STS 126 Return Samples: Assessment of Air Quality aboard the Shuttle (STS-126) and International Space Station (ULF2)

The toxicological assessments of 2 grab sample canisters (GSCs) from the Shuttle are reported in Table 1. Analytical methods have not changed from earlier reports. The recoveries of the 3 surrogates (^{13}C-acetone, fluorobenzene, and chlorobenzene) from the 2 GSCs averaged 106, 107, and 109 %, respectively. Based on the end-of-mission sample, the Shuttle atmosphere was acceptable for human respiration.

Table 1. Analytical Summary of Shuttle Samples

Sample Location	Date of Sample	NMVOCs [a] (mg/m^3)	Freon 218 (mg/m^3)	T Value[b] (units)	Alcohols (mg/m^3)	Formaldehyde ($\mu g/m^3$)
Preflight	11/14/08	0.3	0	0.02	0.1	--
Middeck (end mission)	11/29/08	2	201	0.44	0.8	--

[a] Non-methane volatile organic hydrocarbons, excluding Freon 218
[b] Calculated excluding CO_2, formaldehyde, and siloxanes.

The toxicological assessment of 17 GSCs and 10 pairs of formaldehyde badges from the ISS is shown in Table 2. The recoveries of the 3 standards (as listed above) from the GSCs averaged 87, 76 and 81%, respectively. Two formaldehyde badge lab controls averaged 99% recovery.

Table 2. Analytical Summary of ISS Results

Module/Sample	Approx. Date	NMVOCs[a] (mg/m^3)	Freon 218 (mg/m^3)	T Value[b] (units)	Alcohols (mg/m^3)	Formaldehyde ($\mu g/m^3$)
Lab	6/18/08	9	327	0.22	7	24
JEM	6/18/08	6	294	0.97	5	--
SM	6/18/08	12	321	0.20	10	22
JEM	7/18/08	8	289	1.72[c]	4	--
Lab	7/18/08	5	327	0.16	3	25
SM	7/18/08	5	344	0.18	4	20
SM	8/12/08	8	352	1.15[c]	7	21
Lab	8/12/08	9	462	0.17	8	32
JEM	8/12/08	8	525	0.52	6	--
Lab	9/29/08	15	392	0.86	6	32
Columbus	9/29/08	7	519	0.19	5	--
SM	9/29/08	7	501	0.17	5	26
JEM	10/22/08	10	469	0.46	8	--
Lab	10/22/08	12	531	0.51	10	34
SM	10/22/08	10	559	0.44	8	28
MPLM (first entry)	11/13/08	10	43	1.29[d]	3	--
Lab	11/27/08	5	500	0.17	4	--
Guideline		*<25*	*none*	*<1.0*	*<5*	*<120*

[a] Non-methane volatile organic hydrocarbons, excluding Frreon 218
[b] Calculated excluding CO_2, formaldehyde, and siloxanes.
[c] Elevated T values due to trace amount of propenal, an irritant.
[d] Elevated T value due to trimethylsilanol, a central nervous system depressant and offgas product.

Based on these limited samples (Table 2), the ISS atmosphere is acceptable for human respiration. The Freon 218 levels suggest that little scrubbing of this compound was taking place and that the levels increased between the July and August samples, perhaps from an additional small leak.

The amount of Freon 218 in the MPLM first entry sample is typical of the reality that about 10% of the ISS atmosphere is mixed with the air of a newly opened module before the first-entry sample is acquired. The relatively high level of trimethylsilanol in the MPLM first entry sample was expected given that this compound is a common offgas product. There is no risk to crew health because crew exposure is momentary as the vapor is dispersed into the general ISS atmosphere and scrubbed.

The alcohol levels were often above the target limit of 5 mg/m^3. Formaldehyde levels continue to show consistently lower values in the SM when compared to the Lab. Levels in either module are well below the acceptable level for formaldehyde exposure.

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Enclosures
Table 1A: Analytical concentrations of compounds found in the STS-126 GSCs
Table 1B: Analytical concentrations of compounds found in ULF2 GSCs
Table 2A: T-values of the compounds in table 1A
Table 2B: T-values of the compounds in table 1B