JSC TOXICOLOGY GROUP

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Memorandum Number

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SUBJECT: Toxicological Assessment of ISS Air and Water Quality: May 2014 – September 2014 (Increment 40), including Orb-2 and ATV-5 First Ingresses and a Contingency Sample from the SM

SUMMARY: Based on these limited data, air quality was acceptable on ISS for this period, and potable water remains acceptable for crew consumption.

AIR QUALITY

A summary of the analytical results is provided in Table 1. Data shaded in grey are suspect. Although the mini grab sample container (mGSC) passed the formal leak check procedure, post-flight pressure checking suggested a possible leak. See toxicological evaluation of ISS Air Quality for more detailed information. May samples, collected 4/28/2014, were previously provided in the Increment 39 report.

Table 1. Analytical Summary of ISS air analyses

Sample Location	Sample Date	NMVOCs[a] (mg/m^3)	Freon 218 (mg/m^3)	Alcohols[b] (mg/m^3)	T-Value[c] (units)	CO_2 (mg/m^3)	Formaldehyde (µg/m^3)
Lab	6/2/2014	20	5.0	15	0.4	7300	34
SM	6/2/2014	21	3.9	16	0.4	7500	27
SM Contingency	6/10/2014	54	5.6	26	--[d]	9800	--
Lab	7/1/2014	18	5.1	13	0.4	6400	35
JEM	7/1/2014	17	4.3	12	0.4	6500	--
SM	7/1/2014	--	--	--	--	--	26
Orb-2 Ingress	7/17/2014	18	2.2	6.6	0.4[e] 1.2	4000	
Lab	7/29/2014	19	2.8	15	0.4	7400	33
Col	7/29/2014	49	0.5	5.5	31	2000	--
SM	--	--	--	--	--	--	22
ATV-5 Ingress	8/13/2014	56	1.3	7.2	2.9 6.9	3000	--
Lab	9/3/2014	11	2.3	7.4	0.4	8200	29
SM	9/3/2014	11	5.1	7.3	0.4	8600	25
Guideline		*<25*	---	*<5*	*<1*[f]	*<9300*	*<120*

[a]Non-methane volatile organic hydrocarbons, excluding Freon 218
[b]Includes acetone
[c]Sum of the ratios of the measured concentration and the corresponding 180-day SMAC for each compound, excluding CO_2
[d]Contingency exposures are not expected to last for 180-days, and therefore, this T-value was not calculated.
[e]Value based on 7-day SMACs used for evaluating first ingress.
[f]T-value <1 used to evaluate routine monthly sampling; T-value <3 used to evaluate first ingress samples

Eleven mGSCs were collected on ISS during Increment 40 and were returned on 38S. Of these, 8 were collected as routine archive samples, 1 was collected during Orbital-2 (Orb-2) first ingress, 1 was collected during ATV-5 first

ingress, and 1 contingency sample was collected during a smoke event in the Russian Service Module (SM) on 6/10/2015. Four pairs of passive-diffusion formaldehyde badges were also deployed in the US Lab and SM during this Increment and were returned aboard 39S.

Complete data tables of all measured concentrations and corresponding T-values based on 180-day SMACs for the routine archive samples are enclosed. Data tables containing T-values based on both the 7-day and 180-day SMACs are enclosed for the first ingress samples, as well as data tables containing the measured concentrations of the compounds detected in the contingency sample. No T-value table is provided for the contingency sample, because short-term SMACs are not available for all compounds detected. The detection limit for all target compounds was 0.025 mg/m^3, with the exception of m/p-xylenes and hexachloro-1,3-butadiene, which were 0.05 and 0.075 mg/m^3, respectively. The average relative recoveries of the 3 surrogate standards from the mGSCs were as follows: ^{13}C-acetone, 104 ± 5%; fluorobenzene-d_5, 98 ± 5%; and chlorobenzene-d_5, 90 ± 11%. For the passive-diffusion formaldehyde badges, positive control recoveries (1 trip and 1 lab control) were 96% and 110%, respectively.

During Increment 40, one Air Quality Monitor (AQM) unit (S/N 1003) was located in Col from 4/10/2014-6/6/2014. The unit was relocated to the JEM from 6/6/2014 – 7/25/2014, and then returned to the Lab. The other AQM unit remained in the US Lab throughout the Increment. Simultaneous automated sampling sessions are scheduled every 73 hours, which results in 2-3 sampling sessions per unit per week. Nominally, data are received weekly. Monthly average concentrations for Increment 40 are presented in Table 2.

Table 2. Average monthly concentrations (mg/m^3) of AQM target compounds.

	May	June	July	August	September	Average
2-Propanol	0.2[b]	0.1[c]	0.1[c]	0.1[a]	0.1[a]	0.1
Acetone	0.3[b]	0.2[c]	0.3[c]	0.2[a]	0.2[a]	0.2
Acrolein	ND	ND	ND	ND	ND	ND
Benzene	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND
DMCPS[d]	1.8[b]	1.7[c]	1.7[c]	1.6[a]	1.5[a]	1.6
Hexanal	ND	ND	ND	ND	ND	ND
Hexane	ND	ND	ND	ND	ND	ND
m,p-Xylenes	ND	ND	ND	ND	ND	ND
Methanol	0.4[b]	0.4[c]	0.4[c]	0.4[a]	0.4[a]	0.4
o-Xylene	TRACE	TRACE	TRACE	0.1[a]	0.1[a]	0.1
OMCTS[e]	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE
Toluene	ND	ND	ND	ND	ND	ND
2-Butanone	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE
Acetaldehyde	0.1[a]	0.1[a]	0.1[a]	0.1[a]	0.1[a]	0.1
Dichloromethane	0.1[a]	0.1[a]	0.1[a]	TRACE	0.1[a]	0.1
Ethanol	5.0[a]	7.9[a]	7.7[a]	6.3[a]	6.4[a]	6.7
Ethyl Acetate	0.1[a]	0.1[a]	0.1[a]	0.1[a]	TRACE	0.1
HMCTS[f]	1.9[a]	1.7[a]	1.7[a]	1.7[a]	1.8[a]	1.8
n-Butanol	0.2[a]	0.2[a]	0.2[a]	0.2[a]	0.2[a]	0.2
Trimethylsilanol	0.3[a]	0.3[a]	0.3[a]	0.3[a]	0.3[a]	0.3

[a]Concentrations detected in Lab
[b]Concentrations detected in Col
[c]Concentrations detected in JEM
[d]Decamethylcyclopentasiloxane
[e]Octamethylcylcotetrailoxane
[f]Hexamethycyclotrisiloxane

Toxicological Evaluation of ISS Air Quality

Routine sampling: Routine monthly mGSC sampling provides a limited set of samples on which to perform an air quality assessment, but is complementary to in-flight air monitoring data collected by the AQMs. With the exception of the sample collected in Columbus in July, T-values for all routine samples (mGSC and AQM) collected during Increment 40 were below 1 in all locations, indicating no concern for crew health. The high T-value noted in the July Columbus sample was due almost exclusively to the presence of hexafluoro-1-propene. This compound has not been detected on ISS previously, and was not seen in any other sample collected during this Increment. Short-term exposure to this compound, if present, would not be expected to cause adverse effects. Historical data and data from the AQM survey of the USOS indicate fairly uniform mixing across the USOS, and data from the mGSC in the Lab and data from the AQM on 7/29/2014 indicate no compounds of concern. Although the mGSC passed the formal leak check procedure, a possible leak or inadvertent activation is suggested by the low concentrations of CO_2 and Freon 218 present in the sample. **Taken together, the evidence strongly suggests that the sample collected in Columbus on 7/29/2014 was an invalid sample and not representative of ISS air.** In addition, we are not aware of any reports of mucosal or ocular irritation, headache, or nausea from crew during this time.

Increment T-values from mGSCs (Table 1 and Figure 1) and the AQM (Figure 2) correlate well, with average total values ~0.4 units. The primary contributors to the total T-value across all routine sampling locations throughout this time period were hexamethylcyclotrisiloxane (HMCTS) and acetaldehyde. These compounds were measured well below levels of health concern, but HMCTS may contribute to periodic accumulation of siloxane compounds in the water recovery system (see Water Quality).

