Soyuz 24 Return Samples: Assessment of Air Quality aboard the International Space Station

International Space Station: Fifteen mini-grab sample containers (m-GSCs) were returned aboard Soyuz. This is the first time all samples were acquired with the mini-grab samplers. The toxicological assessment of 15 m-GSCs from the ISS is shown in Table 1. The recoveries of the 3 internal standards, ^{13}C-acetone, fluorobenzene, and chlorobenzene, from the GSCs averaged 75, 97 and 79%, respectively. Formaldehyde badges were not returned on Soyuz 24.

Table 1. 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)
Lab	12/21/10	6.8	100	0.27	5.8
JEM	12/21/10	6.9	140	0.26	6.1
SM	12/21/10	7.9	73	0.28	6.0
Lab	1/14/11	4.7	67	0.27	3.9
Col	1/14/11	4.9	60	0.29	4.0
SM	1/14/11	5.0	68	0.31	4.0
HTV2 (**first entry**)	1/27/11	15	95	**2.50**	6.0
JEM	2/14/11	5.3	82	0.33	4.1
Lab	2/14/11	5.7	79	0.33	4.5
SM	2/14/11	5.1	67	0.29	4.1
ATV2 vestibule	2/25/11	5.0	67	0.33	3.9
ATV2 center (**first entry**)	2/25/11	11	8	**1.23**	5.3
Col	3/15/11	5.5	62	0.35	4.3
Lab	3/15/11	5.4	67	0.32	4.3
SM	3/15/11	5.0	54	0.34	4.1
Guideline		*<25*	*none*	*<1.0*[b]	*<5*

[a] Non-methane volatile organic hydrocarbons, excluding Freon 218

[b] Based on 180-d SMACs and calculated excluding CO_2, formaldehyde, and siloxanes. First entry guideline is < 3.

The T-values of samples taken during nominal operations suggest uniformly clean air. The first entry samples show higher levels of pollution, but <3 units. Based on Freon 218 and CO_2 levels, the ATV first-entry sample was captured quickly, but the HTV2 first-entry sampling was delayed. The main contributors to the high T-value in HTV2 sample were trimethylsilanol and fluorotrimethylsilane. Freon 218 (perfluoropropane) levels continue to be high and fairly uniformly distributed throughout the ISS stack. This compound is far from toxic at these levels.

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Enclosures

Table 1: Analytical concentrations of compounds found in the Soyuz 24 return m-GSCs

