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Station 15

Page 1 of 1

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ANALYSIS OF K WEST BASIN CANISTER GAS

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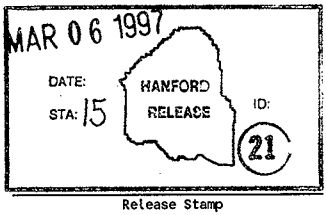
Abstract: The gas in 34 barrels of 25 fuel storage canisters in K West Basin was sampled in 1995 and 1996. The samples were analyzed using gamma energy analysis and mass spectrometry. The sample data and an analysis of the data are presented. Total fission gas activity in the canisters is estimated.



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EXECUTIVE SUMMARY

Samples of the gas have been obtained from 34 barrels of 25 fuel storage canisters in the K West Basin. Analyses of the samples revealed primarily hydrogen with some oxygen, nitrogen, and krypton-85. The hydrogen content of the gas ranged from 50% to 99% and the oxygen ranged from 0.1% to 32%. Krypton-85 averaged 3,100 μCi/barrel and measured as much as 12,700 μCi/barrel. A worst case analysis has indicated that, on average, krypton-85 should not exceed 5,500 μCi/barrel in the gas of the K West Basin canisters. Tritium is also expected to exist in the canister gas but should not exceed 310 μCi/barrel, on average.

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ANALYSIS OF K WEST BASIN CANISTER GAS

1.0 INTRODUCTION

Gas and Liquid samples have been collected from a selection of the approximately 3,820 spent fuel storage canisters in the K West Basin. The samples were taken to characterize the contents of the gas and water in the canisters providing source term information for two subprojects of the Spent Nuclear Fuel Project (SNFP) (Fulton 1994): the K Basins Integrated Water Treatment System Subproject (Ball 1996) and the K Basins Fuel Retrieval System Subproject (Waymire 1996).

The barrels of ten canisters were sampled for gas and liquid in 1995, and 50 canisters were sampled in a second campaign in 1996. The analysis results from the first campaign have been reported (Trimble 1995a, 1995b, 1996a, 1996b). The analysis results from the second campaign liquid samples have been documented (Trimble and Welsh 1997; Trimble 1997). This report documents the results for the gas samples from the second campaign and evaluates all gas data in terms of expected releases when opening the canisters for SNFP activities.

The fuel storage canisters consist of two closed and sealed barrels, each with a gas trap. The barrels are attached at a trunion to make a canister, but are otherwise independent (Figure 1). Each barrel contains up to seven N Reactor fuel element assemblies. A gas space of nitrogen was established in the top 2.2 to 2.5 inches (5.6 to 6.4 cm) of each barrel. Many of the fuel elements were damaged allowing the metallic uranium fuel to be corroded by the canister water. The corrosion releases fission products and generates hydrogen gas. The released gas mixes with the gas-space gas and excess gas passes through the gas trap into the basin water. The canister design does not allow canister water to be exchanged with basin water.

The canister selection and sample evaluation were in accordance with the following data quality objectives provided by Makenas 1996: (1) to help guide subsequent fuel and sludge sampling in the K West Basin by providing information about the condition of the fuel in specific canisters, (2) to provide information for comparison to the fuel and sludge sample examinations, and (3) to provide information to water cleanup and air permits associated with moving the fuel to dry storage. Table 1 lists the canisters sampled for gas and includes a description of each. The canister selections included both canister types, Mark I (MKI) and Mark II (MKII), and all three N Reactor fuel types, Mark IA (1.25% enriched) and Mark IV (0.95% and 0.71% enriched). Canisters containing documented fuel breaks and scrap fuel (chips) were also selected. In addition canisters with a range of discharge date keys, fuel burnup (^{240}Pu%), and encapsulation dates were sampled. Also, MKII canisters containing grade "D" fuel were among the selections. Grade "D" fuel was stored for a time in the K East Basin before being encapsulated at the N Basin. Most K West Basin fuel have resided only in the N Reactor Basin before being encapsulated and shipped to K West Basin.

Figure 1. A Mark II Canister Barrel.

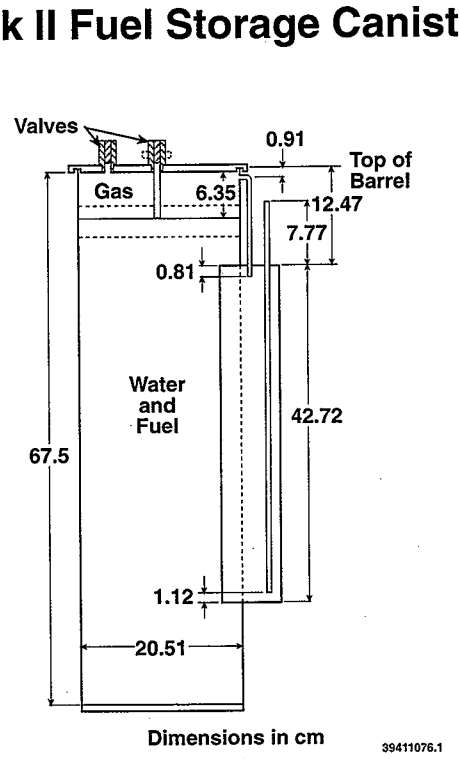

Table 1. K West Basin Canisters Sampled for Gas.