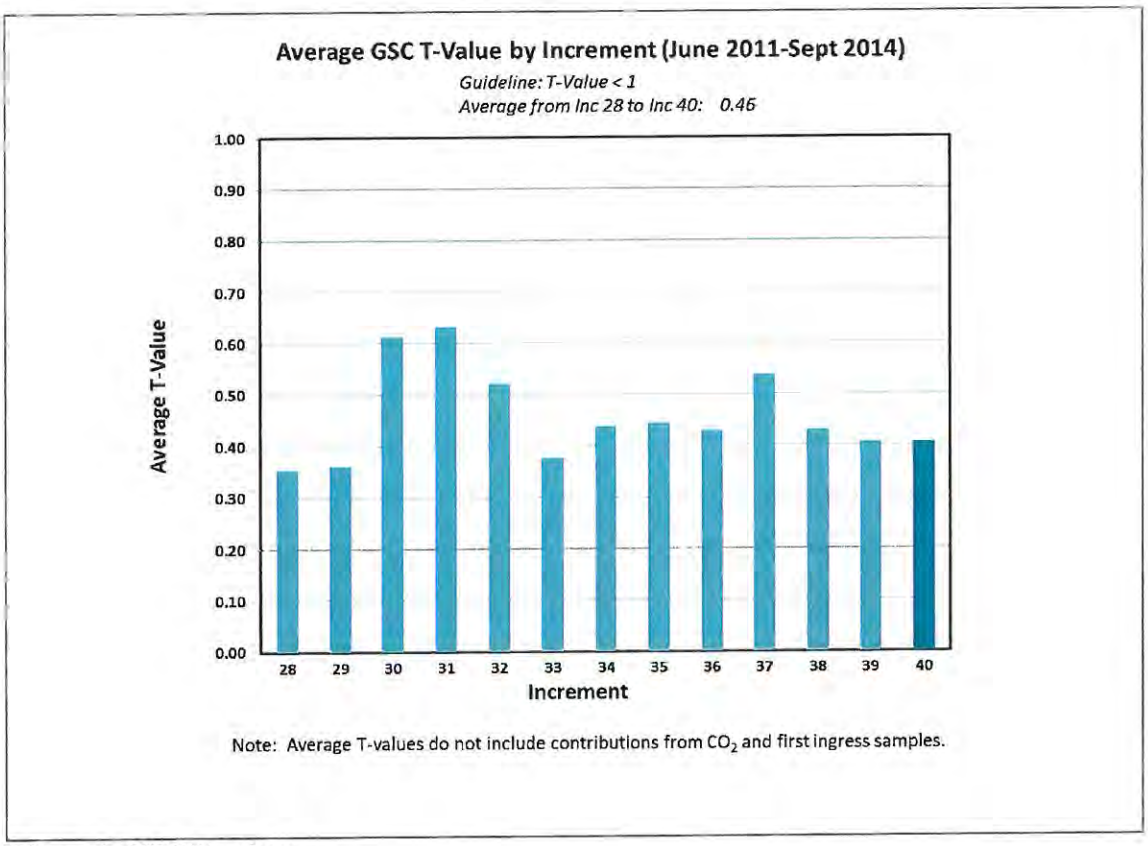

Figure 1. GSC T-values

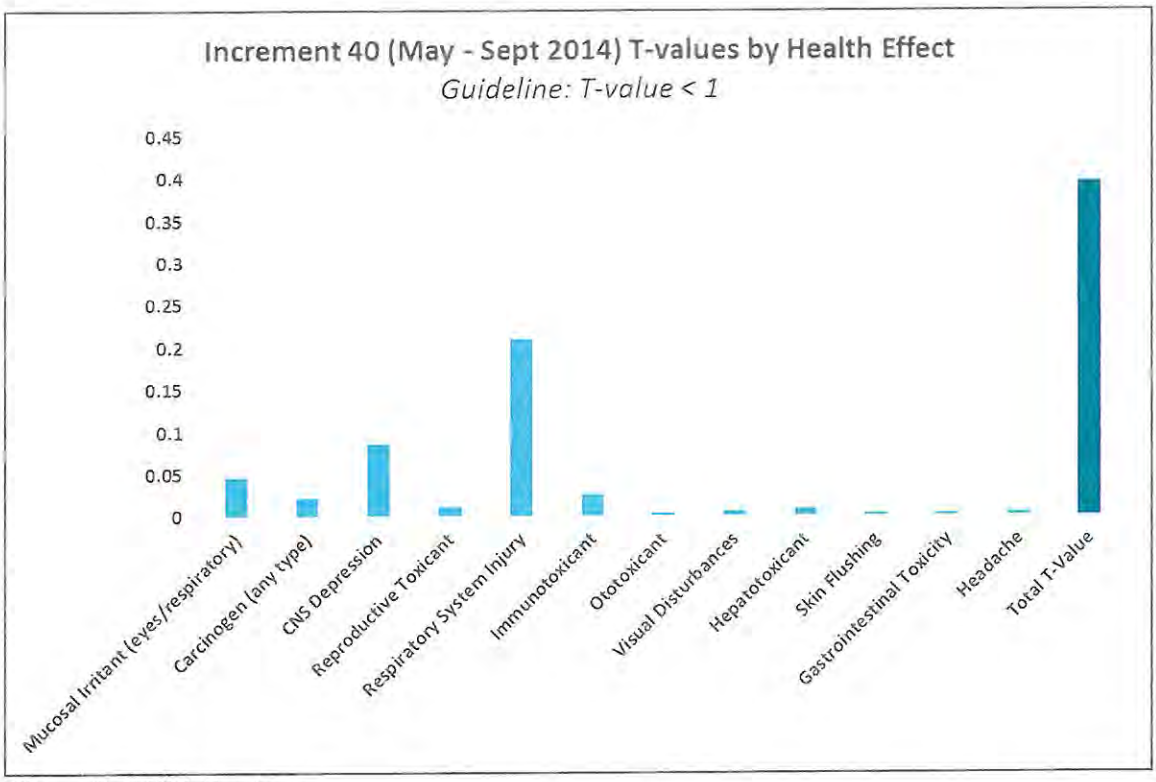

Figure 2. AQM T-values

The mGSCs provide only a snapshot of conditions and are not ideal for evaluating potential CO_2 exposures; however, reported levels were below 4 mmHg (9300 mg/m^3), as requested for this Increment in Chit 012325. **Notably, alcohol values in all routine monthly samples continue to exceed the alcohol guideline of <5 mg/m^3, which is intended to protect the water recovery system from risk of overloading.** These levels are primarily due to a sustained increase in ethanol levels on ISS. We are unaware of any new sources of ethanol but have notified ECLS engineers that levels remain elevated. Formaldehyde levels in the US Lab (shown in Table 1 and Figure 3) are generally consistent with historic levels, and remain below the SMAC of 120 μg/m^3. Levels have returned to baseline after the brief excursion in the US Lab in April.

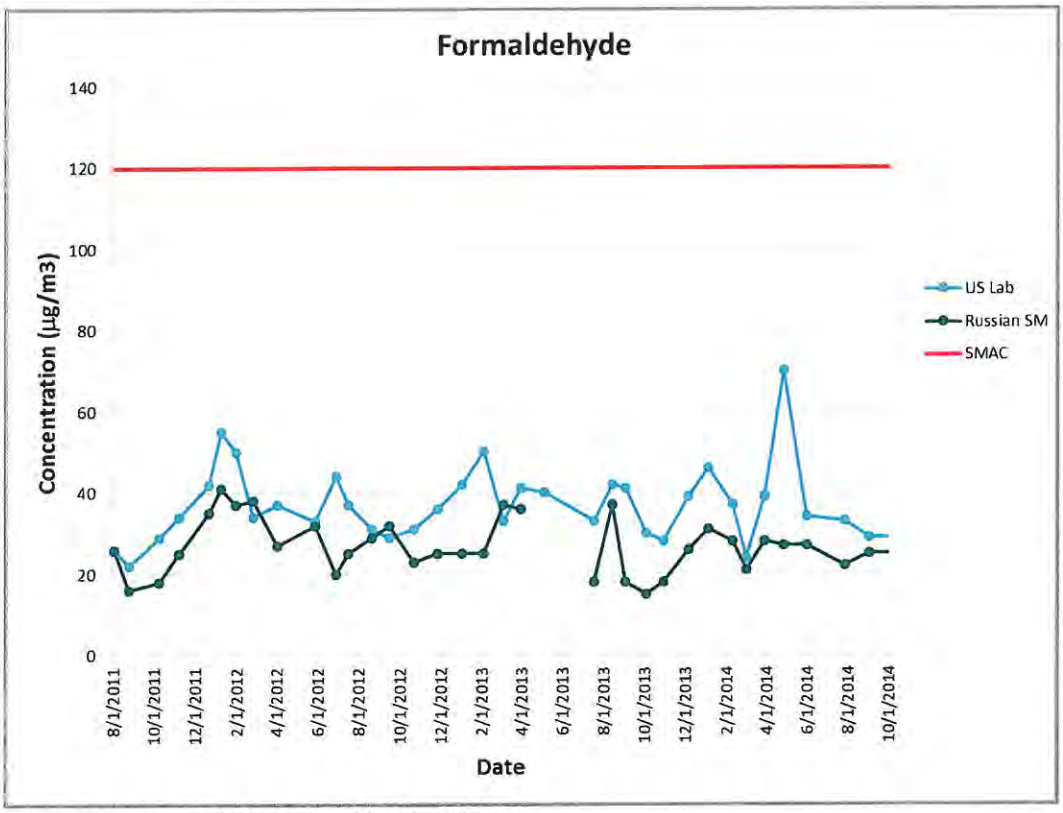

Figure 3. Formaldehyde trending in ISS air.

