

## LABORATORY REPORT

December 9, 2008

Ralph Kubitzki  
HGI Industries, Inc.  
2055 High Ridge Road  
Boynton Beach, FL 33426

**RE: Odorox MDU S/N ODHG 000389**

Dear Ralph:

Enclosed are the results of the sample(s) submitted to our laboratory on November 5, 2008. For your reference, these analyses have been assigned our service request number P0803771.

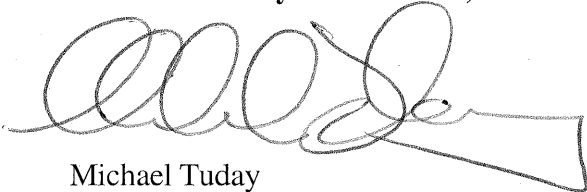
All Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at [www.caslab.com](http://www.caslab.com). Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein. Your report contains \_\_\_\_\_ pages.

Columbia Analytical Services, Inc. is certified by the California Department of Health Services, NELAP Laboratory Certificate No. 02115CA; Arizona Department of Health Services, Certificate No. AZ0694; Florida Department of Health, NELAP Certification E871020; New Jersey Department of Environmental Protection, NELAP Laboratory Certification ID #CA009; New York State Department of Health, NELAP NY Lab ID No: 11221; Oregon Environmental Laboratory Accreditation Program, NELAP ID: CA20007; The American Industrial Hygiene Association, Laboratory #101661; Department of the Navy (NFESC); Pennsylvania Registration No. 68-03307; TX Commission of Environmental Quality, NELAP ID T104704413-08-TX. Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact me for information corresponding to a particular certification.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

**Columbia Analytical Services, Inc.**



Michael Tuday  
Director of Research & Development

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*The results of analyses are given in the attached laboratory report. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for utilization of less than the complete report.*

## HGI Industries

### Odorox Mobile Disinfection Unit (M.D.U.) Hydroxyl Air Processor

The Odorox M.D.U. (Serial No. ODHG 000389) Hydroxyl Air Processor was evaluated to ascertain whether or not the hydroxyl ion generation technology employed in the device causes the formation or significant elevation in the concentration of certain speciated and total volatile organic compounds (VOCs), aldehydes, carbon monoxide (CO) and Ozone (O<sub>3</sub>). A trial consisting of four discreet sampling periods: one 1-hour background evaluation with the device switched off followed by three consecutive 1-hour sampling periods with the device in operation was performed on 18-20 November, 2008.

The test room, an office 11.5' x 11.5' with a 9' ceiling was used to perform the trial. The office is painted drywall, with commercial/office type carpeting and "acoustic" ceiling tile. The test room had both an HVAC register and return. The office contained a particleboard/laminate desk and cabinet, two upholstered office chairs, and desktop computer and twenty-four cardboard archival storage boxes of hardcopy files.

The M.D.U. was placed with its back to a wall such that the unit's exhaust was parallel with the desk four feet away. The air intake to the Odorox M.D.U. was positioned approximately six inches from the only door in the room which was kept closed for the duration of the trial. Inlets to the sampling devices (direct reading ozone monitor, electropolished stainless steel canisters, and aldehyde tube sampling pumps) were placed on top of the desk at a height of 44", in the breathing zone of the investigators.

Aside from the direct reading ozone monitor, two additional types of samples were collected for each sampling period: a whole-air sample collected in an electropolished stainless steel canister (Summa canister) for the measurement of speciated and total volatile organic compounds and carbon monoxide; and a pumped air sample collected on a dinitrophenylhydrazine (DNPH) impregnated silica gel tube for measurement of speciated target aldehydes.

#### Ozone Measurement

The measurement of ozone was performed using a direct reading instrument, a model UV-106 (Serial No. 007) from InDevR 2B Technologies. Ozone is monitored by measuring the absorption of ultraviolet light. The ozone molecule has an absorption maximum at 254 nanometers, coincident with the principal emission wavelength of a low pressure mercury lamp located inside the instrument. Ozone is measured based on the attenuation of light passing through a 15 centimeter long absorption cell fitted with quartz windows. The low pressure mercury lamp is located on one side of the absorption cell, a photodiode at the other. An ozone scrubber provides a null reference. The intensity of light at the photodiode is measured alternatively in air that has passed through the ozone scrubber and air that has not passed through the scrubber. The ozone concentration is calculated from the measurements according to the Beer-Lambert Law.

