



STS 131 Return Samples: Assessment of Air Quality aboard the Shuttle (STS-131) and International Space Station (19A)

Space Shuttle: The toxicological assessments of 1 grab sample canister (GSC) from the Shuttle are reported in Table 1. Analytical methods have not changed from earlier reports. The recoveries of the 3 surrogates (¹³C-acetone, fluorobenzene, and chlorobenzene) from the Shuttle GSC were 100%, 93%, and 101%, respectively. Based on the historical experience using end-of-mission samples, 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 (µg/m ³)
Preflight	4/05/10	0.3	--	0.37	0.20	--
Mid-deck (end of mission)	Unsuitable sample	--	--	--	--	--
<i>Guideline</i>		25	<i>none</i>	1.0	<i>none</i> ^c	<120

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

^b Based on 7-day SMACs and calculated excluding CO₂, formaldehyde, and siloxanes.

^c There is no guideline value because water is not recovered from humidity condensate on Shuttle as it is on ISS.

International Space Station: The toxicological assessment of 7 GSCs from the ISS is shown in Table 2. The recoveries of the 3 standards (as listed above) from the GSCs averaged 62, 87 and 73%, respectively. Concentrations of compounds were corrected for the low recoveries. Recovery from formaldehyde control badges ranged from 90 to 112%.

Table 2. Analytical Summary of ISS Results

Module/ Sample	Date of Sample	NMVOCs ^a (mg/m ³)	Freon 218 (mg/m ³)	T Value ^b (units)	Alcohols (mg/m ³)	Formaldehyde (µg/m ³)		
						date	SM	Lab
SM	3/01/10	10	98	1.12 ^c	5.7			
Lab	3/01/10	9	87	1.16 ^c	5.5	11/29/09	22	35
JEM	3/01/10	11	95	1.17 ^c	6.1 ^c	1/4/10	26	44
Columbus	4/08/10	6	92	0.36	3.5	1/21/10	25	33
Lab	4/08/10	6	90	0.35	3.5	3/1/10	--	30
SM	4/08/10	7	94	0.42	4.2	4/16/10	23	27
MPLM (first entry)	4/08/10	17	7 ^d	2.88	3.2	4/20/10	46	35
<i>Guideline</i>		<25	<i>none</i>	<1.0	<5		<120	

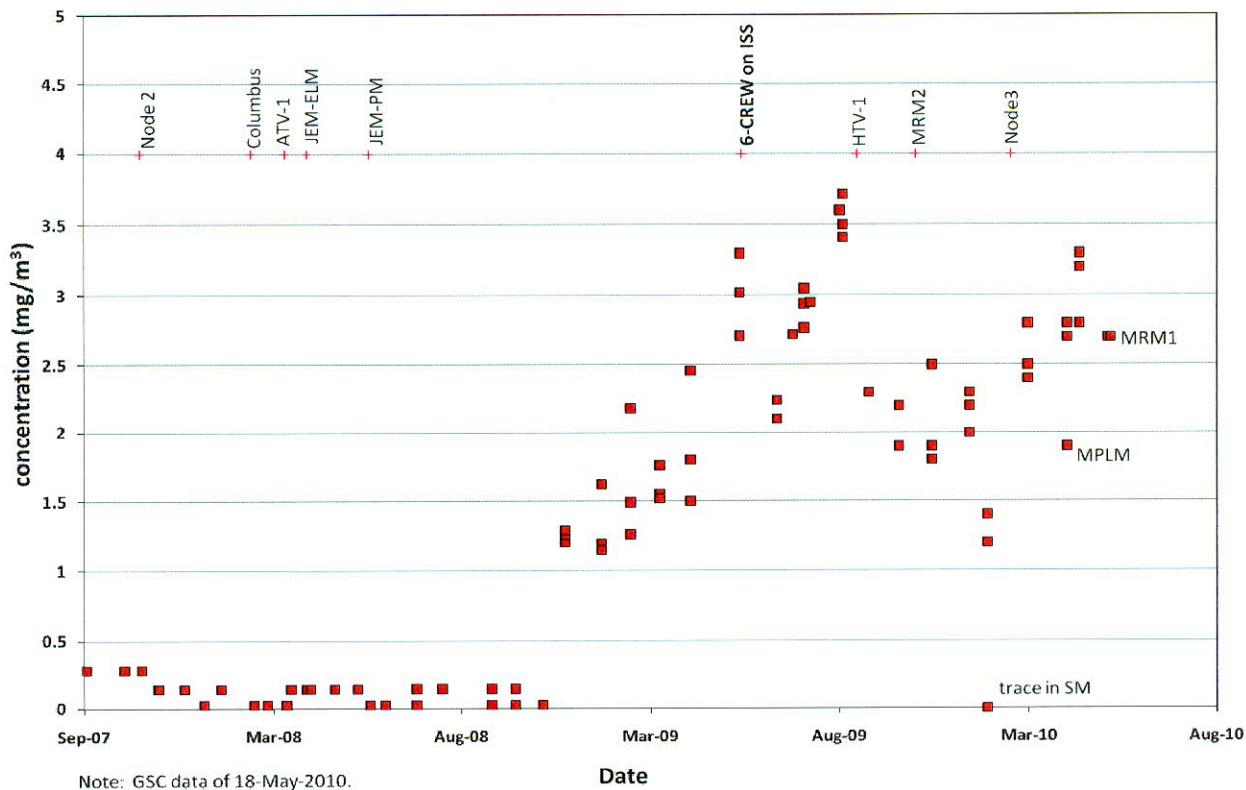
^a Non-methane volatile organic hydrocarbons, excluding Freon 218

^b Based on 180-d SMACs and calculated excluding CO₂, formaldehyde, and siloxanes.

