

February 25, 2010

---

## Proposed Objective Odor Control Test Methodology for Waste Containment

---

### Background

The Orion Cockpit Working Group has requested that an odor control testing methodology be proposed to evaluate the odor containment effectiveness of waste disposal bags to be flown on the Orion Crew Exploration Vehicle. As a standardized "odor containment" test does not appear to be a matter of record for the project, a new test method is being proposed. This method is based on existing test methods used in industrial hygiene for the evaluation of respirator fit in occupational settings, and takes into consideration peer reviewed documentation of human odor thresholds for standardized contaminants, industry standard atmospheric testing methodologies, and established criteria for laboratory analysis. The proposed methodology is quantitative, though it can readily be complimented with a qualitative subjective assessment.

Isoamyl acetate (IAA – also known as isopentyl acetate) is commonly used in respirator fit testing, and there are documented methodologies for both measuring its quantitative airborne concentrations. IAA is a clear, colorless liquid with a banana-like odor, documented detectable smell threshold for humans of 0.025 PPM, and a 15 PPB level of quantitation limit.

### Proposed Methodology

1. Place a measured sample of IAA (possibly diluted with distilled water, or absorbed into a sponge, or some other dissemination method) into the planned containment device (charcoal bag, WMS cylinder, etc.). Determine generation rate prior to testing based upon chosen dissemination methodology (for calculation of time needed for IAA vaporization to attain desired airborne concentration within containment device).
2. Place a charcoal tube sampling array within the containment device and another outside the containment device. This allows you to know the airborne concentration of IAA inside and outside containment. Care must be taken to prevent contamination of the sampling media within the containment device.
3. Based on the IAA generation rate within the containment device, wait an appropriate period of time until the internal airborne concentration reaches the desired level.
4. Perform qualitative subjective assessment by having human test subjects stand in proximity of the containment device and perform an olfactory test of the ambient air. Have them indicate pass/fail as to whether or not they detect IAA's banana like odor.
5. Ensure the outside sample stays below 0.025 PPM (threshold of smell) by having the ambient air sampling media laboratory tested at an AIHA accredited laboratory.

### References

- Code of Federal Regulations (CFR) 29.1910.134: *Appendix A - Fit Testing Procedures*. August, 2004. [http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9780](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9780)
- OSHA. *Sampling and Analytical Methods: Isoamyl Acetate*. February, 2005. <http://www.osha.gov/dts/sltc/methods/partial/pv2142/pv2142.html>
- OSHA. *Chemical Sampling Information (CSI): Isoamyl Acetate*. September, 2007. [http://www.osha.gov/dts/chemicalsampling/data/CH\\_247700.html](http://www.osha.gov/dts/chemicalsampling/data/CH_247700.html)
- NIOSH. *Pocket Guide to Chemical Hazards: Isoamyl Acetate*. February, 2009. <http://www.cdc.gov/niosh/npg/npgd0347.html>