Orb-2 First Ingress: A pre-launch off-gas test was not conducted for Orb-2, but the predicted T-value was estimated to range between 0.5-0.7 units based on the pre-flight off-gas tests performed on Orb-D1 and Orb-1. The measured T-value on ISS was 0.4 units based on 7-day SMACs. The sample was collected 10 minutes after hatch opening. CO_2 and Freon 218 levels measured in the first ingress sample indicate that some mixing did occur with the ISS atmosphere prior to sample collection; however, mixing was much less complete than that seen for SpX-3, which occurred 18 minutes after hatch opening.

ATV-5 First Ingress: The measured T-value during first ingress was 2.9 units. The sample was collected 17 minutes after hatch opening; however, due to the larger volume of ATV, CO_2 and Freon 218 levels measured in the first ingress sample indicate that only limited mixing occurred with the ISS atmosphere prior to sample collection. The primary contributors to the T-value were trimethylsilanol (TMS), fluorotrimethylsilane, HMCTS, and acetaldehyde. TMS and related silanol compounds were detected as primary contributors during the pre-flight off-gas test conducted by ESA. TMS is the only individual compound that exceeded its 7-day SMAC. The SMAC is set to protect against CNS depression seen in rodents exposed to oral doses of TMS and may be conservative since there are no data available for inhalation exposures. We did not receive any reports of crew symptoms at first ingress, and while the AQM showed slightly elevated TMS levels for approximately 1 month after ATV-5 docking, the levels diluted across the stack were below the SMAC.

SM Contingency Sample: On June 10, 2014, crew reported smoke coming from the BRP-M. Crew pressed the manual alarm to shut off ventilation and removed power from the SRV-K which stopped the smoke. Crew took CSA-CP readings and collected a contingency GSC sample. Approximately 30 target compounds and an additional 13 non-target compounds were detected at levels higher than those nominally detected on ISS. All of the non-target compounds were detected at low concentrations and would not be of concern for short-term exposure. Of the target compounds, carbon monoxide (CO), chloromethane, acetaldehyde, acetone, 2-methyl-2-propanol, 2-methylfuran, n-butanol, benzene, chlorobenzene, 1,4-dichlorobenzene, 1,2-dichlorobenzene, and 2-methyl-1-propene were notably elevated. These compounds are generally consistent with a smoke/overheating event. CO levels detected in

the GSC (9 mg/m^3 or 8 ppm) were consistent with CO levels reported by the CSA-CPs (9-11 ppm) and were well below masking limits. Measured concentrations of acetaldehyde, acetone, n-butanol, chlorobenzene, 1,4-dichlorobenzene, 1,2-dichlorobenzene, and 2-methyl-1-propene were all measured below 180-day SMAC levels and are therefore not a concern for crew health. Benzene and 2-methylfuran exceeded 180-day SMAC levels but were below contingency (1-hour and 24-hour) SMAC levels and did not persist in the environment, due to scrubbing by the A2 and BMP filters and stowage of the BRP-M in a rubber-lined sealed bag in Progress.

WATER QUALITY

Archive samples were collected from the potable water dispenser (PWD) in the US segment and the SVO-ZV and SRV-K systems in the RS during Increment 40 and were returned on 38S. A summary of select analytical results from those samples is provided in Table 2. Complete data tables for the chemical analyses run on the samples are found in report #2014-WFL-ISSWQ-006.1.

Table 2. Analytical Summary of ISS Water Analyses

Sample Location	Sample Date	TOC (mg/L)	DMSD (mg/L)	Conductivity (µS/cm)	Iodine/Total Iodine (mg/L)	Total Silver (µg/L)
PWD (aux port)	7/7/2014	1.20	4.1	2	2.1/2.6	<2
PWD (ambient)	8/6/2014	1.99	7.2	2	<0.05/<0.05	<2
PWD (hot)	9/3/2014	1.93	6.9	2	<0.05/<0.05	<2
SVO-ZV	9/3/2014	1.15	<0.5	320[a]	--/<0.05	46
SRV-K	9/3/2014	12.0	<0.5	231[a]	--/<0.05	36

[a]Russian water is intentionally mineralized.

Toxicological Evaluation of ISS Water Quality: Routine monthly sampling provides a very limited data set for water quality assessment; however, data from archive samples complement the in-flight data collected by the total organic carbon analyzer (TOCA) and the colorimetric water quality monitor kit (CWQMK). Manganese levels in the SVO-ZV (57 µg/L) and in the SRV-K (85 µg/L) exceeded the MORD limit of 50 µg/L but remained well below the US Spacecraft Water Exposure Guideline (SWEG) of 300 µg/L. All other compounds measured in archive samples were below MORD limits, indicating no concern for crew consumption. Total organic carbon (TOC) data from in-flight and archival sampling of the US potable water system are shown in Figure 4. There was excellent agreement between in-flight levels measured using the TOCA and post-flight archival samples. TOC levels during Increment 40 were notably elevated in the US potable water samples, but remained below the SWEG of 3.0 mg/L. Consistent with previous TOC increases, the primary contributor to the TOC rise was dimethylsilanediol (DMSD). Throughout this time period, DMSD levels remained well below the SWEG of 35 mg/L and did not present a risk to crew health. TOC levels were also elevated in the SRV-K. The primary contributors to the high TOC were ethanol and methanol. The methanol concentration (3.2 mg/L) was well below the SWEG of 40 mg/L, and ethanol also remains well below levels of concern for crew health, but continued monitoring is recommended, especially in light of the elevated alcohol levels that were also seen in the air.

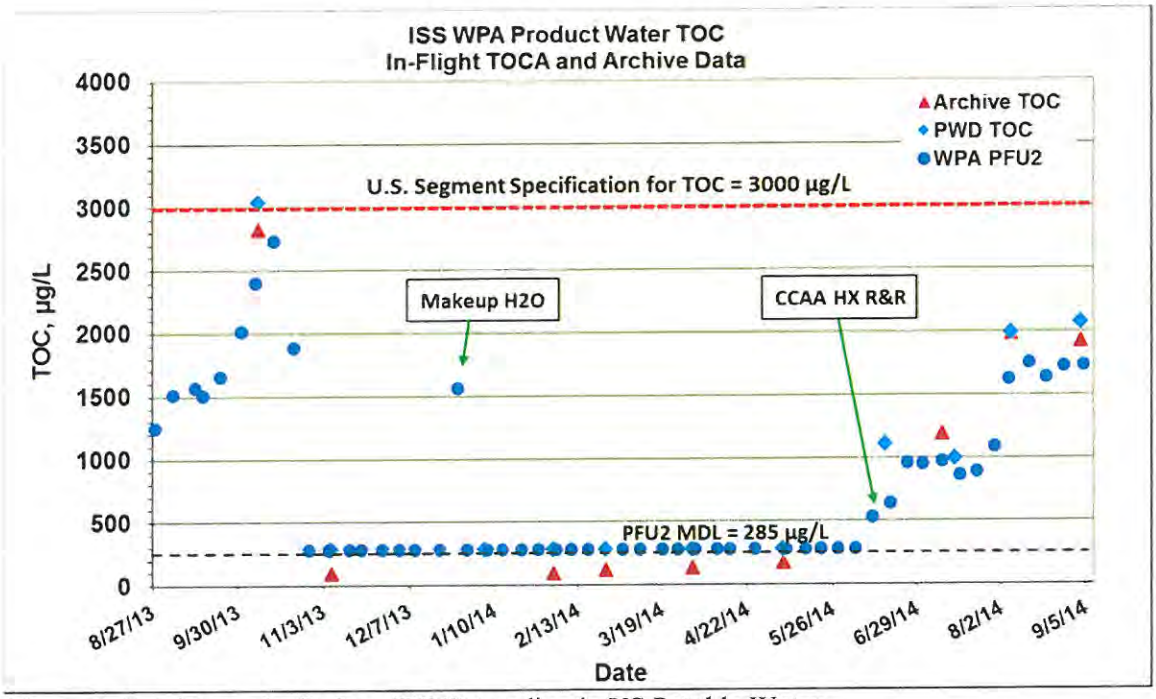

Figure 4. Total Organic Carbon (TOC) trending in US Potable Water

Conductivity provides an indirect measure of the total amount of inorganic contaminants. Inorganic levels in US water were very low, as expected. Inorganic levels in Russian water are consistent with historical averages and do not present any risk for crew health. Iodine and silver are biocides used on the US and Russian segments, respectively. Iodine is added to the water produced by the WPA but is removed prior to crew consumption to avoid potential thyroid dysfunction. The iodine concentration measured in the US product water (2.1 mg/L) water was within the biocidal range of 1-4 mg/L. Total iodine levels measured in samples from the PWD indicate successful removal of the iodine prior to crew consumption. Conversely, silver levels in Russian water samples are expected to remain above the minimal effective biocidal level of 100 µg/L. Levels in the SVO-ZV (46 µg/L) and SRV-K (36 µg/L) samples were well below this acceptable level, which increases the risk of microbial growth. See the Soyuz 38 post-flight report issued by the Environmental Microbiology Laboratory for results from microbial analyses run on the samples.