^c Higher T value is due to traces of propenal, a mucosal irritant. High alcohol is due to ethanol.

^d The relatively low value for Freon 218 suggests that capture of the first-entry sample was immediately after hatch opening.

Carbon Monoxide



Carbon Monoxide Accumulation aboard ISS: From late 2008 the nominal concentrations of CO had been increasing gradually (see figure above). The results from samples returned on this flight and STS-132 indicate that the CO concentrations, after dropping in late 2009, have cycled upward. In any case, these changes are well below the 180-day SMAC for CO, which is 17 mg/m³. There is no threat to crew health. The source of the additional CO is unknown.

General Observations about ISS Air Quality:

This is a very limited set of samples on which to perform an air quality assessment. However, based on these samples, we have no reason to believe that nominal ISS air is unsafe to breathe. Past observations of sporadic traces of propenal have recurred, but at a lower level. We must continue to be vigilant when dealing with nominal atmospheres in ISS. New, unmanned modules, such as the MPLM, require special attention when the crew first enters.

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Enclosures

Table 1A: Analytical concentrations of compounds found in the STS-131 GSCs

Table 1B: Analytical concentrations of compounds found in 19A GSCs

Table 2A: T-values of the compounds in table 1A

Table 2B: T-values of the compounds in table 1B

TABLE 1A
ANALYTICAL RESULTS OF
STS-131 GRAB SAMPLE CONTAINER AIR SAMPLES

CHEMICAL CONTAMINANT	CONCENTRATION (mg/m ³)
	AA04892 PREFLIGHT SN 1071 04/05/10 @5:23 EDT
TARGET COMPOUNDS (TO-14/POLAR)***	
FREON12	<0.025
CHLOROMETHANE	<0.025
FREON114	<0.025
METHANOL	TRACE
ACETALDEHYDE	TRACE
VINYLCHLORIDE	<0.025
BROMOMETHANE	<0.025
ETHANOL	0.16
CHLOROETHANE	<0.025
ACETONITRILE	TRACE
PROPENAL	<0.025
ACETONE	TRACE
PROPANAL	TRACE
ISOPROPANOL	TRACE
FREON11	<0.025
FURAN	<0.025
ACRYLONITRILE	<0.025
PENTANE	TRACE
2-METHYL-2-PROPANOL	<0.025
METHYLACETATE	<0.025
1,1-DICHLOROETHENE	<0.025
DICHLOROMETHANE	<0.025
3-CHLOROPROPENE	<0.025
FREON113	<0.025
N-PROPANOL	<0.025
1,1-DICHLOROETHANE	<0.025
BUTANAL	<0.025
2-BUTANONE	<0.025
CIS-1,2-DICHLOROETHENE	<0.025
2-METHYLFURAN	<0.025
ETHYLACETATE	<0.025
HEXANE	<0.025
CHLOROFORM	<0.025
2-BUTENAL	<0.025
1,2-DICHLOROETHANE	<0.025
1,1,1-TRICHLOROETHANE	<0.025
N-BUTANOL	<0.025
BENZENE	<0.025
CARBONTETRACHLORIDE	<0.025
2-PENTANONE	<0.025
2-METHYLHEXANE	<0.025
2,3-DIMETHYLPENTANE	<0.025
PENTANAL	<0.025
3-METHYLHEXANE	<0.025
1,2-DICHLOROPROPANE	<0.025
1,4-DIOXANE	<0.025
TRICHLOROETHENE	<0.025
2,5-DIMETHYLFURAN	<0.025
N-HEPTANE	<0.025
4-METHYL-2-PENTANONE	<0.025
CIS-1,3-DICHLOROPROPENE	<0.025
2-PENTENAL	<0.025
TRANS-1,3-DICHLOROPROPENE	<0.025
1,1,2-TRICHLOROETHANE	<0.025
TOLUENE	<0.025
HEXANAL	<0.025
METHYLOXIDE	<0.025
1,2-DIBROMOETHANE	<0.025
BUTYLACETATE	<0.025
OCTANE	<0.025
TETRACHLOROETHENE	<0.025
CHLOROBENZENE	<0.025
ETHYLBENZENE	<0.025
M/P-XYLENES	<0.025
2-HEPTANONE	<0.025
CYCLOHEXANONE	<0.025
HEPTANAL	<0.025
STYRENE	<0.025
1,1,2,2-TETRACHLOROETHANE	<0.025
O-XYLENE	<0.025
NONANE	<0.025
1,3,5-TRIMETHYLBENZENE	<0.025
1,2,4-TRIMETHYLBENZENE	<0.025
1,3-DICHLOROBENZENE	<0.025
1,4-DICHLOROBENZENE	<0.025
1,2-DICHLOROBENZENE	<0.025
1,2,4-TRICHLOROBENZENE	<0.025
HEXACHLORO-1,3-BUTADIENE	<0.025