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

TABLE 1
ANALYTICAL RESULTS OF
24S RETURN MINI-GRAB SAMPLE CONTAINER AIR SAMPLES

CHEMICAL CONTAMINANT	CONCENTRATION (mg/m3)														
	AA05052 S/N 2047 LAB 12/21/10 @ 13:30 GMT	**AA05053 S/N 2042 JEM 12/21/10 @ 13:31 GMT**	**AA05054 S/N 2039 SM 12/21/10 @ 13:35 GMT**	**AA05055 S/N 2045 LAB 01/14/11 @ 15:12 GMT**	**AA05056 S/N 2048 COLUMBUS 01/14/11 @ 15:16 GMT**	**AA05057 S/N 2051 SM 01/14/11 @ 15:20 GMT**	**AA05058 S/N 2043 HTV2 01/27/11 @ 21:00 GMT**	**AA05059 S/N 2044 JEM 02/14/11 @ 10:47 GMT**	**AA05060 S/N 2041 LAB 02/14/11 @ 10:50 GMT**	**AA05061 S/N 2056 SM 02/14/11 @ 23:00 GMT**	**AA05062 S/N 2050 ATV2 VESTIBULE 02/25/11 @ 15:27 GMT**	**AA05063 S/N 2058 ATV2 CENTER VOLUME 02/25/11 @ 16:14 GMT**	**AA05064 S/N 2046 COLUMBUS 03/15/11 @ 11:30 GMT**	**AA05065 S/N 2049 LAB 03/15/11 @ 11:30 GMT**	**AA05066 S/N 2052 SM 03/15/11 @ 13:20 GMT**
TARGET COMPOUNDS (TO-14/POLAR)+++															
FREON12	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
CHLOROMETHANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
FREON114	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
METHANOL	0.64	1.35	0.88	0.64	0.48	0.66	0.63	0.56	0.65	0.62	0.70	0.78	0.59	0.67	0.58
ACETALDEHYDE	0.14	0.16	0.14	0.14	0.14	0.17	0.12	0.11	0.12	0.13	0.33	0.32	0.14	0.14	0.11
VINYLCHLORIDE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
BROMOMETHANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
ETHANOL *	**4.6**	**4.2**	**5.4**	**2.5**	**2.6**	**2.7**	2.2	**3.0**	**3.1**	**2.8**	**2.6**	1.8	**3.0**	**2.9**	**2.8**
CHLOROETHANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
ACETONITRILE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
PROPENAL	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
ACETONE	0.29	0.29	0.33	0.38	0.43	0.42	0.36	0.34	0.41	0.37	0.36	0.88	0.40	0.44	0.40
PROPANAL	TRACE	<0.050	TRACE	<0.050	<0.050	<0.050	TRACE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
ISOPROPANOL *	0.14	0.14	0.15	0.16	0.36	0.18	**2.7**	0.20	0.30	0.18	0.17	1.7	0.24	0.22	0.21
FREON11	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
FURAN	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	TRACE	<0.050	<0.050	<0.050
ACRYLONITRILE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
PENTANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
2-METHYL-2-PROPANOL	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	TRACE	<0.050	<0.050	<0.050	<0.050	0.071	<0.050	<0.050	<0.050
METHYLACETATE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.052	0.064	0.058	TRACE	<0.050	TRACE	0.050	TRACE
1,1-DICHLOROETHENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
DICHLOROMETHANE	<0.050	<0.050	<0.050	<0.050	TRACE	<0.050	0.089	TRACE	TRACE	TRACE	TRACE	0.21	TRACE	TRACE	<0.050
3-CHLOROPROPENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
FREON113	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
N-PROPANOL	<0.050	<0.050	<0.050	0.084	TRACE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,1-DICHLOROETHANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
BUTANAL	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
2-BUTANONE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	TRACE	<0.050	<0.050	<0.050	<0.050	TRACE	TRACE	TRACE	TRACE
CIS-1,2-DICHLOROETHENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
2-METHYLFURAN	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
ETHYLACETATE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	0.071	0.077	0.069	0.050	<0.050	0.076	0.097	0.094
HEXANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
CHLOROFORM	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
2-BUTENAL	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,2-DICHLOROETHANE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.050	TRACE	TRACE	TRACE
1,1,1-TRICHLOROETHANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
N-BUTANOL	0.091	0.074	0.099	0.13	0.084	0.082	0.094	0.088	0.092	0.082	0.087	0.090	0.083	0.084	0.091
BENZENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
CARBONTETRACHLORIDE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
2-PENTANONE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
2-METHYLHEXANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.068	<0.050	<0.050	<0.050	<0.050	0.11	<0.050	<0.050	<0.050
2,3-DIMETHYLPENTANE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	0.098	TRACE	TRACE	TRACE	TRACE	0.15	TRACE	TRACE	TRACE
PENTANAL	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
3-METHYLHEXANE	TRACE	TRACE	TRACE	<0.050	<0.050	TRACE	0.16	<0.050	TRACE	TRACE	TRACE	0.22	TRACE	TRACE	TRACE
1,2-DICHLOROPROPANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,4-DIOXANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
TRICHLOROETHENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
2,5-DIMETHYLFURAN	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
N-HEPTANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.057	<0.050	<0.050	<0.050	<0.050	0.096	<0.050	<0.050	<0.050
4-METHYL2-PENTANONE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
CIS-1,3-DICHLOROPROPENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
2-PENTENAL	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
TRANS-1,3-DICHLOROPROPENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,1,2-TRICHLOROETHANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
TOLUENE	0.080	0.080	0.082	0.063	0.066	0.061	0.23	0.057	0.065	0.062	0.065	0.36	0.086	0.082	0.075
HEXANAL	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
MESITYLOXIDE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,2-DIBROMOETHANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
BUTYLACETATE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
OCTANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
TETRACHLOROETHENE	TRACE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.31	<0.050	<0.050	<0.050
CHLOROBENZENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
ETHYLBENZENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	TRACE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
M/P-XYLENES	<0.050	<0.050	TRACE	<0.050	<0.050	<0.050	TRACE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
2-HEPTANONE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
CYCLOHEXANONE	TRACE	<0.050	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.050	<0.050	TRACE	<0.050	<0.050	<0.050
HEPTANAL	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
STYRENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,1,2,2-TETRACHLOROETHANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
O-XYLENE	0.096	0.097	0.12	0.086	0.095	0.094	0.064	0.13	0.13	0.12	0.11	0.18	0.072	0.090	0.087

NONANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,3,5-TRIMETHYLBENZENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,2,4-TRIMETHYLBENZENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,3-DICHLOROBENZENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,4-DICHLOROBENZENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,2-DICHLOROBENZENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,2,4-TRICHLOROBENZENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
HEXACHLORO-1,3-BUTADIENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
TARGET COMPOUNDS (TOXIC)++++															
1,3-BUTADIENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
ETHYLENE OXIDE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
CARBON DISULFIDE	TRACE	<0.050	TRACE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
2-METHYL-2-PROPENAL	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	TRACE	<0.050	<0.050	<0.050	<0.050	TRACE	<0.050	<0.050	<0.050
3-BUTEN-2-ONE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
2-ETHOXYETHANOL	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
DIMETHYLDISULFIDE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
OCTAMETHYLCYCLOTETRASILOXANE	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##
NON-TARGET COMPOUNDS++++															
OCTAFLUOROPROPANE++	100	140	73	67	60	68	95	82	79	67	67	8.0	62	67	54
SULFURHEXAFLUORIDE	0.12	0.15	0.10	0.082	TRACE	0.057	0.080	0.074	0.068	TRACE	0.085	<0.050	0.074	<0.050	<0.050
PROPENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
CHLORODIFLUOROMETHANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	TRACE	<0.050	<0.050	<0.050	<0.050
CARBONYLSULFIDE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	TRACE	<0.050	<0.050	<0.050	<0.050	TRACE	<0.050	<0.050	<0.050
2-METHYLPROPANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	TRACE	<0.050	<0.050	<0.050	<0.050	0.23	<0.050	<0.050	<0.050
1-BUTENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	TRACE	<0.050	<0.050	<0.050	<0.050	0.076	<0.050	<0.050	<0.050
FLUOROTRIMETHYLSILANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.28	<0.050	<0.050	<0.050	<0.050	0.062	<0.050	<0.050	<0.050
2-METHYL-1,3-BUTADIENE(ISOPRENE)	0.060	0.064	0.071	0.057	0.060	0.066	TRACE	0.060	0.068	0.067	0.054	<0.050	0.066	0.064	0.062
TRIMETHYLSILANOL	0.20	0.085	0.16	0.19	0.23	0.18	6.6	0.37	0.33	0.27	0.24	1.5	0.43	0.37	0.29
HEXAMETHYLDISILOXANE	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##
PENTAMETHYLDISILOXANE-1-OL	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##
HEXAMETHYLCYCLOTRISILOXANE	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##
C11-ALKANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.11	<0.050	<0.050	<0.050
C11-ALKANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.18	<0.050	<0.050	<0.050
C11-ALKANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.067	<0.050	<0.050	<0.050	<0.050	0.24	<0.050	<0.050	<0.050
2-ETHYLHEXANOL	0.081	0.056	0.088	0.066	0.090	0.063	0.090	0.10	0.083	0.067	TRACE	0.084	0.070	0.072	0.074
C11-ALKENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
C11-ALKANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.12	<0.050	<0.050	<0.050
C11-ALKANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
C11-ALKANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.081	<0.050	<0.050	<0.050	<0.050	0.31	<0.050	<0.050	<0.050
LIMONENE	0.075	0.066	0.082	0.071	0.082	0.097	TRACE	TRACE	TRACE	TRACE	<0.050	TRACE	<0.050	<0.050	<0.050
C11-ALKANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.069	<0.050	<0.050	<0.050	<0.050	0.26	<0.050	<0.050	<0.050
C12-ALKANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.078	<0.050	<0.050	<0.050	<0.050	0.28	<0.050	<0.050	<0.050
C12-ALKANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.12	<0.050	<0.050	<0.050
C12-ALKANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.10	<0.050	<0.050	<0.050
DECAMETHYLCYCLOPENTASILOXANE	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##
DODECAMETHYLPENTASILOXANE	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##
TOTAL ALCOHOLS PLUS ACETONE	**5.8**	**6.1**	**6.8**	**3.9**	**4.0**	**4.0**	**6.0**	**4.1**	**4.5**	**4.1**	**3.9**	**5.3**	**4.3**	**4.3**	**4.1**
TARGET COMPOUNDS (GC)+++															
CARBON MONOXIDE	1.8	2.0	1.8	1.8	2.0	2.2	1.7	2.1	2.1	1.7	1.9	1.4	2.0	1.8	2.6
METHANE	6.7	7.2	7.0	19	19	19	11	19	18	19	21	TRACE	21	20	20
HYDROGEN	2.7	3.4	3.6	3.3	3.3	3.4	< 0.41	3.5	3.3	3.3	3.0	< 0.41	3.3	3.4	3.4
CARBON DIOXIDE	6700	8200	7300	6900	7300	7600	5100	7000	7000	7400	8400	1200	6400	5900	6300
TOTAL CONCENTRATION (NON-METHANE HYDROCARBONS)	**110**	**150**	**81**	**72**	**65**	**73**	**110**	**87**	**85**	**72**	**72**	**19**	**68**	**73**	**59**
TOTAL CONCENTRATION - OFP (NON-METHANE HYDROCARBONS)	**6.8**	**6.9**	**7.9**	**4.7**	**4.9**	**5.0**	**15**	**5.3**	**5.7**	**5.1**	**5.0**	**11**	**5.5**	**5.4**	**5.0**

