
spills, or when spilled material comes in contact with water, self-contained
breathing apparatus is preferred.

Carefully sweep up spilled material (avoid generating dust) and place in an
appropriate container for disposal. Do not contaminate with oxidizable materials.
Neutralize any residue with dilute, alkaline sodium bisulfite or thiosulfate
solution: absorb with sand or vermiculite and place in a compatible container for
disposal. If spilled material is wet, neutralize and proceed as stated above.

Material is toxic to fish. Do not discharge into lakes, streams, ponds or public
water unless in accordance with an NPDES permit.
98297  Dantobrom RW Granular

****************************** VI - SPILL AND DISPOSAL INFORMATION (continued)******************************

WASTE DISPOSAL METHODS
Dispose of in compliance with all Federal, state and local laws and regulations. Incineration is the preferred method. Relatively small quantities of product may be neutralized as stated above, and, if in accordance with local laws and the operators of the local sewage treatment plant, the neutralized material may be discharged into the sewer system.

****************************** VII - PERSONAL PROTECTION INFORMATION ******************************

ENGINEERING CONTROLS
In processes where dusts or airborne particulates may be generated, proper ventilation must be provided in accordance with good ventilation practices.

RESPIRATORY PROTECTION
In processes where dusts or airborne particulates may be generated, a NIOSH/MSHA jointly approved respirator is advised.

PROTECTIVE GLOVES
Rubber or neoprene, to prevent skin contact.

EYE PROTECTION
Wear chemical goggles where there is a potential for eye contact. Use safety glasses with side shields where there is no potential for contact.

OTHER PROTECTIVE EQUIPMENT
Eye wash; safety shower; protective clothing (long sleeves, coveralls or other, as appropriate), to prevent skin contact.

****************************** VIII - STORAGE AND HANDLING ******************************

PRECAUTIONS FOR STORAGE AND HANDLING:
Do not breathe dust. Avoid generating dust. Store in a cool, dry place, isolated from all organic material. Product is a strong oxidizer and is corrosive. Avoid heat and direct sunlight. Do not allow product to come in contact with oxidizable material. Keep container closed. Please also see "Unusual Fire and Explosion Hazards" in Section III of this MSDS for information on the dust explosivity of this material.

Empty containers retain product residues and can be dangerous. Do not pressurize, cut weld, braze, solder, drill, grind or expose such containers to heat or flame. They may explode and cause injury. Follow all MSDS precautions in handling empty containers.
**IX - TOXICOLOGY & ECOTOXICOLOGY INFORMATION**

The toxicity and ecotoxicity information provided is for this material and component(s) of this material(s).

**TOXICITY**

**ACUTE**
- oral LD_{50} (rat): 468 - 477 mg/kg
- eye irritation (rabbit): Severe irritant and corrosive
- skin irritation (rabbit - Draize test): Corrosive to both abraded and unabraded skin
- skin corrosivity (rabbit - US DOT test): Not corrosive

For Bromochloro-5,5-dimethylhydantoin:
- dermal LD_{50} (rabbit): >2000 mg/kg
- skin sensitization (guinea pig - Buehler Test): Skin sensitizer.

For 1,3-Dichloro-5,5-dimethylhydantoin:
- skin sensitization (guinea pig - Buehler Test): Skin sensitizer.

**ECOTOXICITY**

**AQUATIC**

For Dantobrom RW Granular:
- LC_{50} (rainbow trout - 96 hours): 0.5 mg/l
- LC_{50} (bluegill sunfish - 96 hours): 1.2 mg/l
- LC_{50} (Daphnia magna - 48 hours): 0.4 mg/l
- LC_{50} (mysis shrimp - 96 hours): 0.93 mg/l
- LC_{50} (sheepshead minnow - 96 hours): 1.4 mg/l (as Br_{3})
- EC_{50} (eastern oysters - 96 hours): 0.84 mg/l (as Br_{3})

For 1,3-Dichloro-5-ethyl-5-methylhydantoin:
- EC_{50} (Algae - Selenastrum sp. - 72 hours): 0.12 mg/l

**X - MISCELLANEOUS AND REGULATORY INFORMATION**

**INTERNATIONAL LEVEL REGULATIONS:**

**CANADIAN WORKPLACE HAZARDOUS MATERIAL INFORMATION SYSTEM (WHMIS) CLASSIFICATION**

Class C

**DOMESTIC SUBSTANCE LIST (DSL) STATUS**

The components of this material are currently listed on the Canadian DSL.
**FEDERAL LEVEL REGULATIONS:**

**TOXIC SUBSTANCES CONTROL ACT (TSCA INVENTORY) STATUS:**
This product is currently listed on U.S. EPA TSCA 8(b) inventory list.

**TSCA Section 12(b) Export Notification:**
Components present in this product which, if exported, could require either annual or one-time reporting under this regulation are as follows:

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS Number</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXEMPT - FIFRA registered product</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**EPA REGULATION ON PESTICIDES, FIFRA:**
This product is an EPA FIFRA registered pesticide (EPA Registration No. 6836-237).
This product may only be used in the EPA registered application(s) stated on the product label.