### Analysis for Volatile Organic Compounds (VOCs)

Whole air samples were collected in precleaned, evacuated and certified 6-liter Summa passivated stainless steel canisters. The Summa canister samples were analyzed for 75 target volatile organic compounds plus additional tentatively identified compounds and total volatile organic compounds (TVOC) according to EPA Method TO-15.

Time integrated samples were collected using calibrated low volume flow controllers over a one hour time period.

The analysis for speciated and total VOCs was performed using an Agilent Model 6890 Series gas chromatograph/ Model 5973 mass selective detector (GC/MSD) interfaced to a Tekmar Model AUTOC an automated whole-air concentrator.

For the chromatographic separation of VOCs a 60meter x 0.25mm Rxi-1ms bonded phase fused silica column with a 1.0 micron film thickness (Restek Corporation, Bellefonte, PA) was temperature programmed from 40C (hold for 1 minute) to 80C at 5C/minute, then to 160C at 10C/minute, then to 240C at 20C/minute (hold for 5 minutes at 240C).

The mass selective detector was operated in the full scan mode from 33amu to 280amu at 70 electron volts.

The tentatively identified compounds were obtained using a mass spectral library search against an approximately 180,000 entry NIST mass spectral library. In addition to the data system best match algorithm, the analysts employed both intuitive and traditional methods of mass spectral interpretation. Compounds that could not be identified as an exact match were given the most specific generic classification (e.g. – a C<sub>9</sub> carboxylic acid, a C<sub>12</sub> branch chain aliphatic hydrocarbon, etc.). The approximate concentrations were calculated to one significant figure assuming a 1:1 response with an appropriate internal standard compound.

### Measurement of Carbon Monoxide

Samples from the Summa passivated stainless steel canisters were analyzed for carbon monoxide by gas chromatography/total combustion analysis/flame ionization detection according to modified EPA Method 25C.

### Measurement of Formaldehyde and other Carbonyl Compounds

Samples were collected for the measurement of formaldehyde and other carbonyl compounds using silica gel tubes, impregnated with a derivatizing reagent, 2,4-dinitrophenylhydrazine (DNPH). Air was drawn through the tubes at using a personal sampling pump at a nominal rate of one liter per minute for 60 minutes.

The DNPH silica gel tubes were analyzed for 13 target aldehydes according to EPA Method TO-11A. A summary of the method is as follows: The carbonyl compounds in the samples

stream react with the 2,4-dinitrophenylhydrazine reagent to form stable aldehyde-hydrazone derivatives. These derivatives are chemically desorbed from the silica gel using acetonitrile. The desorbed acetonitrile extracts are analyzed using high performance liquid chromatography (HPLC) with ultraviolet (UV) detection.

The front (sample) and back (breakthrough) sections of the silica gel tubes were emptied separately into glass vials. Reagent grade acetonitrile was added to the derivatized silica gel sorbent. Each vial was analyzed separately using a Waters Module I Plus high performance liquid chromatograph equipped with an ultraviolet/visible detector operating at a wavelength of 360 nanometers in the ultraviolet range. A Kromasil C18 (5mm x 2.1mm x 3micron) column (Restek Corporation, Bellefonte, PA) was programmed in a linear gradient mode, going from 100% mobile phase A (60/30/10 water/acetonitrile/tetrahydrofuran) to 100% mobile phase B (60/40 acetonitrile/water) in 7.5 minutes at a flow rate of 0.7 milliliters per minute.

### Summary of Results

The results of analysis are given on the attached summary sheets.

Measured ozone results (60 minute averages) for the three hours the MDU was operating were 13.9 ppbV, 13.2 ppbV and 7.0 ppbV (mean concentration = 11.4 ppbV), respectively, compared to the measured background result of 1.3 ppbV. Comparatively, according to the California Air Resources Board, which operates an ambient air monitoring network with a sampling location for Simi Valley-Cochran Street, approximately 8 miles from the CAS laboratory, the average measured outdoor concentration of ozone during the time period of the three hour MDU measurement was 3 ppbV. The outdoor measurement during the time period of the background evaluation was 19 ppbV.

There was no detection of carbon monoxide above the laboratory method reporting limit during the entire trial.

The measured concentration of formaldehyde (mean of 3-hour test = 13 ug/m<sup>3</sup>) was marginally above the background concentration (9.2 ug/m<sup>3</sup>) but within typical indoor levels. Concentrations of acetaldehyde with the MDU switched on were comparable to the measured background level, within experimental error.