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2/26/15
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Enclosures
Table 1: Analytical concentrations of compounds found in the mGSCs returned on 38S
Table 2: T-values corresponding to analytical concentrations in Table 1, based on 180-day SMACs
Table 2A: T-values corresponding to the analytical concentrations in Table 1, based on 180-day and 7-day SMACs for Orb-2 and ATV-5 first ingress

TABLE I
ANALYTICAL RESULTS OF
38S RETURN, ORB-2 & ATV-5 INGRESS GSC AIR SAMPLES

CHEMICAL CONTAMINANT	CONCENTRATION (mg/M3)										
	AA05775 SN 2063 SM 6/2/14 @ 11:40 GMT	AA05776 SN 2041 LAB 6/2/14 @ 11:45 GMT	AA05777 SN 2059 SM CONTINGENCY 6/10/14 @ 19:00 GMT	AA05778 SN 2070 LAB 7/1/14 @ 12:30 GMT	AA05779 SN 2074 JPM 7/1/14 @ 12:30 GMT	AA05780 SN 2073 ORB-2 INGRESS 7/17/14 @ 9:12 GMT	AA05781 SN 2075 LAB 7/29/14 @ 10:28 GMT	AA05782 SN 2058 COL 7/29/14 @ 10:30 GMT	AA05783 SN 2076 ATV-5 INGRESS 8/13/14 @ 12:20 GMT	AA05784 SN 2090 SM 9/3/14 @ 16:20 GMT	AA05785 SN 2089 LAB 9/3/14 @ 16:25 GMT
TARGET COMPOUNDS (TO-15)											
FREON12	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
CHLOROMETHANE	<0.025	<0.025	0.443	<0.025	<0.025	TRACE	<0.025	<0.025	0.034	<0.025	<0.025
FREON114	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
METHANOL	0.46	0.40	0.88	0.36	0.32	0.45	0.34	0.43	0.61	0.33	0.30
ACETALDEHYDE	0.43	0.28	1.8	0.32	0.22	0.31	0.34	0.27	0.57	0.26	0.22
VINYLCHLORIDE	<0.025	<0.025	<0.025	<0.025	<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	<0.025	<0.025	<0.025	<0.025
ETHANOL *	**15**	**13**	**14**	**12**	**11**	**4.4**	**14**	**3.1**	**3.6**	**6.4**	**6.3**
CHLOROETHANE	<0.025	<0.025	0.26	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
ACETONITRILE	TRACE	<0.025	0.084	<0.025	<0.025	<0.025	<0.025	<0.025	TRACE	<0.025	<0.025
PROPENAL	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
ACETONE	0.35	0.38	1.4	0.38	0.31	0.40	0.38	0.71	0.59	0.38	0.35
PROPANAL	TRACE	TRACE	0.17	<0.025	TRACE	0.025	TRACE	0.041	0.052	TRACE	<0.025
ISOPROPANOL *	0.13	0.20	0.19	0.31	0.14	1.2	0.23	1.2	**2.3**	0.23	0.23
FREON11	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
FURAN	<0.025	<0.025	0.055	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
ACRYLONITRILE	<0.025	<0.025	TRACE	TRACE	TRACE	<0.025	<0.025	<0.025	<0.025	TRACE	TRACE
PENTANE	<0.025	<0.025	0.053	<0.025	<0.025	<0.025	<0.025	<0.025	0.030	<0.025	<0.025
2-METHYL-2-PROPANOL	<0.025	<0.025	0.72	<0.025	<0.025	0.034	<0.025	0.070	0.12	<0.025	<0.025
METHYLACETATE	TRACE	TRACE	0.045	TRACE	TRACE	TRACE	<0.025	<0.025	<0.025	<0.025	<0.025
1,1-DICHLOROETHENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
DICHLOROMETHANE	TRACE	TRACE	TRACE	TRACE	<0.025	0.036	TRACE	<0.025	0.053	TRACE	TRACE
3-CHLOROPROPENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
FREON113	<0.025	<0.025	<0.025	<0.025	<0.025	0.070	<0.025	<0.025	0.053	<0.025	<0.025
N-PROPANOL	TRACE	TRACE	0.034	0.043	0.040	0.12	TRACE	TRACE	TRACE	0.027	0.038
1,1-DICHLOROETHANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
BUTANAL	<0.025	<0.025	0.042	<0.025	<0.025	<0.025	<0.025	<0.025	TRACE	<0.025	<0.025
2-BUTANONE	TRACE	TRACE	0.13	TRACE	TRACE	0.50	TRACE	TRACE	0.26	TRACE	TRACE
CIS-1,2-DICHLOROETHENE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2-METHYLFURAN	<0.025	<0.025	1.2	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
ETHYLACETATE	0.053	0.052	0.052	0.042	0.036	0.097	0.039	0.064	TRACE	TRACE	TRACE
HEXANE	<0.025	<0.025	0.029	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
CHLOROFORM	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	TRACE	<0.025	<0.025
2-BUTENAL	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
1,2-DICHLOROETHANE	TRACE	TRACE	0.076	TRACE	TRACE	<0.025	TRACE	<0.025	<0.025	TRACE	TRACE
1,1,1-TRICHLOROETHANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
N-BUTANOL *	0.051	0.048	**9.6**	0.080	0.061	0.076	0.049	0.061	0.076	0.057	0.056
BENZENE	<0.025	<0.025	1.7	<0.025	<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	<0.025	<0.025	<0.025	<0.025
2-PENTANONE	<0.025	<0.025	0.034	<0.025	<0.025	TRACE	<0.025	<0.025	<0.025	<0.025	<0.025
2-METHYLHEXANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2,3-DIMETHYLPENTANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
PENTANAL	<0.025	<0.025	TRACE	<0.025	<0.025	<0.025	<0.025	<0.025	TRACE	<0.025	<0.025
3-METHYLHEXANE	TRACE	TRACE	TRACE	TRACE	<0.025	TRACE	TRACE	TRACE	0.031	TRACE	<0.025
1,2-DICHLOROPROPANE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
1,4-DIOXANE	<0.025	<0.025	TRACE	<0.025	<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	<0.025	<0.025	<0.025	<0.025
2,5-DIMETHYLFURAN	<0.025	<0.025	0.035	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
N-HEPTANE	<0.025	<0.025	TRACE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
4-METHYL2-PENTANONE	<0.025	<0.025	<0.025	<0.025	<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	<0.025	<0.025	<0.025	<0.025
2-PENTENAL	<0.025	<0.025	<0.025	<0.025	<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	<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	<0.025	<0.025	<0.025	<0.025
TOLUENE	<0.025	<0.025	0.21	<0.025	<0.025	0.029	<0.025	<0.025	0.11	<0.025	<0.025
HEXANAL	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	TRACE	<0.025	<0.025
MESITYLOXIDE	<0.025	<0.025	<0.025	<0.025	<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	<0.025	<0.025	<0.025	<0.025
BUTYLACETATE	<0.025	<0.025	0.11	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
OCTANE	<0.025	<0.025	TRACE	<0.025	<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	<0.025	<0.025	<0.025	<0.025
CHLOROBENZENE	<0.025	<0.025	4.6	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
ETHYLBENZENE	<0.025	<0.025	TRACE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
M/P-XYLENES	<0.050	<0.050	TRACE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
2-HEPTANONE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
CYCLOHEXANONE	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	TRACE	<0.025	<0.025
HEPTANAL	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	TRACE	<0.025	<0.025
STYRENE	<0.025	<0.025	<0.025	<0.025	<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	<0.025	<0.025	<0.025	<0.025
O-XYLENE	0.034	0.029	0.14	TRACE	TRACE	TRACE	0.052	<0.025	0.12	0.036	0.028
NONANE	<0.025	<0.025	<0.025	<0.025	<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	<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	<0.025	<0.025	<0.025	<0.025
1,3-DICHLOROBENZENE	<0.025	<0.025	0.16	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
1,4-DICHLOROBENZENE	<0.025	<0.025	3.6	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
1,2-DICHLOROBENZENE	<0.025	<0.025	2.2	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
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
HEXACHLORO-1,3-BUTADIENE	<0.075	<0.075	<0.075	<0.075	<0.075	<0.075	<0.075	<0.075	<0.075	<0.075	<0.075

