# REPORT
## Intertek Testing Services, NA Inc.
**1717 Arlingate Lane COLUMBUS, OHIO 43228**

PROJECT NO.: G100385167 DATE: April 29, 2011

**REPORT NO. 100385167COL-001**

**RENDERED TO:**
**Blue Wave International Corp**
**1867 Ridgecrest Rd**
**Prescott, AZ 86305**

**STANDARD REFERENCED AND TEST METHOD:**

ITS Non-Standardized Test: Microbial Reduction Rate Test

**AUTHORIZATION:**

The test was authorized by Rolf Engelhard; A representative from Blue Wave International Corp.

**GENERAL DESCRIPTION:** The test performed was the Microbial Reduction Rate Test conducted at the Intertek microbiology lab in Columbus, Ohio. The models Air Purifier #1 and Air Purifier #2 were tested for their ability to reduce the number of microorganisms aspirated into a 411.4 cu ft test room. The sample was received on April 14, 2011 and they are currently prototype models. The test chamber was contaminated with *Penicillium citrinum* (ATCC#36382) and *Staphylococcus epidermis* (ATCC# 12228).

**TEST DESCRIPTION**

Nutrient agar was prepared for the bacteria cultures and potato dextrose agar was prepared for the mold cultures.

All agars were sterilized using an autoclave to a temperature of 121°C.

The bacterial and mold cultures were prepared using pre-grown cultures acquired from ATCC (American Type Culture Collection with respective numbers describing each microorganism).

Using an inoculating loop, the cultures were transferred daily in nutrient/yeast broth for not more than two weeks. Nutrient broth was used for the growth of bacteria. Yeast broth was used for the growth of mold. At the conclusion of two weeks, a fresh transplant from stock culture was made. Bacterial cultures were incubated at 37 $\pm$ 2°C for 24 hours. Mold cultures were grown at 30-32°C and 85 % relative humidity for 28 days.

The stock cultures were maintained on nutrient agar. Cultures were stored at 5 ± 1°C and transfer once a month.

This operation was completed for each microorganism.

Samples were set in the center of the testing room. Activation was performed by manipulation of the power source from outside the chamber.

The collision nebulizer was then put into the test chamber where it was attached to an Erlenmeyer vacuum flask and a nitrogen tank. The nozzle of the flask pointed outward toward the room.

The room (411.4 cubic feet) was now sealed and a negative control was taken. This ensures that there were no other microorganisms in the test chamber prior to testing.

The nitrogen for the aspirator was set and started for aspiration into the test chamber.

A positive control sample of the air was now to be taken. This provided reaffirming data that the correct amount of the microorganism was put into the test chamber.

Samples were taken every 30 minutes from the air sampler that was attached to the chamber wall. The agar plates were put into the air sampler and the microorganism was vacuumed onto the plate.

The bacteria samples were then put into the incubator at their appropriate temperatures and allowed to grow for 48 hours. Mold cultures were grown in the environmental chamber at 30-32°C and 85 % relative humidity for 2-3 days.

This process was repeated as above, this time each air cleaner was turned on at time zero or when you take the first sample. These results were then compared to the natural decay of the microorganism to arrive at percent reduction. Each air purifier was allowed 10 minutes to warm up per the manufacturer's instructions.

This process was performed for each microorganism.

**CALIBRATED EQUIPMENT:**

| Calibrated Equipment | Manufacturer | Identification No. | Calibration Date | Calibration Due |
|---|---|---|---|---|
| Micropipette | Fisher Scientific | CE 1141 | 03/12/11 | 03/12/12 |
| Incubator | Precision | CE 1155 | 03/12/11 | 03/12/12 |
| Thermometer | Precision | CE 1135 | 03/12/11 | 03/12/12 |
| Environmental Chamber | Thermotron | CE 1142 | For Reference only | See CE 1151 |
| Digital Hygrometer | Fisher Scientific | CE 1151 | 01/12/11 | 01/12/12 |

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**RESULTS:**

The negative controls showed no signs of growth.

The positive controls showed complete growth over the agars surface. The original number of each microorganism aspirated into the chamber was 1 x $10^8$ cfu/ml.

Air Purifier #1-

*S. epidermis* has shown;
A 50.6% reduction from the natural decay after 1 hour,
A 59.4% reduction from the natural decay after 2 hours,
A 93.4% reduction from the natural decay after 4 hours

*P. citrinum* has shown;
A 47.4% reduction from the natural decay after 1 hour,
A 66.3% reduction from the natural decay after 2 hours,
A 92.7% reduction from the natural decay after 4 hours

Air Purifier #2-

*P. citrinum* has shown;
A 50.0% reduction from the natural decay after 1 hour,
A 64.0% reduction from the natural decay after 2 hours,
A 90.2% reduction from the natural decay after 4 hours

## *Penicillium citrinum*

| Time (minutes) | Natural Decay (colonies) CFU | Air Purifier #1 (colonies) CFU | Air Purifier #2 (colonies) CFU |
|---|---|---|---|
| 0 | 138 | 139 | 136 |
| 30 | 129 | 101 | 108 |
| 60 | 116 | 61 | 58 |
| 90 | 98 | 38 | 42 |
| 120 | 86 | 29 | 31 |
| 150 | 69 | 23 | 29 |
| 180 | 54 | 17 | 22 |
| 210 | 47 | 11 | 13 |
| 240 | 41 | 3 | 4 |
| Total End % Reduction | N/A | 92.7% | 90.2% |

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## *Staphylococcus epidermis*

| Time (minutes) | Natural Decay (colonies) CFU | Air Purifier #1 (colonies) CFU |
|---|---|---|
| 0 | 287 | 285 |
| 30 | 252 | 174 |
| 60 | 241 | 119 |
| 90 | 229 | 91 |
| 120 | 212 | 86 |
| 150 | 189 | 63 |
| 180 | 161 | 33 |
| 210 | 126 | 17 |
| 240 | 91 | 6 |
| Total End % Reduction | N/A | 93.4% |

**CONCLUSION:** This report documents the performance of the air purifier #1 and air purifier #2. The microbiological test sample evaluations were conducted at the Intertek laboratory located in Columbus, OH between April 18, 2011 and April 29, 2011. The air purifier #1 does successfully reduce *S. epidermis* 93.4% and *P. citrinum* 92.7% in 4 hours. The air purifier #2 does successfully reduce *P. citrinum* 90.2% in 4 hours.

Test Performed by:

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Report Approved by:

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