

Toxicological Assessment of ISS Air Quality: SpaceX-2 First Ingress



One mini-grab sample container (m-GSC) was collected by crew members onboard ISS during first ingress into SpaceX-2 on March 3, 2013, three days after late cargo loading and a pre-launch clean air purge.

Complete data tables of all measured concentrations and corresponding t-values based on 7-day and 180-day SMACs are enclosed. A summary of the analytical results is shown in Table 1. Shading indicates data that are limited due to low sample pressures. Recoveries of the 3 surrogate standards from the m-GSC were as follows: ¹³C-acetone, 96%; fluorobenzene, 95%; and chlorobenzene, 68%.

The sample pressure of the m-GSC collected at first ingress was quite low (2.6 psia) relative to the typical pressure range of 13-14 psia, indicating a problem with sample acquisition. The sample was deemed valid due to the lower concentrations of Freon 218 (octafluoropropane) and carbon dioxide relative to typical samples from ISS air, and to the presence of perfluoro-2-methylpentane, a coolant used in the Dragon vehicle; however, data are somewhat limited by a higher detection limit (0.170 mg/m³ compared to the normal detection limit of 0.05 mg/m³) due to the low pressure.

Table 1. Analytical Summary of ISS results

Sample Location	Sample Date	NMVOCs ^a (mg/m ³)	Freon 218 (mg/m ³)	CO ₂ (mg/m ³)	Alcohols (mg/m ³)	T-value ^b (units)
SpaceX-2 first ingress	3/3/2013	19	2.9	3562	11	0.72 (0.52)
<i>Guideline</i>		<25	---	<9300	<5	<1

^a Non-methane volatile organic hydrocarbons, excluding Freon 218

^b Based on 180-d SMACs and calculated excluding CO₂; parentheses indicate value based on 7-day SMACs

Toxicological Evaluation of ISS Air Quality: Although somewhat limited by the low sample pressure, the T-value measured at first entry met acceptable limits and does not pose a concern for crew health. The CO₂ and Freon 218 levels measured in the SpX-2 first ingress sample indicate that some mixing occurred with the ISS atmosphere prior to sample collection. The primary contributor to the total T-value was trimethylsilanol. Perfluoro (2-methyl) pentane vapors from the heat-exchange fluid used by the Dragon vehicle, were previously detected at levels on SpX-D (1300 mg/m³) that indicated a leak into the habitable volume. The vapor concentration measured at SpX-2 first ingress was 1.5 mg/m³, indicating that steps taken to mitigate the leak have been largely successful.

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Enclosures Table 1A: Analytical concentrations of compounds found in the first ingress m-GSC
 Table 2A: T-values corresponding to analytical concentrations in Table 1.