**CERCLA (Comprehensive Environmental Response, Compensation and Liability Act of 1980):** requires notification of the National Response Center (Telephone 800-424-8802) in the event of a release of quantities of the following hazardous materials contained in this product, if the release is equal to or greater than the Reportable Quantities (RQs) listed in 40 CFR 302.4:

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS Number</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>None known</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SARA Title III, Sections 302/304 (Superfund Amendments and Reauthorization act of 1986):** This act requires emergency planning, including agency notification, for possible release of the following components of this material, based upon the Threshold Planning Quantities (TPQs) and release Reportable Quantities (RQs) listed for the Components in 40 CFR 355:

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS Number</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>None known</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**MATERIAL SAFETY DATA SHEET**

**EMERGENCY TELEPHONE: 800-424-9300 (Chentrec)**

Lonza Inc.
90 Boroline Road Allendale, NJ 07401
800-777-1875 (9am – 5pm) 309-697-7200 (After 5pm)

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*************** X - MISCELLANEOUS AND REGULATORY INFORMATION (continued) **********

FEDERAL LEVEL REGULATIONS (continued):

SARA Title III Sections 311/312 - This act requires reporting under the Community Right-to-Know provisions due to the inclusion of the following components of this material in one or more of the five hazard categories listed in 40 CFR 370:

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS Number</th>
<th>Hazard *)</th>
<th>Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-Bromo-1-chloro-5,5-dimethylhydantoin</td>
<td>126-06-7</td>
<td>A, F</td>
<td></td>
</tr>
<tr>
<td>1-Bromo-3-chloro-5,5-dimethylhydantoin</td>
<td>16079-88-2</td>
<td>A, F</td>
<td></td>
</tr>
<tr>
<td>1,3-Dichloro-5,5-dimethylhydantoin</td>
<td>118-52-5</td>
<td>A, F</td>
<td></td>
</tr>
<tr>
<td>1,3-Dichloro-5-ethyl-5-methylhydantoin</td>
<td>89415-87-2</td>
<td>A, F</td>
<td></td>
</tr>
</tbody>
</table>

*) The five hazard categories are as follows: F=FIRE HAZARD; S= SUDDEN RELEASE OF PRESSURE; R=REACTIVE; A=IMMEDIATE (ACUTE) HEALTH HAZARD; C=DELAYED (CHRONIC) HEALTH HAZARD

SARA Title III Section 313 - This act requires submission of annual reports off the releases of the following components of this material if the threshold reporting quantities as listed in 40 CFR 372, are met or exceeded:

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS Number</th>
<th>Typical Maximum Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>None known</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

STATE RIGHT-TO-KNOW REGULATIONS:

CALIFORNIA PROPOSITION 65 - Components present in this material which the State of California has found to cause cancer, birth defects or other reproductive harm are as follows:

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS Number</th>
<th>Typical Maximum Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bromoform</td>
<td>75-25-2</td>
<td>12 ppm</td>
</tr>
</tbody>
</table>

MASSACHUSETTS Right-to-Know - The following components of this material are included in the Massachusetts Substance List and are present at or above reportable levels:

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS Number</th>
<th>Typical Maximum Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>None known</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MICHIGAN Critical Materials - The following components of this material are included in the Michigan Critical Materials List:

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>None known</td>
<td></td>
</tr>
</tbody>
</table>

The information provided herein is compiled from internal reports and data from professional publications. IT IS FURNISHED WITHOUT WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED. It is intended to assist in evaluating the suitability and proper use of the material in manufacturing and in the development and implementation of safety precautions and procedures.
98297  Dantocbrom RW Granular

****************** X - MISCELLANEOUS AND REGULATORY INFORMATION (continued) ********

STATE RIGHT-TO-KNOW REGULATIONS (Continued):

NEW JERSEY Right-to-Know - The following components of this material are included in the New Jersey Hazardous Substance List and are present at or above reportable levels:

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS Number</th>
<th>Typical Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-Bromo-1-chloro-5,5-dimethylhydantoin</td>
<td>126-06-7</td>
<td>*</td>
</tr>
<tr>
<td>1-Bromo-3-chloro-5,5-dimethylhydantoin</td>
<td>16079-88-2</td>
<td>*</td>
</tr>
<tr>
<td>(* The sum of the two asterisked components is approximately 60%.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,3-Dichloro-5,5-dimethylhydantoin</td>
<td>118-52-5</td>
<td>28%</td>
</tr>
<tr>
<td>1,3-Dichloro-5-ethyl-5-methylhydantoin</td>
<td>89415-87-2</td>
<td>11%</td>
</tr>
</tbody>
</table>

Pennsylvania Right-to-Know - The following components of this material are included in the Pennsylvania Hazardous Substance List and are present at or above reportable levels:

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS Number</th>
<th>Typical Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>None known</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
I Identification of the substance & the company

Chemical name: 2,2-Dibromo-3-nitriopropionamide
CAS number: 10222-01-2
Chemical formula: C\textsubscript{3}H\textsubscript{7}BrO\textsubscript{2}N
Chemical family: Halogenated cyanacetamide
Molecular weight: 241.84
Type of product and use: A microbiocidal bactericide, fungicide, algicide and slimicide, in treating industrial cooling water systems and pulp & paper mills.
Company identification:
Address and telephone:
95 MacCorkle Ave. SW, South Charleston, WV 25303, USA
Tel: (304) 746-3000
Emergency telephone number:
For USA: Chemrec (800)424-9300

II Composition / information on ingredients

Hazardous component(s):
2,2-Dibromo-3-nitriopropionamide - 98% min

III Hazards identification

Adverse human health effects:
- Toxic by inhalation
- Risk of serious damage to eyes
- Irritant to skin

Environmental effects:
- Very toxic to aquatic environment

IV First-aid measures

Eye contact:
Holding the eyelids apart, flush eyes promptly with copious flowing water for at least 20 minutes. Get medical attention immediately.