Significantly, the concentration of total volatile organic compounds (as toluene) was reduced by greater than 40% over the three hour period with the MDU in operation.

**COLUMBIA ANALYTICAL SERVICES, INC.**

RESULTS SUMMARY

Page 1 of 1

**Client:** HGI Industries, Inc.  
**Client Project ID:** Odorox M.D.U. (S/N ODHG 000389)

CAS Project ID: P0803771

Test Code: Ozone By Direct Reading Instrument  
 Instrument ID: UV-106 (InDevR 2B Technologies)  
 Analyst: K. Chen  
 Matrix: Continuous Monitor  
 Test Conditions: Full Fan Speed, Full Processor Power

Date Analyzed: 11/20/2008

**Ozone Results**

CAS #	Compound	MDU OFF	MDU ON			MRL ppmV
		Bkgd P0803771-009 ppmV	Hour 1 P0803771-010 ppmV	Hour 2 P0803771-011 ppmV	Hour 3 P0803771-012 ppmV	
10028-15-6	Ozone	0.0013	0.0139	0.0132	0.0070	0.001

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS

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**Client:** HGI Industries, Inc.  
**Client Project ID:** Odorox MDU S/N ODHG 000389

CAS Project ID: P0803771

**Carbon Monoxide**

Test Code: EPA Method 25C Modified  
Instrument ID: HP5890 II/GC1/FID/TCA  
Analyst: Zheng Wang/Wade Henton  
Sampling Media: 6.0 L Summa Canister(s)  
Test Notes:

Date(s) Collected: 11/18/08  
Date Received: 11/18/08  
Date Analyzed: 11/18/08

Client Sample ID	CAS Sample ID	Canister Dilution Factor	Injection Volume ml(s)	Result ppmV	MRL ppmV	Data Qualifier
Odorox MDU Off Background VOC1	P0803771-005	1.65	0.50	ND	8.3	
Odorox MDU On Hour 1 VOC2	P0803771-006	1.64	0.50	ND	8.2	
Odorox MDU On Hour 2 VOC3	P0803771-007	1.60	0.50	ND	8.0	
Odorox MDU On Hour 3 VOC4	P0803771-008	1.61	0.50	ND	8.1	
Method Blank	P081118-MB	1.00	0.50	ND	5.0	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

**COLUMBIA ANALYTICAL SERVICES, INC.**

RESULTS SUMMARY

Page 1 of 1

**Client:** HGI Industries, Inc.  
**Client Project ID:** Odorox M.D.U. (S/N ODHG 000389)

CAS Project ID: P0803771

Test Code: EPA Method TO-11A  
 Instrument ID: Waters LC Module I Plus/UV\_Vis 360/LC1  
 Analyst: Hani Cherazaie  
 Matrix: Silica Gel DNPH Tube  
 Test Notes:

Date Collected: 11/18/08  
 Date Received: 11/18/08  
 Date Analyzed: 11/18/08

### Aldehyde Summary Results

CAS #	Compound	MDU OFF	MDU ON		
		Bkgrd µg/m <sup>3</sup>	Hour 1 µg/m <sup>3</sup>	Hour 2 µg/m <sup>3</sup>	Hour 3 µg/m <sup>3</sup>
50-00-0	Formaldehyde	9.2	14	13	12
75-07-0	Acetaldehyde	3.5	4.4	4.0	3.7
123-38-6	Propionaldehyde	ND	ND	ND	ND
4170-30-3	Crotonaldehyde, Total	ND	ND	ND	ND
123-72-8	Butyraldehyde	ND	ND	ND	ND
100-52-7	Benzaldehyde	ND	ND	ND	ND
590-86-3	Isovaleraldehyde	ND	ND	ND	ND
110-62-3	Valeraldehyde	ND	ND	ND	ND
529-20-4	o-Tolualdehyde	ND	ND	ND	ND
620-23-5	m,p-Tolualdehyde	ND	ND	ND	ND
104-87-0		ND	ND	ND	ND
66-25-1	n-Hexaldehyde	ND	ND	ND	ND
5779-94-2	2,5-Dimethylbenzaldehyde	ND	ND	ND	ND

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

**COLUMBIA ANALYTICAL SERVICES, INC.**

RESULTS OF ANALYSIS

Page 1 of 1

**Client:** HGI Industries, Inc.  
**Client Project ID:** Odorox MDU S/N ODHG 000389

CAS Project ID: P0803771

**TVOC as Toluene**

Test Code: EPA TO-15  
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9  
 Analyst: Elsa Moctezuma  
 Sampling Media: 6.0 L Summa Canister(s)  
 Test Notes:

