Space X First Entry Sample Analysis

The toxicological assessment of one sample collected on May 26, 2012 and returned to earth on May 31, 2012 was analyzed for pollutants that had offgassed into the Dragon capsule by the time of first entry operations performed by the ISS crew. The components identified in the first-entry sample and their contributions to the total T-value are shown in the Table.

Compound	**Measured T-Value at First Entry after 33 days (7-d SMACs)**	**Predicted T-Value after 33 d from 4-day Ground-based Off Gas Test**
methanol	0.04	0.11
acetaldehyde	0.06	0.13
2-propanol	0.10	0.05
toluene	0.02	0.07
2-methyl-2-propenal	0.01	0.06
Trimethylsilanol	0.89	1.88
hexamethylcyclotrisiloxane	0.16	0.10
fluorotrimethylsilane	1.12	1.55
carbon monoxide	0.05	0
carbon dioxide	0.12	Not analyzed
Total T values of compounds	**2.6**	**3.9**

These data show that for this specific module and hardware, the linear phase of offgasing observed during the 4-day test fell off in the intervening 29 days. Using a linear prediction model out to 33 d slightly overestimated the individual and collective T-values that were found in the first-entry sample. This "fall off" does not generalize to subsequent flights. The only individual exceptions to this were hexamethylcyclotrisiloxane, carbon monoxide, and 2-propanol. These compounds have other sources besides new-module offgassing.

During the 4-day ground-based offgas test, the concentrations of perfluoro(2-methyl)pentane increased from1.2 to 3.3 mg/m^3, which looked like offgassing from materials inside the module. Analysis of the first-entry sample showed a concentration of 1300 mg/m^3. This compound is clearly not from offgassing, and through follow up investigation, we determined that this compound is used as a heat-exchange fluid in the Space X vehicle. The best explanation for the rapid increase in the concentration of this compound is that it leaked from the system, with the leak rate being increased by the vibrations experienced during launch and perhaps docking. Given that the free volume of the Dragon capsule is about 10 m^3, the amount of perfluoro(2-methyl)pentane that escaped from the system was approximately 13,000 mg or 13 g. The compound is virtually non-toxic, so there was no appreciable effect on the T values (0.009 units); however, the providers of the capsule should investigate the possibility of a small leak in their system. The total amount of perfluoro(2-methyl)pentane in the system to start with was approximately 32,000 g, thus the leak was tiny, but perhaps worth investigation.

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John T. James, Chief Toxicologist — date