Skin contact:
Remove contaminated clothing. Wash skin thoroughly with mild soap and plenty of water for at least 15 minutes. Wash clothing before re-use. Get medical attention if irritation persists.

Inhalation:
In case of dust inhalation or breathing fumes released from heated material, remove person to fresh air.
Keep him quiet and warm. Apply artificial respiration if necessary and get medical attention immediately.
**Material Safety Data Sheet**

**Product**

**Biobrom C - 100G**

**MSDS code:** 8341G-USA

**Date:** 24/07/2000

**Supersedes:** 30/06/1998

---

**Ingestion**

If swallowed, wash mouth thoroughly with plenty of water and give water to drink. Get medical attention immediately.

**************************************************************************

**NOTE:** Never give an unconscious person anything to drink.

**************************************************************************

**Note to the physician**

Corrosive to eyes

In case of ingestion do not induce vomiting.

No specific antidote.

Treat symptomatically and supportively.

---

**Fire - fighting measures**

**Flash point**

None

**Auto-ignition temperature**

Not applicable

**Flammable/Explosion limits**

Not flammable

**Extinguishing media**

Carbon dioxide, dry chemicals, foam, water spray (fog).

**Fire fighting procedure**

Cool containers with water spray.

Fire fighters should wear full protective clothing and self-contained breathing apparatus (SCBA) in positive pressure mode.

**Unusual fire and explosion hazards**

Dust may form a weak explosive mixture with air (class St1), but is not sensitive to ignition from electrostatic discharges.

Will decompose from ca. 160°C releasing poisonous and corrosive fumes of HBr, Br2 and NOx.

---

**Accidental release measures**

**Personal precautions**

Wear self-contained breathing apparatus, full PVC clothing, PVC gloves and boots.

**After spillage / leakage**

Sweep up, place in a bag and hold for waste disposal or possible re-use.

Avoid raising dust.

---

**Handling and storage**

**Handling**

Keep containers tightly closed.

Avoid producing or diffusing dust into the air.

**Storage**

Store in a dry, cool, well-ventilated and shaded area, away from heat sources away from incompatible materials (see "materials to avoid").
MATERIAL SAFETY DATA SHEET

Biobrom C - 100G

MSDS code: 8341G-USA

Date: 24/07/2000
Supersedes: 30/06/1998

Exposure controls / personal protection

Exposure limits:
- TLV-TWA Not established
- Ventilation requirements Ventilation must be sufficient to maintain dust below 10mg/m³ 8 hours TWA (ACGIH recommended Threshold Limit Value for total dust).

Personal protection equipment:
- Respiratory protection Dust respirator
- Gloves Protective gloves
- Eye protection Chemical safety goggles
- Others Body covering clothes and boots

Industrial hygiene Safety shower and eye bath should be provided. Do not eat, drink or smoke until after-work showering and changing clothes.

Physical and chemical properties

Appearance White to off-white crystalline solid or powder of mild antiseptic odour
Melting point/range 123 - 125°C
Boiling point/range Not determinable, decomposes above 160°C
Specific gravity 2.375 at 21°C
Vapour pressure 8.25×10⁻⁴ mm Hg at 25°C
Relative vapour density (air=1) Not applicable under standard conditions
Evaporation rate (ether=1) Not applicable under standard conditions

Solubility:
- Solubility in water 17±0.05 g/l at 25.7°C
- Solubility in other solvents acetone - 35 g/100g
ethanol - 25 g/100g
dimethyl formamide - 120 g/100g
polyethylene glycol (Mw 200) - 120 g/100g

Thermal decomposition From ca. 160°C

Stability and reactivity

Stability Stable under normal conditions
Materials to avoid Oxidizing agents, reducing agents
Conditions to avoid Keep away from light and heat
Hazardous decomposition ---products Br₂, HBr, CNBr, NOₓ, C₂H₅Br, CH₂Br

Clearon Corp. 95 MacCorlde Avenue, SW 25303 South Charleston, WV USA
MATERIAL SAFETY DATA SHEET

Product: Biobrom C-100G
MSDS code: 8341G-USA

Date: 24/07/2000
Supersedes: 30/06/1998

Hazardous polymerization: Will not occur

Toxicological information
Acute toxicity:
- Rat oral LD50: 308 mg/kg
- Rat dermal LD50: >2000 mg/kg
- Rat inhalation LC50: 0.32 mg/l/4 hour
- Eye irritation (rabbit): Corrosive
- Dermal irritation (rabbit): Moderate irritant

Dermal sensitization
-(guinea pig): Weak sensitizer

Effects of overexposure:
- Ocular: Corrosive
- Dermal: Irritant
- Inhalation: In severe cases pulmonary oedema may be developed
  Irritant to upper respiratory tract
- Ingestion: Corrosive by ingestion.
  Abdominal pain, nausea, vomiting and diarrhoea
- Sensitization: May cause skin sensitization

Sub-chronic toxicity:
- NOEL: 5 mg/kg/day (13 weeks oral, rat)

Chronic toxicity: Not available
Carcinogenicity: Not known to be a carcinogen.
Not included in NTP 8th Report on Carcinogens.
Not classified by IARC.

