

## AirSource 3000 Test Summary

### LAB TEST FOR ODORS

Test Supervised By	J. Campbell, Performance Analytical, Inc.
Device Tested	AirSource 3000
Objective	To determine if the device is effective in reducing odors.
Test Chamber	1,008 cu. ft. PAI Testing Room
Test Equipment	Gas Chromatographs/Mass Spectrometer, HP-5972 Tekmar
Test Procedure	Prior to the start of each test, the room was flushed and then background levels of contaminants of concern were sampled. An atmosphere of known levels of contaminants was generated during which a ceiling fan was used to ensure a mix. Between 15 and 17 samples of each were collected. Duration was four hours. Samples were analyzed by Gas Chromatographs following ASTM D5504-98.
Summary	The device reduced the odors by the following percentage in four hours:

<b>Compound</b>	<b>Odor</b>	<b>% Reduction</b>
Hydrogen Sulfide	Rotten Eggs	32%
Methyl Mercaptan	Rotten Cabbage	40%
Carbon Disulfide	Vegetable Sulfide	11%
Butyl Acetate	Sweet Banana	50%
Methyl Methacrylate	Plastic/Sharp	56%

Qualifications	Performance Analytical, Inc. is a NELAP accredited lab that is certified for organic analyses by the American Ind. Hygiene Association.
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## AirSource 3000 Test Summary

# HOUSEHOLD TEST FOR BACTERIA, MOLD, & YEAST

Test Supervised By	Dr. Dee Graham, Independent Consultant
Device	AirSource 3000 Prototype
Ozone Levels	An O3 DTKTR sensitive to ozone at 0.05 ppm in air was operated continuously through the test period. Modest ozone odor was detectable in both homes and the O3 DTKTR detected ozone intermittently at 0.05 ppm in both homes.
Base Line	Base line air samples for <u>no treatment</u> were drawn one foot away from the device, before power was turned on to the device.
Procedure	The device was operated as directed under normal household conditions. Five replicate air samples were drawn from a target area located 13 feet from the device and about 3 feet above the floor at intervals of 8 hours, 30 hours, 54 hours, 102 hours, and 150 hours after start. Standard Petri Dishes containing APD Agar (Yeast and Molds) and PCA Agar (aerobic microorganisms) were inoculated at each sampling interval. The PDI International Air sampler was calibrated to deliver 100 liters of air in one minute and 500 liters of air in five minutes. The sample head contains 219 1 mm holes, directed at the surface of agar plates. Standard aseptic techniques were observed in collecting all air samples. Inoculated plates were returned promptly to the laboratory for incubation and counting. Representative plates were photographed, and then all plates were autoclaved before disposal.
Test Plan & Sampling Procedure	The study was conducted in a household environment. Normal home activities were continued in each home during the test period. In each household, we collected five air samples at five-minute intervals from each of the following points: 0 Hours- <u>No Treatment (Base Line)</u> —five 100-liter samples of ambient room air before the air purifier was powered. The device operated continuously and five 500-liter air samples were taken from the same target area located 13' 2" from the device after intervals of 8, 30, 54, 102 and 150 hours in each home. At each test interval, five air samples were collected for yeast and mold and five samples for aerobic plate counts. After incubation and counting for mold and bacteria, representative dishes were photographed to visually illustrate the related counts.
Laboratory Tests	California Microbiological Consultants, Inc. collected the air samples using a SAS-SUPER100 air sampler (PDI International) to expose standard 90mm Petri Dishes and performed the microbiological determinations in an approved commercial laboratory.
Summary	After four days:  <b>Test 1</b> Mold: 97.7% reduction <b>Test 2</b> Yeast & Mold: 90.9% reduction <b>Test 3</b> Mold: 77.0% reduction <b>Test 4</b> Bacteria*: 34.5% reduction  *Note: Bacteria tests in homes with low ambient bacteria levels will show low percentage drops.
Qualifications	Dr. Graham is a food scientist and an ozone consultant to Electric Power Research Institute. He is an expert in food bacteria contamination and ozone.

## AirSource 3000 Test Summary

# OFFICE TEST FOR BACTERIA, MOLD, & YEAST

Test Supervised By	Jim Hart, PE, Licensed Professional Chemical Engineer - RGF Director of Engineering Walter Ellis, Biologist - RGF Lab Director Greg Carr, Technician – RGF
Device Tested	AirSource 3000
Objective	To determine if the device is effective in reducing microbials.
Test Equipment	Standard office restroom 5' x 6' x 8' RSL centrifugal air sampler Easy gel & petri dishes Incubation chamber
Base Line	Base line test ran for 24 hours-3 intervals. Tests per 24 hours were used 0800, 1300 and 1800 hrs.
Test Procedure	Wear sterile gloves, face mask, etc. At each interval, perform a centrifugal test and a settling plate test.
Test Results	Summary:  <b>Centrifugal Test</b> Total Plate Count Reduction by third day: 88% Yeast & Molds Reduction by third day: 71% <b>Plate Test</b> Total Plate Count Reduction by third day: 78% Yeast & Molds Reduction by third day: 90%