TABLE 1A
ANALYTICAL RESULTS OF
STS-131 GRAB SAMPLE CONTAINER AIR SAMPLES

CHEMICAL CONTAMINANT	CONCENTRATION (mg/m ³)
	AA04892 PREFLIGHT SN 1071 04/05/10 @5:23 EDT

TARGET COMPOUNDS (TOXIC) ++	
1,3-BUTADIENE	<0.025
ETHYLENE OXIDE	<0.025
CARBON DISULFIDE	<0.025
2-METHYL-2-PROPENAL	<0.025
3-BUTEN-2-ONE	<0.025
2-ETHOXYETHANOL	<0.025
DIMETHYLDISULFIDE	<0.025
OCTAMETHYLCYCLOTETrasilOXANE	*

NON-TARGET COMPOUNDS ++	
OCTAFLUOROPROPANE**	<0.025
SULFURHEXAFLUORIDE	<0.025
1,1,1,2-TETRAFLUOROETHANE	<0.025
BROMOTRIFLUOROMETHANE +	<0.025
FORMALDEHYDE&	0.043
1,1-DIFLUOROETHANE	<0.025
DIFLUOROCHLOROMETHANE	<0.025
C5-ALKANE	TRACE
TRIMETHYLSILANOL	<0.025
HEXAMETHYLCYCLOTRISILOXANE	*
C11-ALKANE	<0.025
C11-ALKANE	<0.025
C11-ALKANE	<0.025
C11-ALKANE	<0.025
C11-ALKANE	<0.025
C12-ALKANE	<0.025
C12-ALKANE	<0.025
C12-ALKANE	<0.025
C12-ALKANE	<0.025
C12-ALKANE	<0.025
C12-ALKANE	<0.025
C12-ALKANE	<0.025
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C12-ALKANE	<0.025
C12-ALKANE	<0.025
C12-ALKANE	<0.025
C12-ALKANE	<0.025
C12-ALKANE	<0.025
C12-ALKANE	<0.025
C12-ALKANE	<0.025
DECAMETHYLCYCLOPENTASILOXANE	*
DODECAMETHYLPENTASILOXANE	*

TOTAL ALCOHOLS PLUS ACETONE	0.20
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TARGET COMPOUNDS (GC)***	
CARBON MONOXIDE	TRACE
METHANE	< 1.6
HYDROGEN	< 0.41
CARBON DIOXIDE	1500

TOTAL CONCENTRATION (NON-METHANE HYDROCARBONS)	0.30
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TOTAL CONCENTRATION MINUS OFP (NON-METHANE HYDROCARBONS)	0.30
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+CORRECTED FOR ION 69
& BLANK CORRECTED

*Present, subject to large, random variability, therefore not quantifiable

** Measurements are calibrated by one-point calibration

*** Measurements are calibrated by multi-point initial calibration and verified by mid-point continuing calibration.

++ Book B-values are used for quantitation. B-values are referenced in the book "Compilation of Mass Spectral Data" by A. Cornu and R. Massot, 1966

< : Value is less than the laboratory report detection limit.

TRACE: Amount detected is sufficient for compound identification only.