Date(s) Collected: 11/18/08  
 Date Received: 11/18/08  
 Date Analyzed: 11/18/08

Client Sample ID	CAS Sample ID	Injection Volume Liter(s)	Canister Dilution Factor	Result $\mu\text{g}/\text{m}^3$	Data Qualifier
Odorox MDU Off Background VOC1	P0803771-005	1.00	1.65	<b>150</b>	
Odorox MDU On Hour 1 VOC2	P0803771-006	1.00	1.64	<b>110</b>	
Odorox MDU On Hour 2 VOC3	P0803771-007	1.00	1.60	<b>100</b>	
Odorox MDU On Hour 3 VOC4	P0803771-008	1.00	1.61	<b>89</b>	
Odorox MDU On Hour 3 VOC4	P0803771-008DUP	1.00	1.61	<b>89</b>	
Method Blank	P081118-MB	1.00	1.00	ND	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.



**COLUMBIA ANALYTICAL SERVICES, INC.**

RESULTS SUMMARY

Page 1 of 3

**Client:** HGI Industries, Inc.  
**Client Project ID:** Odorox M.D.U. (S/N ODHG 000389)

CAS Project ID: P0803771

Test Code: EPA TO-15  
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9  
 Analyst: Elsa Moctezuma  
 Matrix: 6.0 L Summa Canister(s)  
 Test Notes:

Date Collected: 11/18/08  
 Date Received: 11/18/08  
 Date Analyzed: 11/18/08

## Volatile Organic Compound Summary Results

CAS #	Compound	MDU OFF	MDU ON		
		Bkgrd µg/m <sup>3</sup>	Hour 1 µg/m <sup>3</sup>	Hour 2 µg/m <sup>3</sup>	Hour 3 µg/m <sup>3</sup>
115-07-1	<b>Propene</b>	2.2	1.5	1.4	1.6
75-71-8	<b>Dichlorodifluoromethane (CFC 12)</b>	2.0	1.9	1.9	1.9
74-87-3	Chloromethane	ND	ND	ND	ND
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	ND	ND	ND
75-01-4	Vinyl Chloride	ND	ND	ND	ND
106-99-0	1,3-Butadiene	ND	ND	ND	ND
74-83-9	Bromomethane	ND	ND	ND	ND
75-00-3	Chloroethane	ND	ND	ND	ND
64-17-5	<b>Ethanol</b>	11	ND	ND	8.6
107-02-8	Acrolein	ND	ND	ND	ND
67-64-1	<b>Acetone</b>	37	36	33	32
75-69-4	<b>Trichlorofluoromethane</b>	0.95	0.93	0.93	0.93
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	ND	ND	1.8
107-13-1	Acrylonitrile	ND	ND	ND	ND
75-35-4	1,1-Dichloroethene	ND	ND	ND	ND
75-09-2	<b>Methylene Chloride</b>	5.1	4.2	4.9	4.0
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	ND	ND	ND
76-13-1	Trichlorotrifluoroethane	ND	ND	ND	ND
75-15-0	<b>Carbon Disulfide</b>	12	9.4	13	14
156-60-5	trans-1,2-Dichloroethene	ND	ND	ND	ND
75-34-3	1,1-Dichloroethane	ND	ND	ND	ND
1634-04-4	Methyl tert-Butyl Ether	ND	ND	ND	ND
108-05-4	Vinyl Acetate	ND	ND	ND	ND
78-93-3	<b>2-Butanone (MEK)</b>	1.0	1.1	0.99	0.95

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

**COLUMBIA ANALYTICAL SERVICES, INC.**

RESULTS SUMMARY

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**Client:** HGI Industries, Inc.  
**Client Project ID:** Odorox M.D.U. (S/N ODHG 000389)

CAS Project ID: P0803771

Test Code: EPA TO-15  
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9  
 Analyst: Elsa Moctezuma  
 Matrix: 6.0 L Summa Canister(s)  
 Test Notes:

Date Collected: 11/18/08  
 Date Received: 11/18/08  
 Date Analyzed: 11/18/08

### Volatile Organic Compound Summary Results

CAS #	Compound	MDU OFF	MDU ON		
		Bkgrd µg/m <sup>3</sup>	Hour 1 µg/m <sup>3</sup>	Hour 2 µg/m <sup>3</sup>	Hour 3 µg/m <sup>3</sup>
156-59-2	cis-1,2-Dichloroethene	ND	ND	ND	ND
141-78-6	Ethyl Acetate	ND	ND	ND	ND
110-54-3	<b>n-Hexane</b>	<b>12</b>	<b>7.8</b>	<b>6.9</b>	<b>5.9</b>
67-66-3	Chloroform	ND	ND	ND	ND
109-99-9	<b>Tetrahydrofuran (THF)</b>	<b>1.7</b>	<b>7.3</b>	<b>11</b>	<b>7.2</b>
107-06-2	1,2-Dichloroethane	ND	ND	ND	ND
71-55-6	1,1,1-Trichloroethane	ND	ND	ND	ND
71-43-2	<b>Benzene</b>	<b>1.3</b>	<b>0.87</b>	ND	ND
56-23-5	Carbon Tetrachloride	ND	ND	ND	ND
110-82-7	Cyclohexane	ND	ND	ND	ND
78-87-5	1,2-Dichloropropane	ND	ND	ND	ND
75-27-4	Bromodichloromethane	ND	ND	ND	ND
79-01-6	Trichloroethene	ND	ND	ND	ND
123-91-1	1,4-Dioxane	ND	ND	ND	ND
80-62-6	Methyl Methacrylate	ND	ND	ND	ND
142-82-5	n-Heptane	ND	ND	ND	ND
10061-01-5	cis-1,3-Dichloropropene	ND	ND	ND	ND
108-10-1	4-Methyl-2-pentanone	ND	ND	ND	ND
10061-02-6	trans-1,3-Dichloropropene	ND	ND	ND	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	ND	ND
108-88-3	<b>Toluene</b>	<b>4.6</b>	<b>3.4</b>	<b>2.3</b>	<b>1.6</b>
591-78-6	2-Hexanone	ND	ND	ND	ND
124-48-1	Dibromochloromethane	ND	ND	ND	ND
106-93-4	1,2-Dibromoethane	ND	ND	ND	ND
123-86-4	n-Butyl Acetate	ND	ND	ND	ND

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

**COLUMBIA ANALYTICAL SERVICES, INC.**

RESULTS SUMMARY

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**Client:** HGI Industries, Inc.  
**Client Project ID:** Odorox M.D.U. (S/N ODHG 000389)

CAS Project ID: P0803771

Test Code: EPA TO-15  
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9  
 Analyst: Elsa Moctezuma  
 Matrix: 6.0 L Summa Canister(s)  
 Test Notes:

Date Collected: 11/18/08  
 Date Received: 11/18/08  
 Date Analyzed: 11/18/08

### Volatile Organic Compound Summary Results

CAS #	Compound	MDU OFF	MDU ON		
		Bkgrd µg/m <sup>3</sup>	Hour 1 µg/m <sup>3</sup>	Hour 2 µg/m <sup>3</sup>	Hour 3 µg/m <sup>3</sup>
111-65-9	n-Octane	ND	ND	ND	ND
127-18-4	Tetrachloroethene	ND	ND	ND	ND
108-90-7	Chlorobenzene	ND	ND	ND	ND
100-41-4	Ethylbenzene	ND	ND	ND	ND
179601-23-1	<b>m,p-Xylenes</b>	<b>2.8</b>	<b>1.7</b>	ND	ND
75-25-2	Bromoform	ND	ND	ND	ND
100-42-5	Styrene	ND	ND	ND	ND
95-47-6	<b>o-Xylene</b>	<b>0.99</b>	ND	ND	ND
111-84-2	n-Nonane	ND	ND	ND	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
98-82-8	Cumene	ND	ND	ND	ND
80-56-8	<b>alpha-Pinene</b>	<b>0.83</b>	ND	ND	ND
103-65-1	n-Propylbenzene	ND	ND	ND	ND
622-96-8	4-Ethyltoluene	ND	ND	ND	ND
108-67-8	1,3,5-Trimethylbenzene	ND	ND	ND	ND
95-63-6	<b>1,2,4-Trimethylbenzene</b>	<b>0.90</b>	ND	ND	ND
100-44-7	Benzyl Chloride	ND	ND	ND	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	ND	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	ND	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	ND	ND
5989-27-5	<b>d-Limonene</b>	<b>1.0</b>	ND	ND	ND
96-12-8	1,2-Dibromo-3-chloropropane	ND	ND	ND	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	ND	ND
91-20-3	Naphthalene	ND	ND	ND	ND
87-68-3	Hexachlorobutadiene	ND	ND	ND	ND

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.