TABLE 1
ANALYTICAL RESULTS OF
38S RETURN, ORB-2 & ATV-5 INGRESS GSC AIR SAMPLES

CHEMICAL CONTAMINANT	CONCENTRATION (mg/M3)										
	AA05775 SN 2063 SM 6/2/14 @ 11:40 GMT	AA05776 SN 2041 LAB 6/2/14 @ 11:45 GMT	AA05777 SN 2059 SM CONTINGENCY 6/10/14 @ 19:00 GMT	AA05778 SN 2070 LAB 7/1/14 @ 12:30 GMT	AA05779 SN 2074 JPM 7/1/14 @ 12:30 GMT	AA05780 SN 2073 ORB-2 INGRESS 7/17/14 @ 9:12 GMT	AA05781 SN 2075 LAB 7/29/14 @ 10:28 GMT	AA05782 SN 2058 COL 7/29/14 @ 10:30 GMT	AA05783 SN 2076 ATV-5 INGRESS 8/13/14 @ 12:20 GMT	AA05784 SN 2090 SM 9/3/14 @ 16:20 GMT	AA05785 SN 2089 LAB 9/3/14 @ 16:25 GMT
SPECIAL INTEREST COMPOUNDS **											
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
ETHYLENE OXIDE	<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	<0.050	<0.050	<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
2-ETHOXYETHANOL	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
DIMETHYL DISULFIDE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
OCTAFLUOROPROPANE &	3.9	5.0	5.6	5.1	4.3	2.2	2.8	0.50	1.3	5.1	2.3
PERFLUORO-2-METHYLPENTANE &	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
CARBONYL SULFIDE &	0.030	<0.025	TRACE	<0.025	<0.025	0.028	<0.025	<0.025	0.045	<0.025	<0.025
ISOBUTANE & *	<0.025	<0.025	TRACE	<0.025	<0.025	1.1	<0.025	**38**	0.46	<0.025	<0.025
2-METHYL-1-PROPENE &	0.039	0.038	1.3	0.046	0.039	0.077	0.047	0.12	0.36	0.048	0.042
DIMETHYL SULFIDE &	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
CARBON DISULFIDE &	TRACE	TRACE	TRACE	<0.025	<0.025	0.11	<0.025	<0.025	TRACE	<0.025	<0.025
TRIMETHYLSILANOL &	0.079	0.095	0.081	0.10	0.10	0.41	0.10	1.6	5.2	0.086	0.089
OCTAMETHYLCYCLOTETRASILOXANE &	<0.075	<0.075	TRACE	<0.075	<0.075	TRACE	TRACE	<0.075	TRACE	<0.075	<0.075
DECAMETHYLCYCLOPENTASILOXANE &	0.43	0.43	0.62	0.48	0.39	0.18	0.33	<0.15	0.48	0.47	0.41
HEXAMETHYLCYCLOTRISILOXANE %	0.96	1.4	2.2	1.3	1.1	6.4	1.4	0.52	37	1.2	1.3
NON-TARGET COMPOUNDS **											
PROPENE &	TRACE	TRACE	0.16	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE
PROPANE &	TRACE	TRACE	0.12	TRACE	TRACE	TRACE	TRACE	0.14	TRACE	TRACE	TRACE
BUTANE &	<0.050	<0.050	0.083	<0.050	<0.050	<0.050	<0.050	TRACE	TRACE	<0.050	<0.050
ISOPRENE &	0.062	0.068	0.36	0.066	0.057	TRACE	0.053	<0.050	TRACE	0.054	0.053
SULFURHEXAFLUORIDE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
HEXAFLUORO-1-PROPENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	1.7	<0.050	<0.050	<0.050
OCTAFLUOROBUTENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.094	<0.050	<0.050	<0.050
1,1,1,2-TETRAFLUOROETHANE	3.0	3.2	3.6	2.5	2.1	0.74	1.7	0.17	0.42	1.7	1.3
1,1-DIFLUOROETHANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.072	<0.050	<0.050	<0.050
TRIDECAFLUOROHEXANE	<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	TRACE	TRACE
PENTAFLUOROPROPENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.095	<0.050	<0.050	<0.050
FLUOROTRIMETHYLSILANE	<0.050	<0.050	<0.050	<0.050	<0.050	TRACE	<0.050	0.061	0.42	<0.050	<0.050
UNIDENTIFIED FLUORINATED HYDROCARBON	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,3-DICHLOROPENTAFLUOROPROPANE	<0.050	<0.050	<0.050	<0.050	<0.050	0.11	<0.050	<0.050	<0.050	<0.050	<0.050
2-METHYL-1-PROPANOL	<0.050	<0.050	0.30	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1-CHLOROBUTANE	<0.050	<0.050	0.26	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
HEXAMETHYLDISILOXANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.67	<0.050	<0.050
2-PROPENOICACID, 2-METHYL-, METHYL ESTER	<0.050	<0.050	0.11	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
3-METHYL-3-BUTEN-1-OL	<0.050	<0.050	0.052	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
4-METHYLENETETRAHYDROPYRAN	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
PENTAMETHYLDISILOXANE-1-OL	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.14	<0.050	<0.050
4-METHYL-2,3-DIHYDROPYRAN	<0.050	<0.050	0.077	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
METHYLPYRAZINE	<0.050	<0.050	0.24	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
3-METHYLPHENOL	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
4,4-DIMETHYL-1,3-DIOXANE	<0.050	<0.050	0.16	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
ETHYLPYRAZINE	<0.050	<0.050	TRACE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
2,3-DIMETHYLPYRAZINE	<0.050	<0.050	0.062	<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	0.14	<0.050	<0.050	0.12	<0.050	<0.050
2-ETHYLHEXANAL	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
2-PROPENOIC ACID, 2-METHYL-, BUTYL ESTER	<0.050	<0.050	0.080	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
BENZALDEHYDE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
3-HEXYN-1-OL	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
C12-ALKANE	<0.050	<0.050	<0.050	<0.050	<0.050	0.12	<0.050	<0.050	0.24	<0.050	<0.050
C12-ALKANE	<0.050	<0.050	<0.050	<0.050	<0.050	TRACE	<0.050	<0.050	0.19	<0.050	<0.050
C4-SUBSTITUTED BENZENE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
C12-ALKANE	<0.050	<0.050	<0.050	<0.050	<0.050	0.27	<0.050	<0.050	0.27	<0.050	<0.050
LIMONENE	0.087	0.088	0.093	0.066	0.056	<0.050	0.070	<0.050	<0.050	<0.050	<0.050
C12-ALKANE	<0.050	<0.050	<0.050	<0.050	<0.050	0.21	<0.050	<0.050	0.21	<0.050	<0.050
C12-ALKANE	<0.050	<0.050	<0.050	<0.050	<0.050	0.20	<0.050	<0.050	0.20	<0.050	<0.050
C12-ALKANE	<0.050	<0.050	<0.050	<0.050	<0.050	0.061	<0.050	<0.050	0.061	<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
C12-ALKANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
DODECAMETHYLPENTASILOXANE	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.33	<0.050	<0.050
TOTAL ALCOHOLS PLUS ACETONE	16	15	26	13	12	6.6	15	5.5	7.2	7.4	7.3
TARGET COMPOUNDS (GC)											
CARBON MONOXIDE	0.57	0.58	9.0	0.56	0.58	1.4	0.79	0.93	5.5	0.50	0.52
METHANE	9.2	9.1	13	22	22	9.8	27	3.7	6.4	25	25
HYDROGEN	5.8	5.3	6.1	5.9	5.9	2.4	6.5	2.4	2.4	5.1	5.0
CARBON DIOXIDE	7500	7300	9800	6400	6500	4000	7400	2000	3000	8200	8600
TOTAL CONCENTRATION (NON-METHANE HYDROCARBONS)	**25**	**25**	**59**	**23**	**21**	**20**	**22**	**49**	**57**	**17**	**13**
TOTAL CONCENTRATION - OFP (NON-METHANE HYDROCARBONS)	**21**	**20**	**54**	**18**	**17**	**18**	**19**	**49**	**56**	**11**	**11**

* GC/FID data results are in bold

** Quantified using "B" response factor except where noted

& Quantified using a multi-point calibration

% Response factor generated from an internal study

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

TRACE: Amount detected is sufficient for compound identification only.

