

The comparison of volatile organic compound measurement and analysis methods in a ground-based simulated spacecraft cabin

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Overview

Volatile organic compounds (VOCs) can be found in tightly sealed environments (an office building or spacecraft). Exposures to VOCs are associated with acute and chronic human health effects. The purpose of this study was to compare two measurement methods (a dosimeter badge to a sorbent tube) and two analysis methods GC/MS using EPA/TO-15 and GC/Gerstel Thermal Desorption System (GTDP) after a chemical cocktail injection.

Key Findings

The chamber has a volume of 90.6 m³ and is 14 feet in diameter and 23 feet in length. It has steel construction with bare metal inside. Two badges were placed in 50" and 70" from floor for 16 hours and 45 minutes. One hour after badges were located, 0.87 microliter/min chemical cocktail was injected into chamber, followed by continuous 1 microliter/min injection.

The levels of VOCs using EPA method TO-15 were:

- Ethanol (0.996 ppm)
- Acetone (0.024 ppm)
- Isopropanol (0.111 ppm)
- Methylene Chloride (0.038 ppm)

GTDP (NASA) showed:

- Ethanol (1.91 ppm)
- Acetone (0.19 ppm)
- Isopropanol (0.10 ppm)
- Dichloromethane (0.01 ppm)



Impact

- Raising awareness among aerospace community to the dangers of VOC exposure within crew capsules.
- Reducing the levels of VOC exposure among astronauts.
- Preventing long term health defects in the nervous system, cardiac system, and respiratory system.
- Encouraging continued monitoring of chemical off-gassing in crew modules.

Explanation

- This research prompts the need for further analysis of current measurement and testing processes
- More research should be conducted regarding indoor air quality of space cabin's to improve the environment for astronauts who stay in shuttles for days or months without accessing fresh air.

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