Genotoxicity: Not clastogenic in chromosome aberration test with Chinese hamster cells.
Not clastogenic in chromosome aberration test with Human Lymphocytes.
Biobrom C-103 did not induce DNA repair synthesis in the hepatocytes of male rats in vitro.

Mutagenicity: Not mutagenic by the Ames Test

Reproductive toxicity: In a 2-generation study in rats, the NOEL for reproduction parameters was >=30 mg/kg/day.

Teratogenicity: Not teratogenic. The NOAEL (for fetal toxicity in rabbits) = 10 mg/kg/day.

Ecological information
Octanol/Water partition
- coefficient: Equivalent Kow = 6.3
MATERIAL SAFETY DATA SHEET

Product: Biobrom C - 100G
MSDS code: 8341G-USA

Aquatic toxicity
- 96 Hour-LC50 - Fish
  2.3 mg/l (Rainbow trout)
  3.4 mg/l (Sheepshead minnow)
  2.3 mg/l (Bluegill sunfish)
  0.72 mg/l (Mysis shrimp)
  0.37 mg/l (Eastern oyster)

- 48 Hour-ECS50
  -- Daphnia magna
  0.85 mg/l

Avian toxicity
- Bobwhite quail, acute oral LD50
  354 mg/kg
- Mallard duck, dietary LC50
  > 5620 ppm
- Bobwhite quail, dietary LC50
  > 5620 ppm

Disposal considerations
Waste disposal
Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state and local environmental regulations when disposing of this material.

Transportation information
US DOT
Proper shipping name: Toxic solid, organic, n.o.s.
Class: 6.1 - Poisons
Label: POISON (6)
Packing Group: II

UN No.
2811

IMO-IMDG code
Proper shipping name: Toxic solid, Organic, n.o.s
Class: 6.1 Toxic substances
Packing Group: II
Label: TOXIC (6.1)
Marking: MARINE POLLUTANT
(IMDG CODE - page 6270-6, amd.29-98)

ICAO/IATA
Class: 6.1
Hazard Label(s): Toxic
MATERIAL SAFETY DATA SHEET

Product: Biobrom C - 100G
MSDS code: 8341G-USA

Page: 6/7
Date: 24/07/2000
Supersedes: 30/06/1998

Regulatory information

USA
- WORKPLACE CLASSIFICATION
  This product is considered hazardous under the OSHA Hazard Communication Standard (29CFR 1910.1200).
- SARA TITLE III
  Section 311/312 Categorization (40CFR 370): This product is categorized as an immediate and delayed health hazard.
- SARA 313
  This product contains a chemical listed at or above de minimis concentrations.

Canada
- Listed in NDSSL

EEC
- Reported in EINECS (No. 2335397)

Japan
- Listed in MITI (ENCS No.2-2795)

Australia
- Listed in AIICS

South Korea
- Listed in ECL (KE-09944)

Other information

The information in this Material Safety Data Sheet should be provided to all who will use, handle, store, transport, or otherwise be exposed to this product. This information has been prepared for the guidance of plant engineering, operations and management and for persons working with or handling this product. Additionally, if this Material Safety Data Sheet is more than three years old, you should contact Clearon at the phone number listed below to make certain that this sheet is current.

Note: (*) Revised from previous version

Although the information and recommendations set forth herein (hereinafter "information") are presented in good faith and believed to be correct as of the date hereof, Clearon Corp. makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its safety and suitability for their purposes prior to use.

In no event will Clearon Corp. be responsible for damages of any nature whatsoever resulting from the use of or reliance upon information. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESSED OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE, ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH THE INFORMATION REFERS.

HEALTH, SAFETY & ENVIRONMENT DEPARTMENT
CLEARON CORPORATION

Clearon Corp. 95 MacCorlde Avenue, SW 25303 South Charleston, WV USA
MATERIAL SAFETY DATA SHEET