OFP - Octafluoropropane

TABLE 2
T-VALUES FOR 38S RETURN GSC AIR SAMPLES

CHEMICAL CONTAMINANT	T-VALUE (180-d SMAC)							
	AA05775 SN 2063 SM 6/2/14 @ 11:40 GMT	AA05776 SN 2041 LAB 6/2/14 @ 11:45 GMT	AA05778 SN 2070 LAB 7/1/14 @ 12:30 GMT	AA05779 SN 2074 JPM 7/1/14 @ 12:30 GMT	AA05781 SN 2075 LAB 7/29/14 @ 10:28 GMT	AA05782 SN 2058 COL 7/29/14 @ 10:30 GMT	AA05784 SN 2090 SM 9/3/14 @ 16:20 GMT	AA05785 SN 2089 LAB 9/3/14 @ 16:25 GMT
TARGET COMPOUNDS (TO-14/POLAR)								
FREON12	ND	ND	ND	ND	ND	ND	ND	ND
CHLOROMETHANE	ND	ND	ND	ND	ND	ND	ND	ND
FREON114	ND	ND	ND	ND	ND	ND	ND	ND
METHANOL	0.00511	0.00450	0.00404	0.00358	0.00380	0.00481	0.00368	0.00335
ACETALDEHYDE	0.10742	0.06995	0.08031	0.05406	0.08475	0.06803	0.06382	0.05445
VINYLCHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND
BROMOMETHANE	ND	ND	ND	ND	ND	ND	ND	ND
ETHANOL	0.00737	0.00673	0.00605	0.00571	0.00699	0.00154	0.00318	0.00316
CHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND
ACETONITRILE	0.00187	ND	ND	ND	ND	ND	ND	ND
PROPENAL	ND	ND	ND	ND	ND	ND	ND	ND
ACETONE	0.00671	0.00731	0.00727	0.00593	0.00737	0.01360	0.00737	0.00671
PROPANAL	0.00114	0.00114	ND	0.00114	0.00114	0.00368	0.00114	ND
ISOPROPANOL	0.00087	0.00131	0.00207	0.00096	0.00151	0.00782	0.00152	0.00153
FREON11	ND	ND	ND	ND	ND	ND	ND	ND
FURAN	ND	ND	ND	ND	ND	ND	ND	ND
ACRYLONITRILE	ND	ND	0.01250	0.01250	ND	ND	0.01250	0.01250
PENTANE	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYL-2-PROPANOL	ND	ND	ND	ND	ND	0.00058	ND	ND
METHYLACETATE	0.00010	0.00010	0.00010	0.00010	ND	ND	ND	ND
1,1-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND
DICHLOROMETHANE	0.00125	0.00125	0.00125	ND	0.00125	ND	0.00125	0.00125
3-CHLOROPROPENE	ND	ND	ND	ND	ND	ND	ND	ND
FREON113	ND	ND	ND	ND	ND	ND	ND	ND
N-PROPANOL	0.00013	0.00013	0.00044	0.00040	0.00013	0.00013	0.00028	0.00038
1,1-DICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND
BUTANAL	ND	ND	ND	ND	ND	ND	ND	ND
2-BUTANONE	0.00042	0.00042	0.00042	0.00042	0.00042	0.00042	0.00042	0.00042
CIS-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYLFURAN	ND	ND	ND	ND	ND	ND	ND	ND
ETHYLACETATE	0.00029	0.00029	0.00023	0.00020	0.00022	0.00036	0.00007	0.00007
HEXANE	ND	ND	ND	ND	ND	ND	ND	ND
CHLOROFORM	ND	ND	ND	ND	ND	ND	ND	ND
2-BUTENAL	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DICHLOROETHANE	0.00781	0.00781	0.00781	0.00781	0.00781	ND	0.00781	0.00781
1,1,1-TRICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND
N-BUTANOL	0.00126	0.00120	0.00201	0.00152	0.00122	0.00153	0.00142	0.00139
BENZENE	ND	ND	ND	ND	ND	ND	ND	ND
CARBONTETRACHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND
2-PENTANONE	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYLHEXANE	ND	ND	ND	ND	ND	ND	ND	ND
2,3-DIMETHYLPENTANE	ND	ND	ND	ND	ND	ND	ND	ND
PENTANAL	ND	ND	ND	ND	ND	ND	ND	ND
3-METHYLHEXANE	0.00104	0.00104	0.00104	ND	0.00104	0.00104	0.00104	ND
1,2-DICHLOROPROPANE	ND	ND	ND	ND	ND	ND	ND	ND
1,4-DIOXANE	ND	ND	ND	ND	ND	ND	ND	ND
TRICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND
2,5-DIMETHYLFURAN	ND	ND	ND	ND	ND	ND	ND	ND
N-HEPTANE	ND	ND	ND	ND	ND	ND	ND	ND
4-METHYL2-PENTANONE	ND	ND	ND	ND	ND	ND	ND	ND
CIS-1,3-DICHLOROPROPENE	ND	ND	ND	ND	ND	ND	ND	ND
2-PENTENAL	ND	ND	ND	ND	ND	ND	ND	ND
TRANS-1,3-DICHLOROPROPENE	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-TRICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND
TOLUENE	ND	ND	ND	ND	ND	ND	ND	ND
HEXANAL	ND	ND	ND	ND	ND	ND	ND	ND
MESITYLOXIDE	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DIBROMOETHANE	ND	ND	ND	ND	ND	ND	ND	ND
BUTYLACETATE	ND	ND	ND	ND	ND	ND	ND	ND
OCTANE	ND	ND	ND	ND	ND	ND	ND	ND
TETRACHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND
CHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND
ETHYLBENZENE	ND	ND	ND	ND	ND	ND	ND	ND
M/P-XYLENES	ND	ND	ND	ND	ND	ND	ND	ND
2-HEPTANONE	ND	ND	ND	ND	ND	ND	ND	ND
CYCLOHEXANONE	ND	ND	ND	ND	ND	ND	ND	ND
HEPTANAL	ND	ND	ND	ND	ND	ND	ND	ND
STYRENE	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-TETRACHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND
O-XYLENE	0.00091	0.00077	0.00034	0.00034	0.00141	ND	0.00098	0.00076
NONANE	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-TRIMETHYLBENZENE	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-TRIMETHYLBENZENE	ND	ND	ND	ND	ND	ND	ND	ND
1,3-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND
1,4-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-TRICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLORO-1,3-BUTADIENE	ND	ND	ND	ND	ND	ND	ND	ND