CANISTER DESCRIPTION								FUEL DESCRIPTION						
CANISTER		Barrel	ENCAPSULATION		Gas Trap Level* (in.)		Gas Vol.			No. of	Broken			
S.N.	type	Material	Date	YEARS	M	U	(cc/barrel)	type	model(s)	Assys	Fuel	Grade	Key	%Pu240
0102	MK I	S.S.	Feb-81	15.6			1600	MIA	AM	14			11806	13.3
0315	MK I	Alum.	Mar-81	15.5			1010	MIV	BE	14			12852	12.8
0738	MK II	S.S.	Apr-83	13.4	3.1	13.6	2100	MIA	AM	14			13686	12.0
0943	MK I	Alum.	Sep-81	15.0			1010	MIV	BE	14	some		12852	12.8
1265	MK II	S.S.	Oct-82	13.9			2100	MIA	AM	14	1 inner		12639	12.6
1443	MK II	S.S.	Mar-83	13.5	1.5	0.5	2100	MIA	AM	14			13859	11.9
1497	MK I	S.S.	Jul-81	15.2			1600	MIA	AM+AT	7+7	1 outer		11979	13.7
1512	MK II	S.S.	Mar-83	13.5	1.9	2.2	1310	MIV	BE	14			13858	11.6
1560	MK I	Alum.	Sep-81	15.0			1010	MIV	BE	14	inners&outers		12852	12.8
1730	MK I	S.S.	Aug-81	15.1			1600	MIA	AM	14			12480	13.3
1740	MK I	Alum.	Sep-81	15.0			1010	MIV	BE	14	some		12852	12.8
1990**	MK II	S.S.	Nov-83	14.1	1	1	1300	MIV	BE+BS	13+1	1 outer		13858	11.6
2554	MK I	S.S.	Apr-82	14.4			1600	MIA	AM	14			12942	12.6
2667	MK I	S.S.	Apr-82	14.4			1600	MIA	AM	14			13371	12.5
2775	MK I	S.S.	May-82	14.3			1600	MIA	AM	14			13525	13.0
4366**	MK II	S.S.	Nov-83	14.1	8	1	1300	MIV	BE	14	1 outer		13858	11.6
4368**	MK II	S.S.	Nov-83	14.1	1	1	1300	MIV	BE	14			13858	11.6
4556**	MK II	S.S.	Nov-83	14.1	1	1	1300	MIV	BE	14			13858	11.6
5903	MK II	S.S.	Feb-88	8.5	0.9	0.4	2100	MIV	BC+BE+BS	1otr+4+1otr	chips		10001	9.7
6082	MK II	S.S.	Feb-88	8.5	1.9	16.6	2100	MIV	BE+BR	1+1 outer	chips		10001	9.7
6641	MK II	S.S.	unknown		16.2	0.8	1311	MIV	BE	14		D	12565	15.4
6743	MK II	S.S.	Sep-84	12.0	3.1	16.8	2100	MIA	AM	14			10982	13.2
6768	MK II	S.S.	Feb-88	8.5	1.5	2.2	2100	MIV	BE+BS	6+1 inner	chips		10001	9.7
8119	MK II	S.S.	Dec-89	6.7	3.1	16.0	2100	MIA	AM	14			13016	12.8
9020	MK I	Alum.	Mar-82	14.5			1540	MIV	BA+BE+BS	11+1+2			13524	12.5

*Indicates water level in the 16.8-inch, MKII gas traps.
**These canisters were sampled in 1995, all others in 1996.
S.N. = serial number, C = cracked, B = broken, M = marked barrel, U = unmarked barrel

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2.0 PROCEDURE

The samples were obtained and analyzed in accordance with a sampling and analysis plan (SAP) (Harris 1996). Specially designed equipment was used to take the samples (Pitkoff 1994). Laboratory testing was performed to evaluate equipment performance characteristics and acceptability for field use (Prescott and Trimble 1996).

Gas samples were taken through the canister barrel-lid side valve before venting the gas to flood the barrel for liquid sampling. The samples were drawn into 15 and 20 mL vacuum vials closed with a rubber septum. The glass vials were potted in stainless steel sleeves to protect against breakage.

Before leaving the K Basin site and usually within 24 hours, the samples were weighed and analyzed using gamma energy analysis (GEA). The on-site GEA provided data on cesium in the liquid and krypton-85 in the gas. These analyses were performed by Special Analytical Studies of SGN Eurisys Services Corporation using their nondestructive analysis (SAS-NDA) truck. A description of the on-site GEA can be found in Trimble 1997.

The liquid samples were shipped to the Hanford 222-S Laboratory for analysis for fission products and corrosion inhibitor ions. The results of these analyses were documented in a separate report (Trimble 1997).

Gas samples were obtain from 29 barrels of 21 canisters during the 1996 campaign and five barrels of four canisters in 1995 (Trimble 1996a). They were analyzed by Pacific Northwest National Laboratory at the Hanford 325 Building using gas mass spectrography analyses. In addition sample pressure and liquid volume were measured. All gas analyses were completed within three weeks from the time of sampling.