Product: Biobrom C - 100G
MSDS code: 8341G-USA

95 MacCorkle Ave., S.W.
South Charleston, WV 25303
Phone Number: (304) 746-3000
USA

Date: 24/07/2000
Supersedes: 30/06/1998

End of document.
Number of pages: 7
ATTACHMENT B
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dipropylene Glycol Methyl Ether</td>
<td>34590-94-8</td>
<td>3048</td>
<td>2032</td>
<td>3.9</td>
<td>0.0004</td>
<td>56.5</td>
<td>0.10</td>
<td>1016</td>
<td>Yes</td>
<td>0.0018</td>
<td>224.14</td>
<td>0.66</td>
<td>1524</td>
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<td></td>
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<tr>
<td>Propylene Glycol</td>
<td>107-98-2</td>
<td>2000</td>
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<td>3.9</td>
<td>0.0004</td>
<td>56.5</td>
<td>0.10</td>
<td>1000</td>
<td>Yes</td>
<td>0.0018</td>
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<td>Yes</td>
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<tr>
<td>Monoethanol Amine</td>
<td>141-43-5</td>
<td>27</td>
<td>18</td>
<td>3.9</td>
<td>0.0004</td>
<td>56.5</td>
<td>0.10</td>
<td>9</td>
<td>Yes</td>
<td>0.0018</td>
<td>224.14</td>
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<td>13.5</td>
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<td>2-Hydroxyethanol</td>
<td>111-76-2</td>
<td>13000</td>
<td>13000</td>
<td>31.5</td>
<td>0.0036</td>
<td>449.9</td>
<td>0.76</td>
<td>6500</td>
<td>Yes</td>
<td>0.0142</td>
<td>1783.18</td>
<td>5.25</td>
<td>6500</td>
<td>Yes</td>
<td></td>
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<tr>
<td>Ethylene Glycol</td>
<td>107-21-1</td>
<td>503</td>
<td>335</td>
<td>0.9</td>
<td>0.0001</td>
<td>12.5</td>
<td>0.02</td>
<td>167.5</td>
<td>Yes</td>
<td>0.0004</td>
<td>49.62</td>
<td>0.15</td>
<td>251.5</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>1,2,4-trimethylbenzene</td>
<td>95-63-6</td>
<td>619</td>
<td>412</td>
<td>0.5</td>
<td>0.0001</td>
<td>7.8</td>
<td>0.01</td>
<td>206</td>
<td>Yes</td>
<td>0.0002</td>
<td>30.78</td>
<td>0.09</td>
<td>309.5</td>
<td>Yes</td>
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<tr>
<td>Aliphatic Hydrocarbon</td>
<td>8052-41-3</td>
<td>2641</td>
<td>1761</td>
<td>0.0</td>
<td>0.0000</td>
<td>0.0</td>
<td>0.00</td>
<td>880.5</td>
<td>Yes</td>
<td>0.0000</td>
<td>0.00</td>
<td>0.00</td>
<td>1320.5</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Acetic Acid</td>
<td>64-19-7</td>
<td>6714</td>
<td>4476</td>
<td>1.2</td>
<td>0.0001</td>
<td>17.6</td>
<td>0.03</td>
<td>2238</td>
<td>Yes</td>
<td>0.0006</td>
<td>69.77</td>
<td>0.21</td>
<td>3357</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Xylene</td>
<td>1330-20-7</td>
<td>1550</td>
<td>100</td>
<td>0.0</td>
<td>0.0000</td>
<td>0.0</td>
<td>0.00</td>
<td>50</td>
<td>Yes</td>
<td>0.0000</td>
<td>0.00</td>
<td>0.00</td>
<td>774</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Cumene</td>
<td>98-82-8</td>
<td>1237</td>
<td>400</td>
<td>0.0</td>
<td>0.0000</td>
<td>0.0</td>
<td>0.00</td>
<td>200</td>
<td>Yes</td>
<td>0.0000</td>
<td>0.00</td>
<td>0.00</td>
<td>618.5</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
University of New Hampshire LGPF
RTAP Emissions from SulfaTreat Vessel Filling

I. RTAPS Contained in SulfaTreat Media

<table>
<thead>
<tr>
<th>RTAP</th>
<th>CAS No.</th>
<th>Max. Wt %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica, crystalline, quartz</td>
<td>14808-60-7</td>
<td>10</td>
</tr>
<tr>
<td>Silica, crystalline, cristobalite</td>
<td>14464-46-1</td>
<td>5</td>
</tr>
</tbody>
</table>

II. Emission Rate Derivation

Emission Factor Used: 0.0033 lb/PM10/ton material transferred
Control efficiency Applied: 99%
Tons SulfaTreat/Vessel: 38 tons/vessel
Loading Rate: 2.5 hours/vessel
Maximum Number of Vessels Loaded per Day: 2 vessels/day
Maximum Content of Silica: 15% total silica

the vendor of the SulfaTreat media was contacted to determine if any test data existed on potential emissions from the re-filling of vessels. There was no such test data available. Absent any test data on potential emissions from re-filling of similar vessels, POWER chose to use an emission factor for uncontrolled aggregate transfer in concrete batch operations that was taken from EPA's AP-42 document (Table 11.12-2, Aggregate Transfer) and apply a control efficiency. Since the transfer of sulfaTreat media occurs in a confined vessel with an elephant hose from the canvas tote acting as a fabric filter, POWER assumed a control efficiency of 99%.

III. Summary of Emissions

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>CAS</th>
<th>RTAP Emitted (lb/day)</th>
<th>24-hr deminimis (lb/day)</th>
<th>RTAP Emitted (lb/year)</th>
<th>Annual deminimis (lb/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica</td>
<td>1309-37-1</td>
<td>0.0004</td>
<td>0.0011</td>
<td>0.0047</td>
<td>0.39</td>
</tr>
</tbody>
</table>

1lb/day emissions: 0.0033 lb/ton x (1-0.99) x 38 ton/vessel x 2 vessels/day x 15% = 0.0004 lb/day
2lb/year emissions: 25 vessels changed out per year (lb/day / 2 x 25): 0.0047 lb/year
ATTACHMENT D
### UNH PLFG in Durham Boilers Env-A 1400 Toxics Modeling Results Worksheet