TABLE 1B
ANALYTICAL RESULTS OF
19A RETURN GRAB SAMPLE CONTAINER AIR SAMPLES

CHEMICAL CONTAMINANT	CONCENTRATION						
	(mg/m3)						
	AA04896 S/N 1103 SM 03/01/10 @ 17:05GMT	AA04897 S/N 1102 LAB 03/01/10 @ 17:08 GMT	AA04898 S/N 1083 JEM 03/01/10 @ 17:09 GMT	AA04899 S/N 1106 COLUMBUS 04/08/10 @ 5:44 GMT	AA04888 S/N 1107 LAB 04/08/10 @ 5:50 GMT	AA04889 S/N 1108 SM 04/08/10 @ 5:58 GMT	AA04887 S/N 1092 MPLM 04/08/10 @ 12:00 GMT
TARGET COMPOUNDS (TO-14/POLAR)++							
FREON 12	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
CHLOROMETHANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
FREON 114	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
METHANOL #	0.40	0.44	0.49	0.46	0.39	0.36	0.24
ACETALDEHYDE #	0.32	0.34	0.45	0.18	0.23	0.28	0.16
VINYLCHLORIDE #	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
BROMOMETHANE #	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
ETHANOL * #	4.7	4.5	5.0	2.5	2.7	3.3	0.62
CHLOROETHANE #	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
ACETONITRILE #	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE
PROPENAL #	TRACE	TRACE	TRACE	<0.025	<0.025	<0.025	<0.025
ACETONE #	0.25	0.29	0.28	0.21	0.20	0.25	0.30
PROPANAL #	0.082	0.12	0.10	0.063	0.047	0.083	0.058
ISOPROPANOL #	0.17	0.15	0.17	0.14	0.12	0.14	1.8
FREON 11	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
FURAN	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
ACRYLONITRILE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
PENTANE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE
2-METHYL-2-PROPANOL#	<0.025	TRACE	<0.025	<0.025	<0.025	<0.025	0.051
METHYLACETATE	0.031	0.033	0.042	0.038	0.044	0.061	<0.025
1,1-DICHLOROETHENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
DICHLOROMETHANE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	0.050
3-CHLOROPROPENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
FREON 113	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
N-PROPANOL	0.041	0.050	0.038	0.030	0.045	0.039	0.033
1,1-DICHLOROETHANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
BUTANAL #	0.041	0.048	0.057	TRACE	TRACE	0.044	0.035
2-BUTANONE #	0.055	0.073	0.043	0.039	0.036	0.038	0.45
CIS-1,2-DICHLOROETHENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2-METHYLFURAN	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
ETHYLACETATE #	0.087	0.081	0.097	0.060	0.070	0.10	TRACE
HEXANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.062
CHLOROFORM	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2-BUTENAL	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
1,2-DICHLOROETHANE	0.070	0.052	0.063	TRACE	TRACE	0.036	<0.025
1,1,1-TRICHLOROETHANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
N-BUTANOL#	0.13	0.11	0.13	0.090	0.067	0.11	0.16
BENZENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
CARBONTETRACHLORIDE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2-PENTANONE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2-METHYLHEXANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.095
2,3-DIMETHYLPENTANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.18
PENTANAL#	TRACE	TRACE	0.034	TRACE	<0.025	TRACE	0.036
3-METHYLHEXANE	TRACE	TRACE	TRACE	<0.025	<0.025	TRACE	0.22
1,2-DICHLOROPROPANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
1,4-DIOXANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
TRICHLOROETHENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2,5-DIMETHYLFURAN	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
N-HEPTANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	TRACE
4-METHYL-2-PENTANONE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
CIS-1,3-DICHLOROPROPENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2-PENTENAL	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
TRANS-1,3-DICHLOROPROPENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
1,1,2-TRICHLOROETHANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
TOLUENE	0.031	TRACE	0.030	TRACE	TRACE	TRACE	0.20
HEXANAL	0.031	TRACE	TRACE	TRACE	<0.025	TRACE	TRACE
MESITYLOXIDE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
1,2-DIBROMOETHANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
BUTYLACETATE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
OCTANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
TETRACHLOROETHENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
CHLOROBENZENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
ETHYLBENZENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
M/P-XYLENES	<0.025	<0.025	<0.025	<0.025	<0.025	TRACE	<0.025
2-HEPTANONE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
CYCLOHEXANONE	0.074	0.058	0.094	0.078	0.043	0.072	TRACE
HEPTANAL	0.077	0.033	0.056	0.056	<0.025	0.046	0.055
STYRENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
1,1,2,2-TETRACHLOROETHANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
O-XYLENE	0.061	0.046	0.053	0.045	0.047	0.065	<0.025
NONANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
1,3,5-TRIMETHYLBENZENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
1,2,4-TRIMETHYLBENZENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
1,3-DICHLOROBENZENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
1,4-DICHLOROBENZENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
1,2-DICHLOROBENZENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
1,2,4-TRICHLOROBENZENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
HEXACHLORO-1,3-BUTADIENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025

TABLE 1B
ANALYTICAL RESULTS OF
19A RETURN GRAB SAMPLE CONTAINER AIR SAMPLES

CHEMICAL CONTAMINANT	CONCENTRATION (mg/m3)						
	AA04896 S/N 1103 SM	AA04897 S/N 1102 LAB	AA04898 S/N 1083 JEM	AA04899 S/N 1106 COLUMBUS	AA04888 S/N 1107 LAB	AA04889 S/N 1108 SM	AA04887 S/N 1092 MPLM
	03/01/10 @ 17:05GMT	03/01/10 @ 17:08 GMT	03/01/10 @ 17:09 GMT	04/08/10 @ 5:44 GMT	04/08/10 @ 5:50 GMT	04/08/10 @ 5:58 GMT	04/08/10 @ 12:00 GMT

TARGET COMPOUNDS (TOXIC)++++							
1,3-BUTADIENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
ETHYLENE OXIDE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
CARBON DISULFIDE	TRACE	TRACE	TRACE	<0.025	<0.025	<0.025	TRACE
2-METHYL-2-PROPENAL#	TRACE	TRACE	TRACE	<0.025	TRACE	TRACE	0.040
3-BUTEN-2-ONE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2-ETHOXYETHANOL	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
DIMETHYLDISULFIDE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
OCTAMETHYLCYCLOTRISILOXANE	##	##	##	##	##	##	##