Sample pressure was used to determine sample validity. The pressure of a gas sample should have been approximately the pressure of the canister gas. Canister pressure was about 1.4 atmosphere, due to the approximately 13 feet (4 meters) depth of the basin water at the top of the canister. An acceptable sample was at least 1.1 atmospheres. Good sample pressure was representative of the canister pressure and allowed an aliquot to be drawn through the vial septum without contamination of the aliquot from atmospheric gases. Sample gas volume at pressure was equal to the nominal volume of the sample vial (15 or 20 mL) minus liquid volume.

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3.0 RESULTS

The gas analysis laboratory reports are included in Appendix A. These data are for "background corrected" results. Background corrected refers to the subtraction of residual (background) gases typically found in empty vials. Also reported was the sample pressure in atmospheres (shown as sample size, cc stp) and the volume of liquid in the sample. Sample size referred to the 1 cc aliquot taken for analysis when expanded to standard temperature and pressure (stp).

Forty-five samples from the 1996 sampling campaign exhibited pressures above 1.1 atmospheres. The samples were from 29 barrels of 21 canisters which included multiple samples from 12 barrels. In addition one sample containing atmospheric gases was analyzed. The samples are listed in Table 2 with analysis results and a calculation of ^{85}Kr per cc of sample at initial pressure. Also included in Table 2 are the sample size (volume at initial pressure) and the canister barrel from which the sample was collected.

Table 3 lists the gas data by canister barrel with averaged data for multiple samples. Also included in Table 3 are data from the first (1995) sampling campaign (Trimble 1996a). Summary statistics for the data are provided in Table 4.

Table 2. Gas Sample Data from the Second (1996) Sampling Campaign.

	sample	canister	hydrogen	oxygen	nitrogen	argon	sum	Kr-85	Kr85
SAMPLE	size*(cc	barrel	percent	percent	percent	percent	percent	uC	uCi/cc
E33	14.6	0102M	83.7	11.1	5	0.071	99.87	14.4	0.99
E34	11.2	0102U	81.4	12.55	5.9	0.104	99.90	7.31	0.65
E20	14.9	0315M	96.4	1.74	1.78	0.042	99.96	3.95	0.27
E22	14.4	0315U	74.4	21.4	4.04	0.069	99.91	4.6	0.32
E27	14.2	0738M	61.8	26.1	11.9	0.129	99.93	9.83	0.69
E28	14.0	0738U	51.6	3.6	44.4	0.29	99.89	29	2.07
E29	14.0	0738U	50.2	1.23	48.2	0.31	99.94	29.5	2.11
D071	19.0	0943M	92.0	2.73	5.1	0.081	99.91	23.4	1.23
E38	14.9	1265M	55.0	0.63	44	0.206	99.84	38	2.55
E36	14.9	1265U	74.2	1.59	24	0.155	99.95	43.5	2.92
E37	14.6	1265U	71.8	0.77	27.1	0.181	99.85	46.3	3.17
D029	15.1	1443M	49.3	2.42	47.8	0.362	99.88	18	1.19
D030	17.2	1443M	51.0	1.71	46.9	0.337	99.95	21	1.22
E39	13.6	1497M	82.1	4.05	13.6	0.135	99.89	30.5	2.24
D165	19.5	1497M	80.4	5.35	13.9	0.173	99.82	58	2.97
E40	14.0	1497U	77.8	4.54	17.3	0.236	99.88	32.3	2.31
D166	18.6	1497U	84.1	3.28	12.3	0.164	99.84	50	2.69
D101	16.5	1512U	89.5	1.53	8.8	0.148	99.98	30	1.82
E09	13.1	1560M	95.1	0.925	3.85	0.071	99.95	30.4	2.32
E11	15.0	1560M	97.2	0.49	2.17	0.047	99.91	33.9	2.26
D102	19.9	1560M	93.8	0.94	5.1	0.07	99.91	52	2.61
E12	15.0	1560U	99.9	0	0	0.006	99.91	60	4.00
D103	19.5	1560U	94.0	1.17	4.63	0.065	99.87	85	4.36
D178	19.1	1730U	55.7	2.04	41.9	0.253	99.97	74	3.87
E14	13.5	1740M	58.2	28.1	13.5	0.169	99.97	0	0.00
E16	14.0	1740U	88.4	6.5	5	0.081	99.98	7.56	0.54
D026 nc	15.5	2554M	45.0	2.96	51	0.366	99.33	37	2.39
D027	18.9	2554M	49.0	1.46	49.2	0.307	99.97	38	2.01
E06	11.5	2667M	84.5	3.445	11.85	0.167	99.91	29.6	2.57
D181	17.6	2667M	77.2	4.11	18.4	0.227	99.94	50	2.84
D182	19.3	2667M	90.6	1.63	7.6	0.113	99.88	58	3.01
E41	12.4	2775M	56.4	2.66	40.5	0.321	99.88	15.8	1.27
E42	13.8	2775U	81.4	0.99	17.4	0.167	99.96	40.5	2.93
D014	15.3	5903U	86.9	2.47	10.3	0.147	99.82	10	0.65
D097	19.5	5903U	94.0	1.15	4.69	0.07	99.91	21	1.08
E18	15.0	6082M	97.4	0.61	1.96	0.041	99.96	14.5	0.97
E25	15.0	6641U	65.5	33.1	1.38	0.033	100.01	1.33	0.09
E26	14.9	6641U	57.6	31.7	10.5	0.142	99.94	1.28	0.09
E13	14.5	6743M	81.0	1.14	17.6	0.152	99.89	38	2.62
D175	15.5	6768U	82.4	2.57	14.5	0.188	99.66	94	6.06
D034	17.6	8119M	60.2	29.15	10.45	0.1475	99.95	8.6	0.49
E01	13.2	9020M	89.3	1.495	8.9	0.149	99.84	11.2	0.85
D019	16.2	9020M	87.0	2.19	10.5	0.165	99.86	14.6	0.90
D020	18.8	9020M	89.2	1.58	9	0.132	99.91	12.3	0.65
D021	18.5	9020M	78.7	3.68	17.3	0.222	99.90	11	0.59
E49**	15.0	BLANK	0.02	21.3	77.7	0.940	99.96	0.00	0.00

