

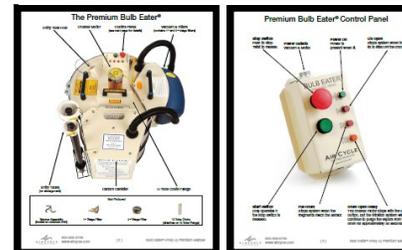


The Bulb Eater® Lamp Crusher

## Summary Guidance on Performance & Emissions Testing for The Bulb Eater®

The Bulb Eater® Lamp Crusher was developed to help promote and facilitate the cost-effective recycling of spent lamps. Additionally, the device has been designed to ensure that lamps are crushed safely and that mercury emissions are effectively controlled. The units include both a HEPA filter and an activated carbon filter; and an automated control panel helps to ensure that the unit is always operated properly. For more on the operations and all of the safety features, please go to:

[http://www.aircycle.com/docs/VRS\(U\)\\_Premium.pdf](http://www.aircycle.com/docs/VRS(U)_Premium.pdf)



### Consideration of Standard Exposure Limits

While it is understood that each state can develop its own standards, the standard exposure limits for inorganic mercury emissions are:

- **American Conference of Governmental Industrial Hygienists (ACGIH) 8-Hour threshold limit value (TLV) of 0.025 milligrams per cubic meter (mg/M<sup>3</sup>).**
- **Occupational Safety and Health Administration's (OSHA) 8-Hour Permissible Exposure Limit (PEL) of 0.1 mg/M<sup>3</sup>.**

Source: [http://www.osha.gov/SLTC/mercury/exposure\\_limits.html](http://www.osha.gov/SLTC/mercury/exposure_limits.html)

### Performance & Emissions Testing Summary

When properly operated, mercury emissions from the operation of the Bulb Eater® are virtually non-detectable; and certainly below the ACGIH and OSHA standards for worker exposure. Air Cycle Corporation has performed extensive testing and evaluation as we continually seek to improve our product. In addition, Air Cycle Corporation has participated in various 3rd-party evaluations and studies — each of which have fully supported our own internal testing and evaluations. Below are examples of studies that we've supported:

Study / Report	Summary Findings
GeoCenter, Testing for the US Navy in Broadview, IL (2003)	Mercury emissions were detected at several points during this extensive study; however, the 8-hr TLV was determined to be less than 0.00005 mg/l or less than the "mercury analytical detection limit," despite crushing two full drums lamps and performing filter and drum change-outs (0.00005 mg/m3 is 2000 times less than the OSHA 0.1 mg/m3 limit).
Industrial Hygiene Survey, Maintenance Facilities in Osceola County, FL (2004)	Mercury emissions were non-detectable or less than the laboratory detection limit of 0.0034 mg/m3.
Industrial Hygiene Survey, Maintenance Facilities in Polk County, FL (2004)	Mercury emissions testing was conducted on top of the drum and on the operator. Emissions were recorded at 0.0234 mg/M3 on the machine. The operator reading was 0.0068 mg/M3. Both readings were 8 hour time weighted averages. *An older, "Standard" model Bulb Eater with was tested in the study, whereas all other studies tested the "Premium" model Bulb Eater, which has more sophisticated filtration.
EPA Region 3 Study in Ashland, VA & Phoenix, AZ (2006)	Extensive testing of the Bulb Eater® and three other devices; mercury emissions detected at several points during study. However, 8-hr TWA never approached 0.1 mg/m3, which is the OSHA limit, despite crushing two full drums of lamps in a plastic containment room with limited ventilation and with background levels of mercury due to testing being performed at lamp recycling facilities. Only four readings were slightly higher than the ACGIH TLV of 0.025 mg/m3 recommended level. *Air Cycle is "Manufacturer C" in the study
Additional study summaries on next page	

Study / Report	Summary Findings
NC EPA Evaluation of Bulb Eater® (2007)	The purpose of this evaluation was to determine if operating the Bulb Eater elevated mercury vapor concentrations to a level considered unhealthy by recognized risk based values. While an increase in mercury was observed, it is not believed that these concentrations present any health problems related to mercury, because the ASTR MRL of 200 ng/m <sup>3</sup> for continuous exposure was not exceeded.
Maryland OSHA (2010—present)	The Maryland OSHA conducted emissions testing and assessments at 6 facilities that operate the Bulb Eater. The summary report has not been completed, but six individual reports are included which document the findings. Most of the readings are “non-detectable” and the ACGIH TLV of 0.025 mg/M <sup>3</sup> was not exceeded in any of the tests. <i>*Final report is under development, but raw testing data is available upon request.</i>

### Summary

Many of the tests of the third-party studies of the Bulb Eater® have registered “non-detectable” quantities of mercury emissions. And while mercury emissions have been detected in several other studies, none of the studies have documented any consistent readings over the ACGIH 8-Hour TLV standard of 0.025 milligrams per cubic meter (mg/M<sup>3</sup>) .

These studies and reports prove that the Bulb Eater® is a very safe device that encourages and facilitates lamp recycling. Additionally, Air Cycle continues to improve its product and safety controls, and the newer models will continue to control emissions and protect the safety of our customers at an even higher level.

**All supporting reports and documentation are available through Air Cycle Corporation upon request. If you would like to discuss the results of any of these or other reports, please feel free to contact us at [www.AirCycle.com](http://www.AirCycle.com).**