NON-TARGET COMPOUNDS++++							
OCTAFLUOROPROPANE++	98	87	95	92	90	94	7.3
SULFURHEXAFLUORIDE	TRACE	0.26	0.30	0.61	0.56	0.59	0.050
1,1,1,2-TERTRAFLUOROETHANE	0.36	0.32	0.36	0.33	0.31	0.35	7.9
BROMOTRIFLUOROMETHANE	TRACE	TRACE	TRACE	0.29	0.28	0.30	<0.025
FORMALDEHYDE	0.12	0.11	0.062	0.083	0.082	0.068	0.036
CHLORODIFLUOROMETHANE	1.2	1.2	1.8	TRACE	TRACE	TRACE	0.14
PROPENE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE
CARBONYLSULFIDE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	0.13
1-BUTENE	0.032	0.032	0.034	TRACE	TRACE	TRACE	0.094
ISOPRENE	0.19	0.15	0.18	0.103	0.108	0.15	0.031
TRIMETHYLSILANOL	0.33	0.31	0.46	0.24	0.16	0.24	2.6
1,3-DIOXOLANE	0.066	0.072	0.074	0.047	0.057	0.065	<0.025
CARBONICACIDDIMETHYLESTER	0.066	0.066	0.075	0.045	0.047	0.062	0.036
BUTANOICACIDHEPTAFLUOROETHYLESTER	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.18
3,3-DIMETHYLPENTANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.13
C7-ALKANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.12
HEXAMETHYLCYCLOTRISILOXANE	##	##	##	##	##	##	##
BENZALDEHYDE	0.074	0.078	0.099	0.065	0.094	0.14	TRACE
2-ETHYL-1-HEXANOL	0.093	<0.025	0.12	0.19	<0.025	0.065	0.098
LIMONENE	0.22	TRACE	0.19	0.10	<0.025	0.084	<0.025
DECAMETHYLCYCLOPENTASILOXANE	##	##	##	##	##	##	##

TOTAL ALCOHOLS PLUS ACETONE	5.7	5.5	6.1	3.5	3.5	4.2	3.2
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TARGET COMPOUNDS (GC)+++							
CARBON MONOXIDE	2.5	2.8	2.4	2.8	2.7	2.7	1.9
METHANE	12	12	12	11	11	11	TRACE
HYDROGEN	2.7	2.9	2.9	2.6	2.8	3.0	<0.41
CARBON DIOXIDE	6800	5800	6200	6700	6500	7100	2600

TOTAL CONCENTRATION (NON-METHANE HYDROCARBONS)	110	96	110	99	96	100	24
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TOTAL CONCENTRATION - OFP (NON-METHANE HYDROCARBONS)	9.5	9.4	11	6.3	5.9	7.3	17
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TO COMPENSATE FOR LOW SURROGATE RECOVERIES, CONCENTRATIONS HAVE BEEN INCREASED BY 30%, ALL OTHER COMPOUNDS HAVE BEEN ADJUSTED BY 20%.

* FROM GC/FID RESULTS

& BLANK CORRECTED

Present, subject to large, random variability, therefore not quantifiable

++ Measurements are calibrated by single-point calibration.

+++ Measurements are calibrated by multi-point initial calibration and verified by mid-point continuing calibration.

++++ Book B-values are used for quantitation. B-values are referenced in the book "Compilation of Mass Spectral Data" by A. Cornu and R. Massot, 1966

<: Value is less than the laboratory report detection limit.

TRACE: Amount detected is sufficient for compound identification only.

TABLE 2A
ANALYTICAL RESULTS OF
STS-131 GRAB SAMPLE CONTAINER AIR SAMPLES

CHEMICAL CONTAMINANT	T-VALUE (7-d SMAC)
	AA04892 PREFLIGHT SN 1071 04/05/10 @5:23 EDT
TARGET COMPOUNDS (TO-14/POLAR)	
FREON12	ND
CHLOROMETHANE	ND
FREON114	ND
METHANOL	0.00014
ACETALDEHYDE	0.00313
VINYLCHLORIDE	ND
BROMOMETHANE	ND
ETHANOL	0.00008
CHLOROETHANE	ND
ACETONITRILE	0.00187
PROPENAL	ND
ACETONE	0.00024
PROPANAL	0.00114
ISOPROPANOL	0.00008
FREON11	ND
FURAN	ND
ACRYLONITRILE	ND
PENTANE	0.00007
2-METHYL-2-PROPANOL	ND
METHYLACETATE	ND
1,1-DICHLOROETHENE	ND
DICHLOROMETHANE	ND
3-CHLOROPROPENE	ND
FREON113	ND
N-PROPANOL	ND
1,1-DICHLOROETHANE	ND
BUTANAL	ND
2-BUTANONE	ND
CIS-1,2-DICHLOROETHENE	ND
2-METHYLFURAN	ND
ETHYLACETATE	ND
HEXANE	ND
CHLOROFORM	ND
2-BUTENAL	ND
1,2-DICHLOROETHANE	ND
1,1,1-TRICHLOROETHANE	ND
N-BUTANOL	ND
BENZENE	ND
CARBONTETRACHLORIDE	ND
2-PENTANONE	ND
2-METHYLHEXANE	ND
2,3-DIMETHYLPENTANE	ND
PENTANAL	ND
3-METHYLHEXANE	ND
1,2-DICHLOROPROPANE	ND
1,4-DIOXANE	ND
TRICHLOROETHENE	ND
2,5-DIMETHYLFURAN	ND
N-HEPTANE	ND
4-METHYL2-PENTANONE	ND
CIS-1,3-DICHLOROPROPENE	ND
2-PENTENAL	ND
TRANS-1,3-DICHLOROPROPENE	ND
1,1,2-TRICHLOROETHANE	ND
TOLUENE	ND
HEXANAL	ND
MESITYLOXIDE	ND
1,2-DIBROMOETHANE	ND
BUTYLACETATE	ND
OCTANE	ND
TETRACHLOROETHENE	ND
CHLOROBENZENE	ND
ETHYLBENZENE	ND
M/P-XYLENES	ND
2-HEPTANONE	ND
CYCLOHEXANONE	ND
HEPTANAL	ND
STYRENE	ND
1,1,2,2-TETRACHLOROETHANE	ND
O-XYLENE	ND
NONANE	ND
1,3,5-TRIMETHYLBENZENE	ND
1,2,4-TRIMETHYLBENZENE	ND
1,3-DICHLOROBENZENE	ND
1,4-DICHLOROBENZENE	ND
1,2-DICHLOROBENZENE	ND
1,2,4-TRICHLOROBENZENE	ND
HEXACHLORO-1,3-BUTADIENE	ND