*Sample size was vial size minus measure liquid volume, where EXX samples were in 15 mL vials and DXXX samples were in 20 mL vials.

**This sample was atmospheric gas (air).

Table 3. K West Basin Canister Gas Data Summary.

canister barrel	hydrogen percent	oxygen percent	nitrogen percent	Kr85 uCi/cc	Kr85 mCi/barrel	Cs-137** mCi/barrel
0102M	83.7	11.1	5.0	0.99	1.58	623
0102U	81.4	12.6	5.9	0.65	1.04	395
0315M	96.4	1.7	1.8	0.27	0.27	119
0315U	74.4	21.4	4.0	0.32	0.32	142
0738M	61.8	26.1	11.9	0.69	1.45	175
0738U	50.9	2.4	46.3	2.09	4.38	177
0943M	92.0	2.7	5.1	1.23	1.25	494
1265M	55.0	0.6	44.0	2.55	5.35	402
1265U	73.0	1.2	25.6	3.05	6.39	703
1443M	50.2	2.1	47.4	1.21	2.53	no data
1497M	81.3	4.7	13.8	2.61	4.17	358
1497U	81.0	3.9	14.8	2.50	4.00	4046
1512U	89.5	1.5	8.8	1.82	2.38	246
1560M	95.4	0.8	3.7	2.40	2.42	179
1560U	97.0	0.6	2.3	4.28	4.32	1242
1730U	55.7	2.0	41.9	3.87	6.20	no data
1740M	58.2	28.1	13.5	0.00	0.00	40
1740U	88.4	6.5	5.0	0.54	0.55	366
1990M*	72.0	0.14	27.6	3.53	4.63	170
2554M	47.0	2.2	50.1	2.26	3.62	no data
2667M	84.1	3.1	12.6	2.81	4.49	3558
2775M	56.4	2.7	40.5	1.27	2.04	101
2775U	81.4	1.0	17.4	2.93	4.70	340
4366M*	65.7	0.56	33.5	1.80	2.36	no data
4368M*	86.4	10.8	2.59	1.36	1.78	210
4368U*	98.6	0.27	1.06	1.79	2.34	340
4556M*	94.5	0.22	5.1	3.00	3.93	200
5903U	90.5	1.8	7.5	0.87	1.81	3247
6082M	97.4	0.6	2.0	0.97	2.03	1232
6641U	61.6	32.4	5.9	0.09	0.11	86
6743M	81.0	1.1	17.6	3.66	7.67	807
6768U	82.4	2.6	14.5	6.06	12.72	no data
8119M	60.2	29.2	10.5	0.49	1.02	174
9020M	86.1	2.2	11.4	0.82	1.26	no data

*From first sampling campaign (Trimble 1996a).
**Liquid sample data (Trimble 1996b, Trimble 1997)

Table 4. Summary Statistics for K West Basin Canister Gas Data.

FUEL TYPE	statistic	hydrogen percent	oxygen percent	nitrogen percent	Kr85* uCi/cc	Kr85 mCi/barrel	Kr-max** mCi/barrel	Cs-137 mCi/barrel
MK IA	MEAN=	67.74	6.62	25.32	2.10	3.79	5.78	912
MK IA	MEDIAN=	67.74	2.66	17.60	2.26	4.00	5.36	399
MK IA	STD DEV=	14.15	8.90	16.56	1.09	2.03	3.15	1304
MK IA	MAX=	84.08	29.15	50.10	3.87	7.67	11.13	4046
MK IA	MIN=	47.00	0.63	5.00	0.49	1.02	1.28	101
MK IA	N=	16	16	16	16	16	16	16
MK IV	MEAN=	84.79	6.39	8.63	1.73	2.47	2.94	554
MK IV	MEDIAN=	88.95	1.78	5.10	1.30	1.92	2.14	210
MK IV	STD DEV=	12.95	10.15	8.95	1.62	2.91	3.58	834
MK IV	MAX=	98.60	32.40	33.50	6.06	12.72	15.43	3247
MK IV	MIN=	58.20	0.14	1.06	0.00	0.00	0.00	40
MK IV	N=	18	18	18	18	18	18	18
all	MEAN=	76.77	6.50	16.49	1.90	3.09	4.27	720
all	MEDIAN=	81.30	2.22	11.66	1.79	2.37	3.24	340
all	STD DEV=	15.87	9.44	15.41	1.38	2.59	3.63	1072
all	MAX=	98.60	32.40	50.10	6.06	12.72	15.43	4046
all	MIN=	47.00	0.14	1.06	0.00	0.00	0.00	40
all	N=	34	34	34	34	34	34	34