TABLE 2
T-VALUES FOR 38S RETURN GSC AIR SAMPLES

CHEMICAL CONTAMINANT	T-VALUE (180-d SMAC)							
	AA05775 SN 2063 SM 6/2/14 @ 11:40 GMT	AA05776 SN 2041 LAB 6/2/14 @ 11:45 GMT	AA05778 SN 2070 LAB 7/1/14 @ 12:30 GMT	AA05779 SN 2074 JPM 7/1/14 @ 12:30 GMT	AA05781 SN 2075 LAB 7/29/14 @ 10:28 GMT	AA05782 SN 2058 COL 7/29/14 @ 10:30 GMT	AA05784 SN 2090 SM 9/3/14 @ 16:20 GMT	AA05785 SN 2089 LAB 9/3/14 @ 16:25 GMT
SPECIAL INTEREST COMPOUNDS								
1,3-BUTADIENE	ND	ND	ND	ND	ND	ND	ND	ND
ETHYLENE OXIDE	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYL-2-PROPENAL	ND	ND	ND	ND	ND	ND	ND	ND
3-BUTEN-2-ONE	ND	ND	ND	ND	ND	ND	ND	ND
2-ETHOXYETHANOL	ND	ND	ND	ND	ND	ND	ND	ND
DIMETHYL DISULFIDE	ND	ND	ND	ND	ND	ND	ND	ND
OCTAFLUOROPROPANE	0.00005	0.00006	0.00006	0.00005	0.00003	0.00001	0.00006	0.00003
PERFLUORO-2-METHYLPENTANE	ND	ND	ND	ND	ND	ND	ND	ND
CARBONYL SULFIDE	0.00249	ND	ND	ND	ND	ND	ND	ND
ISOBUTANE	ND	ND	ND	ND	ND	0.15855	ND	ND
2-METHYL-1-PROPENE	0.00004	0.00003	0.00004	0.00004	0.00004	0.00011	0.00004	0.00004
DIMETHYL SULFIDE	ND	ND	ND	ND	ND	ND	ND	ND
CARBON DISULFIDE	0.00078	0.00078	ND	ND	ND	ND	ND	ND
TRIMETHYLSILANOL	0.01971	0.02381	0.02619	0.02610	0.02539	0.40628	0.02151	0.02222
OCTAMETHYLCYCLOTETRASILOXANE	ND	ND	ND	ND	0.00313	ND	ND	ND
DECAMETHYLCYCLOPENTASILOXANE	0.02861	0.02860	0.03169	0.02626	0.02182	ND	0.03164	0.02716
HEXAMETHYLCYCLOTRISILOXANE	0.10666	0.15545	0.14708	0.12726	0.15693	0.05830	0.13156	0.14113
NON-TARGET COMPOUNDS								
PROPENE &	0.00058	0.00058	0.00058	0.00058	0.00058	0.00058	0.00058	0.000581395
PROPANE &	0.00455	0.00455	0.00455	0.00455	0.00455	0.02604	0.00455	0.004545455
BUTANE &	ND	ND	ND	ND	ND	0.00357	ND	ND
ISOPRENE &	0.02056	0.02257	0.02186	0.01886	0.01769	ND	0.01809	0.017628796
SULFURHEXAFLUORIDE	ND	ND	ND	ND	ND	ND	ND	ND
HEXAFLUORO-1-PROPENE	ND	ND	ND	ND	ND	28.71220	ND	ND
OCTAFLUOROBUTENE	ND	ND	ND	ND	ND	0.00046	ND	ND
1,1,1,2-TETRAFLUOROETHANE	0.02876	0.03035	0.02403	0.02041	0.01631	0.00160	0.01623	0.012870555
1,1-DIFLUOROETHANE	ND	ND	ND	ND	ND	0.00108	ND	ND
TRIDECAFLUOROHEXANE	ND	ND	ND	ND	ND	ND	ND	ND
CHLORODIFLUOROMETHANE	ND	ND	ND	ND	ND	ND	0.00001	7.14286E-06
PENTAFLUOROPROPENE	ND	ND	ND	ND	ND	1.58820	ND	ND
FLUOROTRIMETHYLSILANE	ND	ND	ND	ND	ND	0.12164	ND	ND
UNIDENTIFIED FLUORINATED HYDROCARBON	ND	ND	ND	ND	ND	ND	ND	ND
1,3-DICHLOROPENTAFLUOROPROPANE	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYL-1-PROPANOL	ND	ND	ND	ND	ND	ND	ND	ND
1-CHLOROBUTANE	ND	ND	ND	ND	ND	ND	ND	ND
HEXAMETHYLDISILOXANE	ND	ND	ND	ND	ND	ND	ND	ND
2-PROPENOICACID, 2-METHYL-, METHYL ESTER	ND	ND	ND	ND	ND	ND	ND	ND
3-METHYL-3-BUTEN-1-OL	ND	ND	ND	ND	ND	ND	ND	ND
4-METHYLENETETRAHYDROPYRAN	ND	ND	ND	ND	ND	ND	ND	ND
PENTAMETHYLDISILOXANE-1-OL	ND	ND	ND	ND	ND	ND	ND	ND
4-METHYL-2,3-DIHYDROPYRAN	ND	ND	ND	ND	ND	ND	ND	ND
METHYLPYRAZINE	ND	ND	ND	ND	ND	ND	ND	ND
3-METHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND
4,4-DIMETHYL-1,3-DIOXANE	ND	ND	ND	ND	ND	ND	ND	ND
ETHYLPYRAZINE	ND	ND	ND	ND	ND	ND	ND	ND
2,3-DIMETHYLPYRAZINE	ND	ND	ND	ND	ND	ND	ND	ND
C11-ALKANE	ND	ND	ND	ND	ND	ND	ND	ND
2-ETHYLHEXANAL	ND	ND	ND	ND	ND	ND	ND	ND
2-PROPENOIC ACID, 2-METHYL-, BUTYL ESTER	ND	ND	ND	ND	ND	ND	ND	ND
BENZALDEHYDE	ND	ND	ND	ND	ND	ND	ND	ND
3-HEXYN-1-OL	ND	ND	ND	ND	ND	ND	ND	ND
C12-ALKANE	ND	ND	ND	ND	ND	ND	ND	ND
C12-ALKANE	ND	ND	ND	ND	ND	ND	ND	ND
C4-SUBSTITUTED BENZENE	ND	ND	ND	ND	ND	ND	ND	ND
C12-ALKANE	ND	ND	ND	ND	ND	ND	ND	ND
LIMONENE	0.00076	0.00077	0.00057	0.00049	0.00061	ND	ND	ND
C12-ALKANE	ND	ND	ND	ND	ND	ND	ND	ND
C12-ALKANE	ND	ND	ND	ND	ND	ND	ND	ND
C12-ALKANE	ND	ND	ND	ND	ND	ND	ND	ND
C12-ALKANE	ND	ND	ND	ND	ND	ND	ND	ND
C12-ALKANE	ND	ND	ND	ND	ND	ND	ND	ND
DODECAMETHYLPENTASILOXANE	ND	ND	ND	ND	ND	ND	ND	ND
TARGET COMPOUNDS (GC)								
CARBON MONOXIDE	0.03357	0.03410	0.03274	0.03410	0.04673	0.05476	0.02940	0.03067
METHANE	0.00263	0.00260	0.00631	0.00637	0.00760	0.00105	0.00722	0.00721
HYDROGEN	0.01711	0.01550	0.01743	0.01723	0.01902	0.00704	0.01487	0.01484
CARBON DIOXIDE	0.57562	0.56511	0.49099	0.50330	0.57192	0.15381	0.62783	0.65913
TOTAL T-VALUE	**0.98617**	**0.98881**	**0.93001**	**0.88027**	**1.01140**	**31.39883**	**1.01007**	**1.03183**
TOTAL T-VALUE - CO2	**0.41055**	**0.42370**	**0.43902**	**0.37697**	**0.43948**	**31.24502**	**0.38224**	**0.37270**