TABLE 2A
ANALYTICAL RESULTS OF
STS-131 GRAB SAMPLE CONTAINER AIR SAMPLES

CHEMICAL CONTAMINANT	T-VALUE (7-d SMAC)
	AA04892 PREFLIGHT SN 1071 04/05/10 @5:23 EDT

TARGET COMPOUNDS (TOXIC)	
1,3-BUTADIENE	ND
ETHYLENE OXIDE	ND
CARBON DISULFIDE	ND
2-METHYL-2-PROPENAL	ND
3-BUTEN-2-ONE	ND
2-ETHOXYETHANOL	ND
DIMETHYLDISULFIDE	ND
OCTAMETHYLCYCLOTETRAILOXANE	*

NON-TARGET COMPOUNDS	
OCTAFLUOROPROPANE**	ND
SULFURHEXAFLUORIDE	ND
1,1,1,2-TETRAFLUOROETHANE	ND
BROMOTRIFLUOROMETHANE +	ND
FORMALDEHYDE&	0.35516
1,1-DIFLUOROETHANE	ND
DIFLUOROCHELOROMETHANE	ND
C5-ALKANE	0.00007
TRIMETHYLSILANOL	ND
HEXAMETHYLCYCLOTRISILOXANE	*
C11-ALKANE	ND
C11-ALKANE	ND
C11-ALKANE	ND
C11-ALKANE	ND
C11-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
C12-ALKANE	ND
DECAMETHYLCYCLOPENTASILOXANE	*
DODECAMETHYLPENTASILOXANE	*

TARGET COMPOUNDS (GC)	
CARBON MONOXIDE	0.00454
METHANE	0.00000
HYDROGEN	0.00000
CARBON DIOXIDE	0.11274

TOTAL T-VALUE	0.47925
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*Present, but not included in total T-Value
 ND : Value is less than the laboratory report detection limit.
 Note: Number of decimal places in T-Values do not represent significant figures of measurements.