*At sample pressure
**Kr-85 adjusted to 100% hydrogen
N= Number of observations

4.0 DISCUSSION

The following discussion summarizes the gas data from samples taken in 1995 and 1996 (first and second gas/liquid sampling campaigns) from K West Basin canisters.

4.1 NITROGEN

The canister gas was initially pure nitrogen. Over time much of this gas has been displaced by hydrogen and smaller amounts of oxygen. Nitrogen in the sampled barrels ranged from 1% to 50% with a mean 16%.

4.2 HYDROGEN

The samples were primarily hydrogen, ranging from 47% to 99% with a mean 77%. The hydrogen source is the canister water. Mechanisms that can generate gas from the water include radiolytic decomposition and release by uranium corrosion (Trimble 1996a).

4.3 OXYGEN

Oxygen in the sample barrels ranged from 0.1% to 32% with a mean 6.5%. Four of the 25 barrels sampled contained 26% to 32% oxygen with 58% to 62% hydrogen (Figure 2). This ratio of 0.5 for oxygen to hydrogen was not exceeded in any sample and was typically much lower. The ratio 0.5 indicates radiolytic decomposition. Ratios less than 0.5 suggests gas generation from a combination of corrosion hydrogen and radiolysis.

4.4 KRYPTON-85

The gas typically contained small amounts of ^{85}Kr activity averaging 1.9 μCi/cc and with a maximum 6.1 μCi/cc (at canister pressure). Total ^{85}Kr per barrel averaged 3,100 μCi with maximum 12,700 μCi.

It is assumed that ^{85}Kr is released from the canister fuel as the result of corrosion of the fuel. A fission-gas release model assumed all gas space nitrogen was replaced by corrosion hydrogen providing a worst case prediction of ^{85}Kr in the gas (Trimble 1996b). This model predicted 5,500 μCi/barrel (11,000 μCi/canister) as an average for all K West Basin canisters (Trimble 1996), which is 180% of the sample mean.

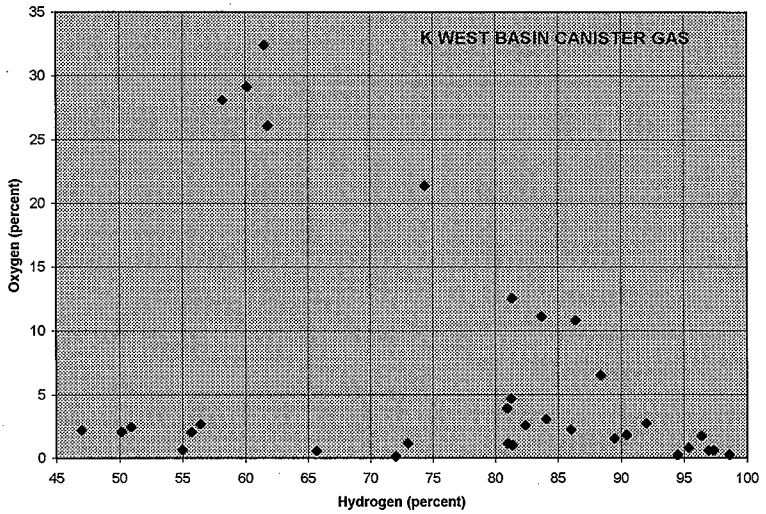
The gas in canisters storing Mark IV fuel could contain an average 3,600 μC/barrel of ^{85}Kr as predicted by the fission-gas release model. Similarly, canisters with Mark IA fuel could average 7,000 μCi/barrel (Trimble 1996b). Since the model assumes 100% corrosion hydrogen in the

gas space, a comparison of these predictions requires that the data be adjusted to 100% hydrogen, i.e., μCi per cc of hydrogen. Using this transformation and multiplying by the barrel gas space volume, the samples from barrels containing Mark IV fuel averaged 2,950 μCi/barrel, and those from barrels with Mark IA fuel averaged 5,360 μCi/barrel (Table 4). In both cases the sample data averages were less than the predicted values by no more than 25%.

4.5 TRITIUM

Tritium was not an analyte of the gas samples but is a fission gas that may be released by fuel corrosion. The fission-gas release model discussed in Section 4.4 predicts that 310 μCi/barrel of tritium could be released to the gas of an average canister in K West Basin (Trimble 1996b). This should be worst case for two reasons. First, significant amounts of tritium are found in the canister water (Trimble 1996b, 1997). The amount of tritium in the water appears to have been about one-third of that in the corroded fuel (Trimble 1996b), the remainder of which is expected to be in the gas. Secondly, not all of the gas space nitrogen has been displaced with hydrogen, and it is the corrosion hydrogen that carries fission gases into the canister gas.