**Date:** 4/23/2013

<table>
<thead>
<tr>
<th>Compound</th>
<th>Conc. in Landfill Gas</th>
<th>mol. weight</th>
<th>HHV of PLFG</th>
<th>24-hr Conc.</th>
<th>24-hr Annual</th>
<th>Annual Conc.</th>
<th>Pass/Fail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen sulfide</td>
<td>34.07 ppm</td>
<td>563.40</td>
<td>730</td>
<td>30</td>
<td>0.000</td>
<td>2</td>
<td>Pass</td>
</tr>
<tr>
<td>1,1,2,2-Tetrachloroethane</td>
<td>167.85</td>
<td>1.11</td>
<td>0.007</td>
<td>25</td>
<td>0.001</td>
<td>16</td>
<td>Pass</td>
</tr>
<tr>
<td>1,1,2-Trichloro-1,2,2-trifluoro</td>
<td>187.37</td>
<td>0.67</td>
<td>0.006</td>
<td>38581</td>
<td>0.001</td>
<td>25721</td>
<td>Pass</td>
</tr>
<tr>
<td>1,1,2-Trichloroethane</td>
<td>133.4</td>
<td>0.16</td>
<td>0.009</td>
<td>277</td>
<td>0.001</td>
<td>184</td>
<td>Pass</td>
</tr>
<tr>
<td>1,1-Dichloroethane (Ethylendicloride)</td>
<td>98.95</td>
<td>0.25</td>
<td>0.010</td>
<td>2037</td>
<td>0.001</td>
<td>1358</td>
<td>Pass</td>
</tr>
<tr>
<td>1,1-Dichloroethylene (Vinylidene chloride)</td>
<td>96.94</td>
<td>0.70</td>
<td>0.003</td>
<td>200</td>
<td>0.000</td>
<td>200</td>
<td>Pass</td>
</tr>
<tr>
<td>1,2-Dichlorobenzene</td>
<td>181.45</td>
<td>0.01</td>
<td>4.37E-04</td>
<td>186</td>
<td>4.79E-05</td>
<td>124</td>
<td>Pass</td>
</tr>
<tr>
<td>1,2,4-Trimethylbenzene (as Trimethylbenzene)</td>
<td>120.19</td>
<td>1.37</td>
<td>0.006</td>
<td>619</td>
<td>0.0005</td>
<td>412</td>
<td>Pass</td>
</tr>
<tr>
<td>1,2-Dichloroethane</td>
<td>96.94</td>
<td>2.84</td>
<td>0.010</td>
<td>16521</td>
<td>0.001</td>
<td>7867</td>
<td>Pass</td>
</tr>
<tr>
<td>1,2-Dichloroethoxy</td>
<td>112.98</td>
<td>0.18</td>
<td>0.001</td>
<td>232</td>
<td>0.000</td>
<td>40</td>
<td>Pass</td>
</tr>
<tr>
<td>1,3,5-Trimethylbenzene (as Trimethylbenzene)</td>
<td>120.19</td>
<td>0.62</td>
<td>0.003</td>
<td>619</td>
<td>0.000</td>
<td>412</td>
<td>Pass</td>
</tr>
<tr>
<td>1,3,5-Butadiene</td>
<td>54.09</td>
<td>0.17</td>
<td>0.004</td>
<td>2</td>
<td>4.30E-04</td>
<td>2</td>
<td>Pass</td>
</tr>
<tr>
<td>Acetone (2-Propanone)</td>
<td>56.08</td>
<td>16.30</td>
<td>0.036</td>
<td>4243</td>
<td>0.003</td>
<td>2829</td>
<td>Pass</td>
</tr>
<tr>
<td>Acetonitrile</td>
<td>41.05</td>
<td>0.36</td>
<td>0.01</td>
<td>120</td>
<td>0.000</td>
<td>60</td>
<td>Pass</td>
</tr>
<tr>
<td>Acrylonitrile</td>
<td>53.06</td>
<td>0.33</td>
<td>0.013</td>
<td>15</td>
<td>0.000</td>
<td>12</td>
<td>Pass</td>
</tr>
<tr>
<td>Benzene</td>
<td>78.11</td>
<td>11.10</td>
<td>0.033</td>
<td>5.7</td>
<td>0.003</td>
<td>3.8</td>
<td>Pass</td>
</tr>
<tr>
<td>Benzyl chloride</td>
<td>126.58</td>
<td>0.02</td>
<td>0.001</td>
<td>19</td>
<td>1.10E-04</td>
<td>12</td>
<td>Pass</td>
</tr>
<tr>
<td>Bromoform</td>
<td>252.73</td>
<td>0.12</td>
<td>0.014</td>
<td>19</td>
<td>0.002</td>
<td>12</td>
<td>Pass</td>
</tr>
<tr>
<td>Bromomethane</td>
<td>94.94</td>
<td>0.02</td>
<td>0.001</td>
<td>20</td>
<td>9.55E-05</td>
<td>5</td>
<td>Pass</td>
</tr>
<tr>
<td>Butyl mercaptan</td>
<td>90.19</td>
<td>0.26</td>
<td>0.01</td>
<td>9</td>
<td>0.001</td>
<td>4.3</td>
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</tr>
<tr>
<td>Carbon disulfide</td>
<td>76.13</td>
<td>1.53</td>
<td>0.004</td>
<td>700</td>
<td>0.000</td>
<td>700</td>
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</tr>
<tr>
<td>Carbon tetrachloride</td>
<td>153.84</td>
<td>0.008</td>
<td>0.000</td>
<td>111</td>
<td>0.000</td>
<td>100</td>
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</tr>
<tr>
<td>Chlorobenzene</td>
<td>112.56</td>
<td>0.48</td>
<td>0.002</td>
<td>231</td>
<td>0.000</td>
<td>154</td>
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</tr>
<tr>