## AirSource 3000 Test Summary

### LAB TEST FOR VOCS

Test Supervised By	J. Campbell, Performance Analytical, Inc.								
Device Tested	AirSource 3000								
Objective	To determine if the device is effective in reducing VOCs (volatile organic compounds).								
Test Chamber	1,008 cu. ft. PAI testing room								
Test Equipment	Gas Chromatograph/Mars, Spectrometer HP-5972 Tekamar								
Test Procedure	The reduction in VOC levels associated with the operation of the device was evaluated over a 4-hour period in an atmosphere containing approximately 100 ppb of each VOC. The atmosphere was generated by volatilizing a cocktail of these compounds inside the room. A fan circulated the air. Grab samples for VOCs were collected in polished stainless steel canisters. These samples were analyzed by EPA TO-11A.								
Summary	The device reduced VOCs by the following percentage in four hours. <table><thead><tr><th>Compound</th><th>% Reduction</th></tr></thead><tbody><tr><td>Methyl Ethyl Ketone</td><td>13%</td></tr><tr><td>d-Limonene</td><td>98%</td></tr><tr><td>Toluene</td><td>29%</td></tr></tbody></table>	Compound	% Reduction	Methyl Ethyl Ketone	13%	d-Limonene	98%	Toluene	29%
Compound	% Reduction								
Methyl Ethyl Ketone	13%								
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Toluene	29%								
Qualifications	Performance Analytical, Inc. is a NELAP accredited lab that is certified for organic analysis by the American Ind. Hygiene Association								

## AirSource 3000 Test Summary

### LAB AND HOUSEHOLD OZONE LEVELS

Test Supervised By	Jim Hart, PE, Licensed Professional Chemical Engineer - RGF Director of Engineering Walter Ellis, Biologist - RGF Lab Director
Device Tested	AirSource 3000
Objective	To determine if the device meets Federal ozone safety standards.
Test Equipment	1 Calibrated PCI-Wedeco Ozone Monitor 1 ATI-Analytical Technology A/R Ozone Gas Meter 2 Calibrated ECO Ozone Sensor Model A-21ZX 2 Calibrated ECO Ozone Sensor Model EZ-1X
Test Location	<b>1. Private residence – 2,200 cu. ft. room</b> <b>2. Office – 8' x 13' x 8' – 832 cu. ft.</b> <b>3. Test Chamber (poly lined) – 1,000 cu. ft.</b>
Base Line	Base line air monitoring was conducted at all locations for 24 hours to determine base line ozone levels.
Test Plan and Procedure	All six ozone meters were tested in the test chamber for 48 hours to determine test equipment variations.

#### Results Reported in Ozone PPM

Test Results	Location / Hours	1	2	10	24	32	48
	<b>1. Private Residence</b>	.00	.00	.01	.01	.02	.02
	<b>2. Office</b>	.01	.01	.02	.02	.02	.03
	<b>3. Test Chamber</b>	.01	.01	.02	.03	.03	.04

*Note: It should be noted the higher the organic load in a room, the lower the ozone readings will be as the ozone will oxidize the organics and revert back to oxygen. All readings are in parts per million (ppm) of ozone.*

Conclusion All readings below FDA limits of .05 ppm

## AirSource 3000 Test Summary

### PARTICULATE

Test Supervised By	J. Campbell, Performance Analytical, Inc.
Device Tested	AirSource 3000
Objective	To determine if the device is effective at removing airborne particulate.
Test Equipment	Laser Particle Counter
Test Chamber	1,008 cu. Ft. PAI Testing Room
Test Procedure	The unit was tested on particulate generated from environmental tobacco smoke (ETS). In order to determine the natural attenuation /degradation of the particulate, the study also included control trials during which the same atmosphere was generated and particulate levels were evaluated over the same time frame. Three experimental and three control trials were conducted, each with a duration of 72 hours.
Test Results Summary	A greater than 95% reduction in particulate levels was achieved for all but the smallest cut size. Natural attenuation rates of particulate removal were typically one and one-half to two times slower than when the Air Source 3000 was operating.

#### **Average Particulate Reductions (72 Hour Test Period)**

<b>Particle Size (um)</b>	0.3	0.5	0.7	1.0	3.0	5.0
<b>Reduction (%)</b>	64	95	99	99.8	99.99	100

Qualifications	Performance Analytical, Inc. is a NELAP accredited lab that is certified for organic analyses by the American Ind. Hygiene Association.
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## **Background:**

The technology utilized in the AirSource includes a photo- ionization cell and an electron generator. These are new and unique technologies and, as such, no UL, ETL or ASTM testing protocols are currently in existence. In addition, no single, independent lab is capable of performing all the tests we want. Accordingly, we used various labs and consultants to validate the tests they were capable of conducting. Together they form a fair and balanced performance validation of the AirSource 3000.

However, we want more! So the Shaklee/RGF AirSource team has developed a testing protocol to perform all the tests at one location with a team of independent experts to validate the tests. Consequently, we have performed a series of independent, preliminary tests - with both an AirSource 3000 prototype and on the production model.

We ask for your patience and understanding, as this scale of testing is a monumental task. There are numerous molds, bacteria and odors for us to analyze. Our plan is to test each one with a minimum of two test methods. For example, odors will be tested by a human panel and then a gas chromatograph test will back up the human test. Molds and bacteria will be tested in homes and in spiked lab test chambers.

We have developed a team of independent experts to evaluate the AirSource 3000 performance and are currently working with a national testing lab to develop an all-encompassing test/certification protocol. Our team of experts was developed to bring a variety of expertise. The team includes:

- A food scientist, bacteria and ozone expert
- **A licensed professional chemical engineer**
- **A biologist**
- **An equipment performance evaluation expert**
- **A university professor, bacteria and ozone expert**

This program will be an ongoing series of testing. Updated results will be posted periodically on this page so check back regularly.