Figure 2. Oxygen and Hydrogen Data for K West Basin Canister Gas.



5.0 CONCLUSIONS

1. The K West Basin canister gas consists of primarily hydrogen with some nitrogen and oxygen. Nitrogen is the original canister gas added during encapsulation. The hydrogen and oxygen are from the canister water. Radiolytic decomposition of the water produces hydrogen and oxygen gases, and water corrosion of the stored fuel generates hydrogen. In most canisters, the corrosion hydrogen has predominated over the radiolysis gases.

2. The canister gas contains fission gases. Krypton-85 averaged 3,100 μCi/barrel (6,200 μCi/canister) compared to a worst case prediction of 11,000 μCi/canister. Krypton-85 in the gas should not exceed 11,200 μCi/canister, on average.

3. Tritium in the gas should not exceed 620 μCi/canister, on average.

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6.0 REFERENCES

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APPENDIX A

GAS SPECIES ANALYSIS REPORTS FOR K WEST CANISTER SAMPLES

ANALYSES WERE BY PACIFIC NORTHWEST NATIONAL LABORATORY IN THE HANFORD 325 BUILDING LABORATORY. TYPICAL REPORT SUBMITTAL LETTERS ARE INCLUDED.

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Battelle
Pacific Northwest Division
P.O. Box 999
Richland, Washington U.S.A. 99352
Telephone (509) 376-3358

September 10, 1996

D.J. Trimble
Nuclear Fuel Evaluations
Westinghouse Hanford Co.
PO Box 1970
Richland, WA 99352

Dear Mr. Trimble

Analyses of the K-west basin fuel canister samples received August 29, 1996 and September 5, 1996 are complete. Uncorrected and corrected reports for sample vial background interferences are attached.

Analyses were performed using the PNNL high sensitivity, quantitative, gas mass spectrometer (WC38625). A performance check of the instrument, is made daily, using high purity nitrogen, prior to sample analyses. The Analytical Chemistry Laboratory log-in numbers are 96-06393, 96-06394, 96-06395, 96-06444 and 96-06445. Work package ED6493 was used for this work.

1 ml aliquots of the samples were removed from the vials using gas sampling syringes. The entire aliquot was injected into a 11.5 cc sample inlet. The pressures and temperature were recorded and the amount of gas in the 1 ml syringe was calculated and reported as the sample size.

If you have any questions concerning this report please free to call 376-3358.

Sincerely yours

M.W. Goheen Staff Scientist
Atomic and Molecular Chemistry

Stan Bos
Concurrence

October 30, 1996

D.J. Trimble
DESH
Mail Slot H0-40
Richland, Washington 99352

Dear Mr. Trimble

Analyses of the K-west basin fuel canister samples received October 23, 1996 and October 25, 1996 are complete. Uncorrected and corrected reports for sample vial background interferences are attached.

Analyses were performed using the PNNL high sensitivity, quantitative, gas mass spectrometer (WC38625). A performance check of the instrument, is made daily, using high purity nitrogen, prior to sample analyses. The Analytical Chemistry Laboratory log-in numbers are 97-00284 through 97-00290. Work package ED7032 was used for this work.

1 ml aliquots of the samples were removed from the vials using gas sampling syringes. The entire aliquot was injected into a 11.5 cc sample inlet. The pressures and temperature were recorded and the amount of gas in the 1 ml syringe was calculated and reported as the sample size.

If you have any questions concerning this report please free to call 376-3358.

Sincerely yours

Stan Bos

Stanley Bos
Atomic and Molecular Chemistry

Concurrence 10-30-96

Battelle Boulevard ■ P.O. Box 999 ■ Richland, WA 99352

Telephone 376-5384 ■ Email SJ_Bos@pnl.gov ■ Fax 373-9675

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 16, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 103
Measurement and test equipment WC38625

Sample Id. D014 (Background corrected)
Analysis Date September 12, 1996
Log-in No. 96-06656

Sample size 1.26 cc stp
Liquid found in vial 4.7 ml

	Mole Percent		Estimate of Precision
Argon	0.147	±	0.003
Carbon dioxide	0.091	±	0.002
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	86.9	±	0.2
Methane	0.028	±	0.001
Nitrogen	10.3	±	0.2
Oxygen	2.47	±	0.05
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	0.002	±	0.0005
Xenon 131	0.003	±	0.0005
Xenon 132	0.004	±	0.0005
Xenon 134	0.007	±	0.0005
Xenon 136	0.011	±	0.001

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 16, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 103
Measurement and test equipment WC38625

Sample Id. D019 (Background corrected)
Analysis Date September 12, 1996
Log-in No. 96-06657