<td>Chlorodifluoromethane (Freon 22)</td>
<td>67.47</td>
<td>1.30</td>
<td>0.003</td>
<td>50000</td>
<td>0.000</td>
<td>50000</td>
<td>Pass</td>
</tr>
<tr>
<td>Chloroform (Ethyl chloride)</td>
<td>64.52</td>
<td>3.95</td>
<td>0.010</td>
<td>10000</td>
<td>0.001</td>
<td>10000</td>
<td>Pass</td>
</tr>
<tr>
<td>Chloroethylene (Vinyl chloride)</td>
<td>62.5</td>
<td>7.34</td>
<td>0.017</td>
<td>9.3</td>
<td>0.001</td>
<td>6.2</td>
<td>Pass</td>
</tr>
<tr>
<td>Chlorotrifluoromethane</td>
<td>119.39</td>
<td>0.08</td>
<td>0.000</td>
<td>175</td>
<td>0.000</td>
<td>117</td>
<td>Pass</td>
</tr>
<tr>
<td>Chloromethane (Methyl chloride)</td>
<td>50.49</td>
<td>1.21</td>
<td>0.002</td>
<td>368</td>
<td>0.000</td>
<td>245</td>
<td>Pass</td>
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<tr>
<td>Chloroform (Ethyl chloride)</td>
<td>64.92</td>
<td>3.86</td>
<td>0.005</td>
<td>30</td>
<td>0.000</td>
<td>15</td>
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</tr>
<tr>
<td>Acetone</td>
<td>56.04</td>
<td>1.13</td>
<td>0.023</td>
<td>123</td>
<td>0.002</td>
<td>60</td>
<td>Pass</td>
</tr>
<tr>
<td>Cyclohexane</td>
<td>84.16</td>
<td>1.01</td>
<td>0.037</td>
<td>6000</td>
<td>0.004</td>
<td>6000</td>
<td>Pass</td>
</tr>
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<td>Cyclohexene</td>
<td>82.14</td>
<td>0.02</td>
<td>0.001</td>
<td>5080</td>
<td>7.24E-05</td>
<td>3387</td>
<td>Pass</td>
</tr>
<tr>
<td>Dichlorodifluoromethane</td>
<td>120.91</td>
<td>6.15</td>
<td>0.325</td>
<td>73661</td>
<td>0.036</td>
<td>49107</td>
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</tr>
<tr>
<td>Dichloroform (Freon 22)</td>
<td>102.92</td>
<td>2.62</td>
<td>0.010</td>
<td>211</td>
<td>0.001</td>
<td>141</td>
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<tr>
<td>Dimethyl disulfide</td>
<td>94.2</td>
<td>0.14</td>
<td>0.006</td>
<td>9.7</td>
<td>0.001</td>
<td>6.5</td>
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<tr>
<td>Dioxane</td>
<td>88.11</td>
<td>0.01</td>
<td>3.19E-04</td>
<td>258</td>
<td>3.50E-05</td>
<td>172</td>
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<tr>
<td>Ethanol</td>
<td>46.08</td>
<td>27.20</td>
<td>0.048</td>
<td>6714</td>
<td>0.004</td>
<td>4476</td>
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</tr>
<tr>
<td>Ethyl acetate</td>
<td>88.11</td>
<td>1.88</td>
<td>0.072</td>
<td>10141</td>
<td>0.008</td>
<td>4829</td>
<td>Pass</td>
</tr>
<tr>
<td>Ethyl benzene</td>
<td>106.16</td>
<td>5.01</td>
<td>0.020</td>
<td>1000</td>
<td>0.002</td>
<td>1000</td>
<td>Pass</td>
</tr>
<tr>
<td>Ethyl mercaptan (Ethanithiol)</td>
<td>62.13</td>
<td>2.28</td>
<td>0.005</td>
<td>9.2</td>
<td>0.000</td>
<td>4.4</td>
<td>Pass</td>
</tr>
<tr>
<td>Ethylene dibromide (1,2-Dibromoethane)</td>
<td>187.88</td>
<td>0.14</td>
<td>0.000</td>
<td>0.050</td>
<td>0.000</td>
<td>0.050</td>
<td>Pass</td>
</tr>
<tr>
<td>Ethylene dichloride (1,2-Dichloroethane)</td>
<td>98.96</td>
<td>0.41</td>
<td>0.002</td>
<td>143</td>
<td>0.000</td>
<td>95</td>
<td>Pass</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>30.03</td>
<td>0.01</td>
<td>1.54E-04</td>
<td>1.3</td>
<td>1.68E-05</td>
<td>0.88</td>
<td>Pass</td>
</tr>
<tr>
<td>Heptane</td>
<td>100.2</td>
<td>1.34</td>
<td>0.059</td>
<td>8249</td>
<td>0.006</td>
<td>5500</td>
<td>Pass</td>
</tr>
<tr>
<td>Hexachlorobutadiene</td>
<td>260.76</td>
<td>0.003</td>
<td>3.98E-04</td>
<td>11</td>
<td>4.36E-05</td>
<td>0.50</td>
<td>Pass</td>
</tr>
<tr>
<td>Hexane</td>
<td>86.17</td>
<td>3.1</td>
<td>0.117</td>
<td>885</td>
<td>0.013</td>
<td>700</td>
<td>Pass</td>
</tr>
<tr>
<td>Hydrogen chloride</td>
<td>36.46</td>
<td>25.00</td>
<td>0.035</td>
<td>20</td>
<td>0.003</td>
<td>20</td>