*** FROM GC/FID RESULTS**

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

++ Measurements are quantified 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 2
ANALYTICAL RESULTS OF
24S RETURN MINI-GRAB SAMPLE CONTAINER AIR SAMPLES

CHEMICAL CONTAMINANT	T-VALUE (180-d SMAC)														
	AA05052 S/N 2047 LAB 12/21/10 @ 13:30 GMT	**AA05053 S/N 2042 JEM 12/21/10 @ 13:31 GMT**	**AA05054 S/N 2039 SM 12/21/10 @ 13:35 GMT**	**AA05055 S/N 2045 LAB 01/14/11 @ 15:12 GMT**	**AA05056 S/N 2048 COLUMBUS 01/14/11 @ 15:16 GMT**	**AA05057 S/N 2051 SM 01/14/11 @ 15:20 GMT**	**AA05058 S/N 2043 HTV2 01/27/11 @ 21:00 GMT**	**AA05059 S/N 2044 JEM 02/14/11 @ 10:47 GMT**	**AA05060 S/N 2041 LAB 02/14/11 @ 10:50 GMT**	**AA05061 S/N 2056 SM 02/14/11 @ 23:00 GMT**	**AA05062 S/N 2050 ATV2 VESTIBULE 02/25/11 @ 15:27 GMT**	**AA05063 S/N 2058 ATV2 CENTER VOLUME 02/25/11 @ 16:14 GMT**	**AA05064 S/N 2046 COLUMBUS 03/15/11 @ 11:30 GMT**	**AA05065 S/N 2049 LAB 03/15/11 @ 11:30 GMT**	**AA05066 S/N 2052 SM 03/15/11 @ 13:20 GMT**
TARGET COMPOUNDS (TO-14/POLAR)															
FREON12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHLOROMETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FREON114	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
METHANOL	0.00706	0.01496	0.00982	0.00710	0.00538	0.00730	0.00698	0.00617	0.00728	0.00693	0.00774	0.00863	0.00661	0.00740	0.00647
ACETALDEHYDE	0.03488	0.03977	0.03437	0.03572	0.03572	0.04131	0.03046	0.02829	0.03124	0.03359	0.08236	0.07877	0.03572	0.03378	0.02794
VINYLCHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BROMOMETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ETHANOL *	**0.00232**	**0.00212**	**0.00269**	**0.00124**	**0.00129**	**0.00136**	0.00110	**0.00148**	**0.00154**	**0.00141**	**0.00130**	0.00092	**0.00152**	**0.00147**	**0.00140**
CHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ACETONITRILE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PROPENAL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ACETONE	0.00551	0.00550	0.00640	0.00734	0.00833	0.00798	0.00688	0.00654	0.00783	0.00703	0.00694	0.01695	0.00763	0.00853	0.00765
PROPANAL	0.00227	ND	0.00227	ND	ND	ND	0.00227	ND	ND	ND	ND	ND	ND	ND	ND
ISOPROPANOL*	0.00090	0.00092	0.00097	0.00105	0.00243	0.00120	**0.01802**	0.00134	0.00197	0.00117	0.00114	0.01149	0.00160	0.00145	0.00137
FREON11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FURAN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.35714	ND	ND	ND
ACRYLONITRILE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PENTANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYL-2-PROPANOL	ND	ND	ND	ND	ND	ND	0.00021	ND	ND	ND	ND	0.00059	ND	ND	ND
METHYLACETATE	ND	ND	ND	ND	ND	ND	ND	0.00043	0.00053	0.00048	0.00021	ND	0.00021	0.00042	0.00021
1,1-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DICHLOROMETHANE	ND	ND	ND	ND	0.00250	ND	0.00890	0.00250	0.00250	0.00250	0.00250	0.02141	0.00250	0.00250	ND
3-CHLOROPROPENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FREON113	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-PROPANOL	ND	ND	ND	0.00086	0.00026	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-DICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BUTANAL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-BUTANONE	ND	ND	ND	ND	ND	ND	0.00083	ND	ND	ND	ND	0.00083	0.00083	0.00083	0.00083
CIS-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYLFURAN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ETHYLACETATE	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	0.00039	0.00043	0.00038	0.00028	ND	0.00042	0.00054	0.00052
HEXANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHLOROFORM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-BUTENAL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DICHLOROETHANE	0.01563	0.01563	0.01563	0.01563	0.01563	0.01563	0.01563	0.01563	0.01563	0.01563	0.01563	ND	0.01563	0.01563	0.01563
1,1,1-TRICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-BUTANOL	0.00227	0.00184	0.00248	0.00335	0.00210	0.00206	0.00235	0.00221	0.00230	0.00204	0.00217	0.00226	0.00209	0.00209	0.00226
BENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CARBONTETRACHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-PENTANONE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYLHEXANE	ND	ND	ND	ND	ND	ND	0.00567	ND	ND	ND	ND	0.00914	ND	ND	ND
2,3-DIMETHYLPENTANE	0.00208	0.00208	0.00208	0.00208	0.00208	0.00208	0.00813	0.00208	0.00208	0.00208	0.00208	0.01211	0.00208	0.00208	0.00208
PENTANAL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-METHYLHEXANE	0.00208	0.00208	0.00208	ND	ND	0.00208	0.01316	ND	0.00208	0.00208	0.00208	0.01859	0.00208	0.00208	0.00208
1,2-DICHLOROPROPANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-DIOXANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TRICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,5-DIMETHYLFURAN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-HEPTANE	ND	ND	ND	ND	ND	ND	0.00476	ND	ND	ND	ND	0.00802	ND	ND	ND
4-METHYL2-PENTANONE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CIS-1,3-DICHLOROPROPENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-PENTENAL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TRANS-1,3-DICHLOROPROPENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-TRICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOLUENE	0.00530	0.00535	0.00549	0.00421	0.00439	0.00409	0.01505	0.00380	0.00434	0.00411	0.00435	0.02417	0.00572	0.00549	0.00501
HEXANAL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MESITYLOXIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DIBROMOETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BUTYLACETATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
OCTANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TETRACHLOROETHENE	0.00074	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00922	ND	ND	ND
CHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ETHYLBENZENE	ND	ND	ND	ND	ND	ND	0.00050	ND	ND	ND	ND	ND	ND	ND	ND
M/P-XYLENES	ND	ND	0.00068	ND	ND	ND	0.00068	ND	ND	ND	ND	ND	ND	ND	ND
2-HEPTANONE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CYCLOHEXANONE	0.00042	ND	0.00042	0.00042	0.00042	0.00042	0.00042	0.00042	0.00042	ND	ND	0.00042	ND	ND	ND
HEPTANAL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
STYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-TETRACHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
O-XYLENE	0.00259	0.00263	0.00323	0.00233	0.00257	0.00255	0.00172	0.00347	0.00346	0.00335	0.00305	0.00492	0.00194	0.00243	0.00235
NONANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-TRIMETHYLBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-TRIMETHYLBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-TRICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLORO-1,3-BUTADIENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

TARGET COMPOUNDS (TOXIC)															
1,3-BUTADIENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ETHYLENE OXIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CARBON DISULFIDE	0.00156	ND	0.00156	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYL-2-PROPENAL	ND	ND	ND	ND	ND	ND	0.01471	ND	ND	ND	ND	0.01471	ND	ND	ND
3-BUTEN-2-ONE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-ETHOXYETHANOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIMETHYLDISULFIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
OCTAMETHYLCYCLOTETRASILOXANE	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##