Sample size 1.27 cc stp
Liquid found in vial 3.8 ml

	Mole Percent		Estimate of Precision
Argon	0.165	±	0.003
Carbon dioxide	0.094	±	0.002
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	87	±	0.2
Methane	0.024	±	0.001
Nitrogen	10.5	±	0.2
Oxygen	2.19	±	0.04
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	0.001	±	0.0005
Xenon 132	0.002	±	0.0005
Xenon 134	0.003	±	0.0005
Xenon 136	0.005	±	0.0005

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 6, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 101
Measurement and test equipment WC38625

Sample Id. D020 (Background corrected)
Analysis Date August 30, 1996
Log-in No. 96-06395

Sample size 1.28 cc stp
Liquid found in vial 1.2 ml

	Mole Percent		Estimate of Precision
Argon	0.132	±	0.003
Carbon dioxide	<0.01	±	
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	89.2	±	0.2
Methane	0.018	±	0.001
Nitrogen	9	±	0.2
Oxygen	1.58	±	0.03
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	0.001	±	0.0005
Xenon 132	0.002	±	0.0005
Xenon 134	0.003	±	0.0005
Xenon 136	0.005	±	0.0005

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 16, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 103
Measurement and test equipment WC38625

Sample Id. D021 (Background corrected)
Analysis Date September 12, 1996
Log-in No. 96-06658

Sample size 1.29 cc stp
Liquid found in vial 1.5 ml

	Mole Percent		Estimate of Precision
Argon	0.222	±	0.004
Carbon dioxide	.0.036	±	0.001
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	78.7	±	0.4
Methane	0.019	±	0.001
Nitrogen	17.3	±	0.4
Oxygen	3.68	±	0.07
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	<0.0005	±	
Xenon 132	0.002	±	0.0005
Xenon 134	0.003	±	0.0005
Xenon 136	0.005	±	0.0005

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 24, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 105
Measurement and test equipment WC38625

Sample Id. D026 (Background corrected)
Analysis Date September 20, 1996
Log-in No. 96-06761

Sample size 1.26 cc stp
Liquid found in vial 4.5 ml

	Mole Percent	Estimate of Precision
Argon		±
Carbon dioxide		±
Carbon monoxide		±
Helium		±
Hydrogen		±
Methane		±
Nitrogen		±
Oxygen		±
Nitrous oxide		±
Other nitrogen oxides		±
Ethane		±
Other hydrocarbons		±
Krypton 83		±
Krypton 84		±
Krypton 85		±
Krypton 86		±
Xenon 131		±
Xenon 132		±
Xenon 134		±
Xenon 136		±

Comments Unable to make a background correction

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 10, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 102
Measurement and test equipment WC38625

Sample Id. D027 (Background corrected)
Analysis Date September 06, 1996
Log-in No. 96-06445

Sample size 1.27 cc stp
Liquid found in vial 1.1 ml

	Mole Percent		Estimate of Precision
Argon	0.307	±	0.006
Carbon dioxide	<0.01	±	
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	49	±	0.9
Methane	0.003	±	0.0005
Nitrogen	49.2	±	0.9
Oxygen	1.46	±	0.03
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	0.003	±	0.0005
Xenon 131	0.003	±	0.0005
Xenon 132	0.005	±	0.0005
Xenon 134	0.008	±	0.0005
Xenon 136	0.012	±	0.001

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 16, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 103
Measurement and test equipment WC38625

Sample Id. D029 (Background corrected)
Analysis Date September 12, 1996
Log-in No. 96-06659

Sample size 1.27 cc stp
Liquid found in vial 4.9 ml

	Mole Percent		Estimate of Precision
Argon	0.362	±	0.007
Carbon dioxide	0.052	±	0.001
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	49.4	±	0.9
Methane	0.013	±	0.001
Nitrogen	47.8	±	0.9
Oxygen	2.42	±	0.05
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	0.001	±	0.0005
Xenon 132	0.002	±	0.0005
Xenon 134	0.003	±	0.0005
Xenon 136	0.004	±	0.0005

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 16, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 103
Measurement and test equipment WC38625

Sample Id. D030 (Background corrected)
Analysis Date September 12, 1996
Log-in No. 96-06660

Sample size 1.27 cc stp
Liquid found in vial 2.8 ml

	Mole Percent		Estimate of Precision
Argon	0.337	±	0.007
Carbon dioxide	0.032	±	0.001
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	51	±	0.9
Methane	0.011	±	0.001
Nitrogen	46.9	±	0.9
Oxygen	1.71	±	0.03
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	0.001	±	0.0005
Xenon 132	0.002	±	0.0005
Xenon 134	0.003	±	0.0005
Xenon 136	0.004	±	0.0005

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 16, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 103
Measurement and test equipment WC38625

Sample Id. D034 (Background corrected)
Analysis Date September 12, 1996
Log-in No. 96-06661

Sample size 1.31 cc stp
Liquid found in vial 2.4 ml

	Mole Percent	Estimate of Precision
Argon	0.146	± 0.003
Carbon dioxide	0.041	± 0.001
Carbon monoxide	<0.01	±
Helium	<0.001	±
Hydrogen	60.3	± 0.6
Methane	0.011	± 0.001
Nitrogen	10.4	± 0.2
Oxygen	29.2	± 0.6
Nitrous oxide	<0.01	±
Other nitrogen oxides	<0.005	±
Ethane	<0.001	±
Other hydrocarbons	<0.001	±
Krypton 83	<0.0005	±
Krypton 84	<0.0005	±
Krypton 85	<0.0005	±
Krypton 86	<0.0005	±
Xenon 131	0.001	± 0.0005
Xenon 132	0.001	± 0.0005
Xenon 134	0.002	± 0.0005
Xenon 136	0.003	± 0.0005