TABLE 2B
ANALYTICAL RESULTS OF
19A RETURN GRAB SAMPLE CONTAINER AIR SAMPLES

CHEMICAL CONTAMINANT	T-VALUE (180-d SMAC)						
	AA04896	AA04897	AA04898	AA04899	AA04888	AA04889	AA04887
	S/N 1103 SM 03/01/10 @ 17:05GMT	S/N 1102 LAB 03/01/10 @ 17:08 GMT	S/N 1083 JEM 03/01/10 @ 17:09 GMT	S/N 1106 COLUMBUS 04/08/10 @ 5:44 GMT	S/N 1107 LAB 04/08/10 @ 5:50 GMT	S/N 1108 SM 04/08/10 @ 5:58 GMT	S/N 1092 MPLM 04/08/10 @ 12:00 GMT
TARGET COMPOUNDS (TO-14/POLAR)							
FREON12	ND	ND	ND	ND	ND	ND	ND
CHLOROMETHANE	ND	ND	ND	ND	ND	ND	ND
FREON114	ND	ND	ND	ND	ND	ND	ND
METHANOL #	0.00446	0.00484	0.00544	0.00510	0.00428	0.00397	0.00269
ACETALDEHYDE #	0.08047	0.13393	0.11161	0.04595	0.05728	0.06885	0.03989
VINYLCHLORIDE #	ND	ND	ND	ND	ND	ND	ND
BROMOMETILANE #	ND	ND	ND	ND	ND	ND	ND
ETHANOL * #	0.00233	0.00225	0.00249	0.00127	0.00136	0.00166	0.00031
CHLOROETHANE #	ND	ND	ND	ND	ND	ND	ND
ACETONITRILE #	0.00187	0.00187	0.00187	0.00187	0.00187	0.00187	0.00187
PROPENAL #	0.62500	0.62500	0.62500	ND	ND	ND	ND
ACETONE #	0.00482	0.00562	0.00535	0.00403	0.00392	0.00477	0.00579
PROPANAL #	0.00749	0.01	0.01	0.00574	0.00425	0.00756	0.00526
ISOPROPANOL #	0.00116	0.00097	0.00110	0.00096	0.00	0.00092	0.01199
FREON11	ND	ND	ND	ND	ND	ND	ND
FURAN	ND	ND	ND	ND	ND	ND	ND
ACRYLONITRILE	ND	ND	ND	ND	ND	ND	ND
PENTANE	0.00139	0.00139	0.00139	0.00139	0.00139	0.00139	0.00139
2-METHYL-2-PROPANOL#	ND	0.00010	ND	ND	ND	ND	0.00042
METHYLACETATE	0.00026	0.00028	0.00035	0.00032	0.00037	0.00051	ND
1,1-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND
DICHLOROMETHANE	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00495
3-CHLOROPROPENE	ND	ND	ND	ND	ND	ND	ND
FREON113	ND	ND	ND	ND	ND	ND	ND
N-PROPANOL	0.00042	0.00051	0.00039	0.00031	0.00046	0.00039	0.00033
1,1-DICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND
BUTANAL #	0.00318	0.00368	0.00435	0.00096	0.00096	0.00337	0.00269
2-BUTANONE #	0.00184	0.00244	0.00145	0.00131	0.00120	0.00125	0.01492
CIS-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND
2-METHYLFURAN	ND	ND	ND	ND	ND	ND	ND
ETHYLACETATE #	0.00048	0.00045	0.00054	0.00033	0.00039	0.00	0.00007
HEXANE	ND	ND	ND	ND	ND	ND	0.00567
CHLOROFORM	ND	ND	ND	ND	ND	ND	ND
2-BUTENAL	ND	ND	ND	ND	ND	ND	ND
1,2-DICHLOROETHANE	0.04376	0.03220	0.03924	0.00781	0.00781	0.02273	ND
1,1,1-TRICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND
N-BUTANOL#	0.00330	0.00	0.00334	0.00225	0.00169	0.00	0.00410
BENZENE	ND	ND	ND	ND	ND	ND	ND
CARBONETETRACHLORIDE	ND	ND	ND	ND	ND	ND	ND
2-PENTANONE	ND	ND	ND	ND	ND	ND	ND
2-METHYLHEXANE	ND	ND	ND	ND	ND	ND	0.00792
2,3-DIMETHYLPENTANE	ND	ND	ND	ND	ND	ND	0.01477
PENTANAL#	0.00078	0.00078	0.00213	0.00078	ND	0.00078	0.00226
3-METHYLHEXANE	0.00104	0.00104	0.00104	ND	ND	0.00104	0.01800
1,2-DICHLOROPROPANE	ND	ND	ND	ND	ND	ND	ND
1,4-DIOXANE	ND	ND	ND	ND	ND	ND	ND
TRICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND
2,5-DIMETHYLFURAN	ND	ND	ND	ND	ND	ND	ND
N-HEPTANE	ND	ND	ND	ND	ND	ND	0.00104
4-METHYL-2-PENTANONE	ND	ND	ND	ND	ND	ND	ND
CIS-1,3-DICHLOROPROPENE	ND	ND	ND	ND	ND	ND	ND
2-PENTENAL	ND	ND	ND	ND	ND	ND	ND
TRANS-1,3-DICHLOROPROPENE	ND	ND	ND	ND	ND	ND	ND
1,1,2-TRICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND
TOLUENE	0.00204	0.00083	0.00200	0.00083	0.00083	0.00083	0.01343
HEXANAL	0.00173	0.00069	0.00069	0.00069	ND	0.00069	0.00069
MESITYLOXIDE	ND	ND	ND	ND	ND	ND	ND
1,2-DIBROMOETHANE	ND	ND	ND	ND	ND	ND	ND
BUTYLACETATE	ND	ND	ND	ND	ND	ND	ND
OCTANE	ND	ND	ND	ND	ND	ND	ND
TETRACHLOROETHENE	ND	ND	ND	ND	ND	ND	ND
CHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND
ETHYLBENZENE	ND	ND	ND	ND	ND	ND	ND
M/P-XYLENES	ND	ND	ND	ND	ND	0.00034	ND
2-HEPTANONE	ND	ND	ND	ND	ND	ND	ND
CYCLOHEXANONE	0.00124	0.00096	0.00156	0.00129	0.00072	0.00120	0.00021
HEPTANAL	0.00368	0.00156	0.00267	0.00269	ND	0.00220	0.00261
STYRENE	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-TETRACHLOROETHANE	ND	ND	ND	ND	ND	ND	ND
O-XYLENE	0.00165	0.00126	0.00143	0.00121	0.00126	0.00177	ND
NONANE	ND	ND	ND	ND	ND	ND	ND
1,3,5-TRIMETHYLBENZENE	ND	ND	ND	ND	ND	ND	ND
1,2,4-TRIMETHYLBENZENE	ND	ND	ND	ND	ND	ND	ND
1,3-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND
1,4-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND
1,2-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND
1,2,4-TRICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND
HEXACHLORO-1,3-BUTADIENE	ND	ND	ND	ND	ND	ND	ND