NON-TARGET COMPOUNDS															
OCTAFLUOROPROPANE++	0.00123	0.00162	0.00086	0.00079	0.00071	0.00080	0.00112	0.00096	0.00093	0.00079	0.00079	0.00009	0.00073	0.00079	0.00063
SULFURHEXAFLUORIDE	0.00010	0.00013	0.00009	0.00007	0.00002	0.00005	0.00007	0.00006	0.00006	0.00002	0.00007	ND	0.00006	ND	ND
PROPENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHLORODIFLUOROMETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00001	ND	ND	ND	ND
CARBONYLSULFIDE	ND	ND	ND	ND	ND	ND	0.00208	ND	ND	ND	ND	0.00208	ND	ND	ND
2-METHYLPROPANE	ND	ND	ND	ND	ND	ND	0.00010	ND	ND	ND	ND	0.00096	ND	ND	ND
1-BUTENE	ND	ND	ND	ND	ND	ND	0.00005	ND	ND	ND	ND	0.00017	ND	ND	ND
FLUOROTRIMETHYLSILANE	ND	ND	ND	ND	ND	ND	0.56538	ND	ND	ND	ND	0.12487	ND	ND	ND
2-METHYL-1,3-BUTADIENE(ISOPRENE)	0.02003	0.02126	0.02379	0.01906	0.02014	0.02188	0.00833	0.02009	0.02269	0.02241	0.01805	ND	0.02189	0.02121	0.02057
TRIMETHYLSILANOL	0.05039	0.02136	0.04040	0.04870	0.05694	0.04452	1.65276	0.09207	0.08148	0.06754	0.05984	0.38545	0.10768	0.09162	0.07361
HEXAMETHYLDISILOXANE	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##
PENTAMETHYLDISILOXANE-1-OL	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##
HEXAMETHYLCYCLOTRISILOXANE	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##
C11-ALKANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00235	ND	ND	ND
C11-ALKANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00383	ND	ND	ND
C11-ALKANE	ND	ND	ND	ND	ND	ND	0.00140	ND	ND	ND	ND	0.00501	ND	ND	ND
2-ETHYLHEXANOL	0.00153	0.00106	0.00165	0.00124	0.00169	0.00119	0.00169	0.00190	0.00156	0.00126	0.00047	0.00158	0.00132	0.00135	0.00140
C11-ALKENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C11-ALKANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00240	ND	ND	ND
C11-ALKANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C11-ALKANE	ND	ND	ND	ND	ND	ND	0.00169	ND	ND	ND	ND	0.00643	ND	ND	ND
LIMONENE	0.00065	0.00058	0.00071	0.00062	0.00071	0.00084	0.00022	0.00022	0.00022	0.00022	ND	0.00022	ND	ND	ND
C11-ALKANE	ND	ND	ND	ND	ND	ND	0.00144	ND	ND	ND	ND	0.00541	ND	ND	ND
C12-ALKANE	ND	ND	ND	ND	ND	ND	0.00150	ND	ND	ND	ND	0.00532	ND	ND	ND
C12-ALKANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00228	ND	ND	ND
C12-ALKANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00197	ND	ND	ND
DECAMETHYLCYCLOPENTASILOXANE	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##
DODECAMETHYLPENTASILOXANE	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##

TARGET COMPOUNDS (GC)															
CARBON MONOXIDE	0.10331	0.11572	0.10641	0.10301	0.11564	0.12969	0.10180	0.12408	0.12081	0.09890	0.11152	0.08186	0.11449	0.10391	0.15257
METHANE	0.00191	0.00204	0.00199	0.00542	0.00551	0.00545	0.00307	0.00530	0.00526	0.00536	0.00590	0.00023	0.00590	0.00576	0.00579
HYDROGEN	0.00789	0.01012	0.01056	0.00962	0.00960	0.01005	0.00000	0.01014	0.00973	0.00957	0.00874	0.00000	0.00971	0.00988	0.00993
CARBON DIOXIDE	0.51872	0.62857	0.55966	0.52948	0.55932	0.58393	0.38953	0.54180	0.53465	0.57276	0.64688	0.08935	0.49488	0.45084	0.48596

TOTAL T-VALUE	**0.79153**	**0.89548**	**0.83644**	**0.79947**	**0.85349**	**0.88658**	**2.89080**	**0.87137**	**0.86102**	**0.86162**	**0.98410**	**1.32215**	**0.84324**	**0.77208**	**0.82626**

TOTAL T-VALUE - OFP	**0.79029**	**0.89386**	**0.83557**	**0.79869**	**0.85278**	**0.88578**	**2.88968**	**0.87040**	**0.86009**	**0.86083**	**0.98331**	**1.32206**	**0.84251**	**0.77129**	**0.82563**

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

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

TRACE: Amount detected is sufficient for compound identification only.