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 2A
T-VALUES FOR
ORB-2 & ATV-5 INGRESS GSC AIR SAMPLES

CHEMICAL CONTAMINANT	AA05780 SN 2073 ORB-2 INGRESS 7/17/14 @ 9:12 GMT		AA05783 SN 2076 ATV-5 INGRESS 8/13/14 @ 12:20 GMT	
	T-VALUE (7-d SMAC)	T-VALUE (180-d SMAC)	T-VALUE (7-d SMAC)	T-VALUE (180-d SMAC)
TARGET COMPOUNDS (TO-15)				
FREON12	ND	ND	ND	ND
CHLOROMETHANE	0.00030	0.00030	0.00084	0.00084
FREON114	ND	ND	ND	ND
METHANOL	0.00495	0.00495	0.00677	0.00677
ACETALDEHYDE	0.07862	0.07862	0.14181	0.14181
VINYLCHLORIDE	ND	ND	ND	ND
BROMOMETHANE	ND	ND	ND	ND
ETHANOL *	0.00219	0.00219	0.00180	0.00180
CHLOROETHANE	ND	ND	ND	ND
ACETONITRILE	ND	ND	0.00187	0.00187
PROPENAL	ND	ND	ND	ND
ACETONE	0.00767	0.00767	0.01132	0.01132
PROPANAL	0.00228	0.00228	0.00472	0.00472
ISOPROPANOL *	0.00771	0.00771	0.01547	0.01547
FREON11	ND	ND	ND	ND
FURAN	ND	ND	ND	ND
ACRYLONITRILE	ND	ND	ND	ND
PENTANE	ND	ND	0.00016	0.00330
2-METHYL-2-PROPANOL	0.00023	0.00028	0.00082	0.00103
METHYLACETATE	0.00010	0.00010	ND	ND
1,1-DICHLOROETHENE	ND	ND	ND	ND
DICHLOROMETHANE	0.00074	0.00365	0.00108	0.00528
3-CHLOROPROPENE	ND	ND	ND	ND
FREON113	0.00018	0.00018	0.00013	0.00013
N-PROPANOL	0.00126	0.00126	0.00013	0.00013
1,1-DICHLOROETHANE	ND	ND	ND	ND
BUTANAL	ND	ND	0.00096	0.00096
2-BUTANONE	0.01669	0.01669	0.00858	0.00858
CIS-1,2-DICHLOROETHENE	ND	ND	ND	ND
2-METHYLFURAN	ND	ND	ND	ND
ETHYLACETATE	0.00054	0.00054	0.00007	0.00007
HEXANE	ND	ND	ND	ND
CHLOROFORM	ND	ND	0.00125	0.00250
2-BUTENAL	ND	ND	ND	ND
1,2-DICHLOROETHANE	ND	ND	ND	ND
1,1,1-TRICHLOROETHANE	ND	ND	ND	ND
N-BUTANOL	0.00095	0.00190	0.00094	0.00189
BENZENE	ND	ND	ND	ND
CARBONTETRACHLORIDE	ND	ND	ND	ND
2-PENTANONE	0.00018	0.00018	ND	ND
2-METHYLHEXANE	ND	ND	ND	ND
2,3-DIMETHYLPENTANE	ND	ND	ND	ND
PENTANAL	ND	ND	0.00078	0.00078
3-METHYLHEXANE	0.00005	0.00104	0.00012	0.00258
1,2-DICHLOROPROPANE	ND	ND	ND	ND
1,4-DIOXANE	ND	ND	ND	ND
TRICHLOROETHENE	ND	ND	ND	ND
2,5-DIMETHYLFURAN	ND	ND	ND	ND
N-HEPTANE	ND	ND	ND	ND
4-METHYL2-PENTANONE	ND	ND	ND	ND
CIS-1,3-DICHLOROPROPENE	ND	ND	ND	ND
2-PENTENAL	ND	ND	ND	ND
TRANS-1,3-DICHLOROPROPENE	ND	ND	ND	ND
1,1,2-TRICHLOROETHANE	ND	ND	ND	ND
TOLUENE	0.00192	0.00192	0.00722	0.00722
HEXANAL	ND	ND	0.00069	0.00069
MESITYLOXIDE	ND	ND	ND	ND
1,2-DIBROMOETHANE	ND	ND	ND	ND
BUTYLACETATE	ND	ND	ND	ND
OCTANE	ND	ND	ND	ND
TETRACHLOROETHENE	ND	ND	ND	ND
CHLOROBENZENE	ND	ND	ND	ND
ETHYLBENZENE	ND	ND	ND	ND
M/P-XYLENES	ND	ND	ND	ND
2-HEPTANONE	ND	ND	ND	ND
CYCLOHEXANONE	ND	ND	0.00021	0.00021
HEPTANAL	ND	ND	0.00060	0.00060
STYRENE	ND	ND	ND	ND
1,1,2,2-TETRACHLOROETHANE	ND	ND	ND	ND
O-XYLENE	0.00017	0.00034	0.00163	0.00321
NONANE	ND	ND	ND	ND
1,3,5-TRIMETHYLBENZENE	ND	ND	ND	ND
1,2,4-TRIMETHYLBENZENE	ND	ND	ND	ND
1,3-DICHLOROBENZENE	ND	ND	ND	ND
1,4-DICHLOROBENZENE	ND	ND	ND	ND
1,2-DICHLOROBENZENE	ND	ND	ND	ND
1,2,4-TRICHLOROBENZENE	ND	ND	ND	ND
HEXACHLORO-1,3-BUTADIENE	ND	ND	ND	ND

TABLE 2A
T-VALUES FOR
ORB-2 & ATV-5 INGRESS GSC AIR SAMPLES

CHEMICAL CONTAMINANT	AA05780 SN 2073 ORB-2 INGRESS 7/17/14 @ 9:12 GMT		AA05783 SN 2076 ATV-5 INGRESS 8/13/14 @ 12:20 GMT	
	T-VALUE (7-d SMAC)	T-VALUE (180-d SMAC)	T-VALUE (7-d SMAC)	T-VALUE (180-d SMAC)
SPECIAL INTEREST COMPOUNDS **				
1,3-BUTADIENE &	ND	ND	ND	ND
ETHYLENE OXIDE	ND	ND	ND	ND
2-METHYL-2-PROPENAL	ND	ND	ND	ND
3-BUTEN-2-ONE	ND	ND	ND	ND
2-ETHOXYETHANOL	ND	ND	ND	ND
DIMETHYL DISULFIDE	ND	ND	ND	ND
OCTAFLUOROPROPANE &	0.00003	0.00003	0.00001	0.00001
PERFLUORO-2-METHYLPENTANE &	ND	ND	ND	ND
CARBONYL SULFIDE &	0.00235	0.00235	0.00376	0.00376
ISOBUTANE &	0.00467	0.00467	0.00191	0.00191
2-METHYL-1-PROPENE &	0.00007	0.00007	0.00032	0.00032
DIMETHYL SULFIDE &	ND	ND	ND	ND
CARBON DISULFIDE &	0.00679	0.00679	0.00078	0.00078
TRIMETHYLSILANOL &	0.10250	0.10250	1.30573	1.30573
OCTAMETHYLCYCLOTETRASILOXANE &	0.00013	0.00313	0.00013	0.00313
DECAMETHYLCYCLOPENTASILOXANE &	0.00183	0.01220	0.00481	0.03206
HEXAMETHYLCYCLOTRISILOXANE %	0.07077	0.70765	0.41382	4.13815
NON-TARGET COMPOUNDS **				
PROPENE &	0.00058	0.00058	0.00058	0.00058
PROPANE &	0.00023	0.00455	0.00023	0.00455
BUTANE &	ND	ND	0.00017	0.00357
ISOPRENE &	0.00417	0.00833	0.00417	0.00833
SULFURHEXAFLUORIDE	ND	ND	ND	ND
HEXAFLUORO-1-PROPENE	ND	ND	ND	ND
OCTAFLUOROBUTENE	ND	ND	ND	ND
1,1,1,2-TETRAFLUOROETHANE	0.00714	0.00714	0.00408	0.00408
1,1-DIFLUOROETHANE	ND	ND	ND	ND
TRIDECAFLUOROHEXANE	ND	ND	ND	ND
CHLORODIFLUOROMETHANE	ND	ND	ND	ND
PENTAFLUOROPROPENE	ND	ND	ND	ND
FLUOROTRIMETHYLSILANE	0.05000	0.05000	0.83547	0.83547
UNIDENTIFIED FLUORINATED HYDROCARBON	ND	ND	ND	ND
1,3-DICHLOROPENTAFLUOROPROPANE	0.00138	0.02866	ND	ND
2-METHYL-1-PROPANOL	ND	ND	ND	ND
1-CHLOROBUTANE	ND	ND	ND	ND
HEXAMETHYLDISILOXANE	ND	ND	0.00668	0.00668
2-PROPENOICACID, 2-METHYL-, METHYL ESTE	ND	ND	ND	ND
3-METHYL-3-BUTEN-1-OL	ND	ND	ND	ND
4-METHYLENETETRAHYDROPYRAN	ND	ND	ND	ND
PENTAMETHYLDISILOXANE-1-OL	ND	ND	0.00275	0.00275
4-METHYL-2,3-DIHYDROPYRAN	ND	ND	ND	ND
METHYLPYRAZINE	ND	ND	ND	ND
3-METHYLPHENOL	ND	ND	ND	ND
4,4-DIMETHYL-1,3-DIOXANE	ND	ND	ND	ND
ETHYLPYRAZINE	ND	ND	ND	ND
2,3-DIMETHYLPYRAZINE	ND	ND	ND	ND
C11-ALKANE	0.00296	0.00296	0.00255	0.00255
2-ETHYLHEXANAL	ND	ND	ND	ND
2-PROPENOIC ACID, 2-METHYL-, BUTYL ESTER	ND	ND	ND	ND
BENZALDEHYDE	ND	ND	ND	ND
3-HEXYN-1-OL	ND	ND	ND	ND
C12-ALKANE	0.00225	0.00225	0.00466	0.00466
C12-ALKANE	0.00048	0.00048	0.00362	0.00362
C4-SUBSTITUTED BENZENE	ND	ND	ND	ND
C12-ALKANE	0.00513	0.00513	0.00528	0.00528
LIMONENE	ND	ND	ND	ND
C12-ALKANE	0.00411	0.00411	0.00406	0.00406
C12-ALKANE	0.00375	0.00375	0.00389	0.00389
C12-ALKANE	0.00117	0.00117	0.00118	0.00118
C12-ALKANE	ND	ND	ND	ND
C12-ALKANE	ND	ND	ND	ND
DODECAMETHYLPENTASILOXANE	ND	ND	0.00165	0.00165
TARGET COMPOUNDS (GC)				
CARBON MONOXIDE	0.02152	0.07975	0.08794	0.32589
METHANE	0.00281	0.00281	0.00184	0.00184
HYDROGEN	0.00696	0.00696	0.00694	0.00694
CARBON DIOXIDE	0.30878	0.30878	0.23024	0.23024
TOTAL T-VALUE	**0.73931**	**1.48862**	**3.14922**	**7.16739**
TOTAL T-VALUE - CO2	**0.43053**	**1.17984**	**2.91898**	**6.93715**

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.