<td>Pass</td>
</tr>
<tr>
<td>Isobutene</td>
<td>56.11</td>
<td>1.1</td>
<td>0.027</td>
<td>2886</td>
<td>0.003</td>
<td>1924</td>
<td>Pass</td>
</tr>
<tr>
<td>Isopropyl alcohol (2-Propanol)</td>
<td>60.11</td>
<td>50.10</td>
<td>0.115</td>
<td>1757</td>
<td>0.009</td>
<td>1171</td>
<td>Pass</td>
</tr>
<tr>
<td>Methyl mercaptan (1,1,2-Trichloroethane)</td>
<td>133.42</td>
<td>0.48</td>
<td>0.002</td>
<td>8621</td>
<td>0.000</td>
<td>5000</td>
<td>Pass</td>
</tr>
<tr>
<td>Methyl ethyl ketone (MEK)</td>
<td>72.11</td>
<td>21.20</td>
<td>0.058</td>
<td>5000</td>
<td>0.005</td>
<td>5000</td>
<td>Pass</td>
</tr>
<tr>
<td>Methyl isobutyl ketone (MIBK, 4-Methyl-2-pentanone)</td>
<td>100.16</td>
<td>1.87</td>
<td>0.007</td>
<td>3000</td>
<td>0.001</td>
<td>3000</td>
<td>Pass</td>
</tr>
<tr>
<td>CAS Number</td>
<td>Compound</td>
<td>Conc. in Landfill Gas weight (µg/m³)</td>
<td>24-hr (ppm)</td>
<td>24-hr (µg/m³)</td>
<td>Annual (µg/m³)</td>
<td>Annual (µg/m³)</td>
<td>Pass/Fail</td>
</tr>
<tr>
<td>------------</td>
<td>----------------------------------</td>
<td>--------------------------------------</td>
<td>-------------</td>
<td>---------------</td>
<td>----------------</td>
<td>----------------</td>
<td>-----------</td>
</tr>
<tr>
<td>74-93-1</td>
<td>Methyl mercaptan (Methanethiol)</td>
<td>48.11</td>
<td>6.97</td>
<td>0.013</td>
<td>4.9</td>
<td>0.001</td>
<td>3.3</td>
</tr>
<tr>
<td>75-9-2</td>
<td>Methylene Chloride (Dichloromethane)</td>
<td>84.94</td>
<td>14.30</td>
<td>0.046</td>
<td>621</td>
<td>0.004</td>
<td>414</td>
</tr>
<tr>
<td>1634-4-4</td>
<td>Methyl-tert butyl ether</td>
<td>88.15</td>
<td>0.12</td>
<td>0.005</td>
<td>3000</td>
<td>4.98E-04</td>
<td>3000</td>
</tr>
<tr>
<td>91-20-3</td>
<td>Naphthalene</td>
<td>127.17</td>
<td>0.11</td>
<td>0.006</td>
<td>186</td>
<td>0.001</td>
<td>3</td>
</tr>
<tr>
<td>111-65-9</td>
<td>Octane</td>
<td>114.23</td>
<td>1.08</td>
<td>0.054</td>
<td>7000</td>
<td>0.006</td>
<td>3333</td>
</tr>
<tr>
<td>106-48-7</td>
<td>p-Dichlorobenzene (1,4-Dichlorobenzene)</td>
<td>147</td>
<td>0.94</td>
<td>0.005</td>
<td>800</td>
<td>0.000</td>
<td>800</td>
</tr>
<tr>
<td>127-18-4</td>
<td>Perchloroethylene (PCE, Tetrachloroethylene)</td>
<td>165.83</td>
<td>3.73</td>
<td>0.024</td>
<td>807</td>
<td>0.002</td>
<td>405</td>
</tr>
<tr>
<td>109-42-5</td>
<td>Styrene, monomer</td>
<td>104.2</td>
<td>0.61</td>
<td>0.002</td>
<td>1000</td>
<td>0.000</td>
<td>1000</td>
</tr>
<tr>
<td>109-99-9</td>
<td>Tetrahydrofuran</td>
<td>72.11</td>
<td>0.97</td>
<td>0.031</td>
<td>742</td>
<td>0.003</td>
<td>494</td>
</tr>
<tr>
<td>108-88-3</td>
<td>Toluene</td>
<td>92.13</td>
<td>42.00</td>
<td>0.147</td>
<td>5000</td>
<td>0.012</td>
<td>5000</td>
</tr>
<tr>
<td>79-1-6</td>
<td>Trichloroethylene</td>
<td>131.4</td>
<td>2.82</td>
<td>0.014</td>
<td>192</td>
<td>0.001</td>
<td>128</td>
</tr>
<tr>
<td>108-5-4</td>
<td>Vinyl acetate</td>
<td>86.09</td>
<td>0.25</td>
<td>0.009</td>
<td>200</td>
<td>0.001</td>
<td>200</td>
</tr>
<tr>
<td>1330-20-7</td>
<td>Xylene (all isomers)</td>
<td>106.16</td>
<td>13.19</td>
<td>0.053</td>
<td>1550</td>
<td>0.004</td>
<td>100</td>
</tr>
</tbody>
</table>

Notes:
Hydrogen sulfide was modeled explicitly. Results for other RTAPs were scaled from the hydrogen sulfide impacts using the ratios of molecular weights and concentrations in raw landfill gas.

Listed concentrations for highlighted compounds are based on site-specific data; all others are based on published data (AP-42).
Listed RTAPS were added based on most recent RTAP analysis conducted for Turnkey Recycling & Environmental Enterprise (3301700003).
Items listed in red bold print are revised numbers based on newest Env-A 1400.