TABLE 2B
ANALYTICAL RESULTS OF
19A RETURN GRAB SAMPLE CONTAINER AIR SAMPLES

CHEMICAL CONTAMINANT	T-VALUE (180-d SMAC)						
	AA04896 S/N 1103 SM 03/01/10 @ 17:05GMT	AA04897 S/N 1102 LAB 03/01/10 @ 17:08 GMT	AA04898 S/N 1083 JEM 03/01/10 @ 17:09 GMT	AA04899 S/N 1106 COLUMBUS 04/08/10 @ 5:44 GMT	AA04888 S/N 1107 LAB 04/08/10 @ 5:50 GMT	AA04889 S/N 1108 SM 04/08/10 @ 5:58 GMT	AA04887 S/N 1092 MPLM 04/08/10 @ 12:00 GMT

TARGET COMPOUNDS (TOXIC)++++							
1,3-BUTADIENE	ND	ND	ND	ND	ND	ND	ND
ETHYLENE OXIDE	ND	ND	ND	ND	ND	ND	ND
CARBON DISULFIDE	0.00078	0.00078	0.00078	ND	ND	ND	0.00078
2-METHYL-2-PROPENAL#	0.00735	0.00735	0.00735	ND	0.00735	0.00735	0.02360
3-BUTEN-2-ONE	ND	ND	ND	ND	ND	ND	ND
2-ETHOXYETHANOL	ND	ND	ND	ND	ND	ND	ND
DIMETHYLDISULFIDE	ND	ND	ND	ND	ND	ND	ND
OCTAMETHYLCYCLOTETRAILOXANE	##	##	##	##	##	##	##

NON-TARGET COMPOUNDS++++							
OCTAFLUOROPROPANE++	0.00115	0.00103	0.00112	0.00109	0.00106	0.00111	0.00009
SULFURHEXAFLUORIDE	0.00001	0.00022	0.00025	0.00051	0.00047	0.00049	0.00004
1,1,1,2-TERTRAFLUOROETHANE	0.00346	0.00307	0.00343	0.00318	0.00300	0.00335	0.07641
BROMOTRIFLUOROMETHANE	0.00000	0.00000	0.00000	0.00003	0.00003	0.00003	ND
FORMALDEHYDE	0.96959	0.87862	0.51355	0.68872	0.68650	0.56604	0.29792
CHLORODIFLUOROMETHANE	0.0	0.0	0.00053	0.00000	0.00000	0.00000	0.00004
PROPENE	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
CARBONYLSULFIDE	0.00104	0.00104	0.00104	0.00104	0.00104	0.00104	0.01079
1-BUTENE	0.00007	0.00007	0.00007	0.00003	0.00003	0.00003	0.00020
ISOPRENE	0.06272	0.05142	0.05853	0.03433	0.03592	0.04863	0.01019
TRIMETHYLSILANOL	0.08246	0.07645	0.11395	0.05922	0.04117	0.06070	0.64364
1,3-DIOXOLANE	0.00183	0.00199	0.00207	0.00131	0.00159	0.00181	ND
CARBONICACIDDIMETHYLESTER	0.00002	0.00002	0.00003	0.00002	0.00002	0.00002	0.00001
BUTANOICACIDHEPTAFLUROETHYLESTER	ND	ND	ND	ND	ND	ND	1.82367
3,3-DIMETHYLPENTANE	ND	ND	ND	ND	ND	ND	0.00419
C7-ALKANE	ND	ND	ND	ND	ND	ND	0.01
HEXAMETHYLCYCLOTIRILOXANE	##	##	##	##	##	##	##
BENZALDEHYDE	0.00043	0.00045	0.00057	0.00037	0.00055	0.00080	0.00007
2-ETHYL-1-HEXANOL	0.00176	ND	0.00236	0.00354	ND	0.00122	0.00186
LIMONENE	0.00194	0.00011	0.00162	0.00	ND	0.00073	ND
DECAMETHYLCYCLOPENTASILOXANE	##	##	##	##	##	##	##

TARGET COMPOUNDS (GC)							
CARBON MONOXIDE	0.14483	0.16560	0.14033	0.16212	0.16031	0.15604	0.11080
METHANE	0.00339	0.00336	0.00344	0.00316	0.00318	0.00317	0.00023
HYDROGEN	0.00803	0.00838	0.00851	0.00756	0.00823	0.00874	0.00000
CARBON DIOXIDE	0.52257	0.44627	0.47630	0.51786	0.49685	0.54648	0.20212

TOTAL T-VALUE	2.60943	2.48615	2.16189	1.57334	1.53941	1.54054	3.37967
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TOTAL T-VALUE - OPP	2.60828	2.48512	2.16077	1.57225	1.53835	1.53943	3.37958
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TO COMPENSATE FOR LOW SURROGATE RECOVERIES, CONCENTRATIONS HAVE BEEN INCREASED BY 30%. ALL OTHER COMPOUNDS HAVE BEEN ADJUSTED BY 20%.

Present, but not included in total T-Value

<: Value is less than the laboratory report detection limit.

TRACE: Amount detected is sufficient for compound identification only.