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 16, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 103
Measurement and test equipment WC38625

Sample Id. D034 Dup (Background corrected)
Analysis Date September 12, 1996
Log-in No. 96-06661

Sample size 1.24 cc stp
Liquid found in vial 2.4 ml

	Mole Percent	Estimate of Precision
Argon	0.149	± 0.004
Carbon dioxide	0.045	± 0.001
Carbon monoxide	<0.01	±
Helium	<0.001	±
Hydrogen	60.1	± 0.6
Methane	0.013	± 0.001
Nitrogen	10.5	± 0.2
Oxygen	29.1	± 0.6
Nitrous oxide	<0.01	±
Other nitrogen oxides	<0.005	±
Ethane	<0.001	±
Other hydrocarbons	<0.001	±
Krypton 83	<0.0005	±
Krypton 84	<0.0005	±
Krypton 85	<0.0005	±
Krypton 86	<0.0005	±
Xenon 131	<0.001	±
Xenon 132	0.001	± 0.0005
Xenon 134	0.002	± 0.0005
Xenon 136	0.003	± 0.0005

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 24, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 104
Measurement and test equipment WC38625

Sample Id. D049 (Background corrected)
Analysis Date September 20, 1996
Log-in No. 96-06758

Sample size 0.77 cc stp
Liquid found in vial 5.4 ml

	Mole Percent	Estimate of Precision
Argon		±
Carbon dioxide		±
Carbon monoxide		±
Helium		±
Hydrogen		±
Methane		±
Nitrogen		±
Oxygen		±
Nitrous oxide		±
Other nitrogen oxides		±
Ethane		±
Other hydrocarbons		±
Krypton 83		±
Krypton 84		±
Krypton 85		±
Krypton 86		±
Xenon 131		±
Xenon 132		±
Xenon 134		±
Xenon 136		±

Comments Unable to make a background correction

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 24, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 105
Measurement and test equipment WC38625

Sample Id. D071 (Background corrected)
Analysis Date September 20, 1996
Log-in No. 96-06759

Sample size 1.25 cc stp
Liquid found in vial 1.0 ml

	Mole Percent		Estimate of Precision
Argon	0.081	±	0.002
Carbon dioxide	0.004	±	0.001
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	92	±	0.1
Methane	0.024	±	0.001
Nitrogen	5.1	±	0.1
Oxygen	2.73	±	0.05
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	0.003	±	0.0005
Xenon 132	0.004	±	0.0005
Xenon 134	0.007	±	0.0005
Xenon 136	0.01	±	0.001

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 01, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 106
Measurement and test equipment WC38625

Sample Id. D072 (Background corrected)
Analysis Date September 26, 1996
Log-in No. 96-06838

Sample size 0.24 cc stp
Liquid found in vial 1.2 ml
Room temperature 69.6 ° F

	Mole Percent		Estimate of Precision
Argon	0.36	±	0.007
Carbon dioxide	0.038	±	0.001
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	66	±	0.5
Methane	0.104	±	0.002
Nitrogen	26.6	±	0.5
Oxygen	6.9	±	0.1
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	<0.0005	±	
Xenon 132	0.002	±	0.0005
Xenon 134	0.004	±	0.0005
Xenon 136	0.007	±	0.0005

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 24, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 105
Measurement and test equipment WC38625

Sample Id. D074 (Background corrected)
Analysis Date September 20, 1996
Log-in No. 96-06760

Sample size 0.55 cc stp
Liquid found in vial 0.4 ml

	Mole Percent		Estimate of Precision
Argon	0.87	±	0.02
Carbon dioxide	<0.001	±	
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	7.6	±	0.2
Methane	0.01	±	0.001
Nitrogen	71.8	±	0.4
Oxygen	19.8	±	0.4
Nitrous oxide	<0.001	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	<0.0005	±	
Xenon 132	<0.0005	±	
Xenon 134	<0.0005	±	
Xenon 136	<0.0005	±	

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 01, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 106
Measurement and test equipment WC38625

Sample Id. D097 (Background corrected)
Analysis Date September 26, 1996
Log-in No. 96-06839

Sample size 1.29 cc stp
Liquid found in vial 0.5 ml
Room temperature 68.9 ° F

	Mole Percent		Estimate of Precision
Argon	0.07	±	0.001
Carbon dioxide	<0.001	±	
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	94	±	0.1
Methane	0.022	±	0.001
Nitrogen	4.69	±	0.09
Oxygen	1.15	±	0.02
Nitrous oxide	<0.001	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	0.003	±	0.0005
Xenon 132	0.005	±	0.0005
Xenon 134	0.009	±	0.001
Xenon 136	0.013	±	0.001

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 01, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 106
Measurement and test equipment WC38625

Sample Id. D101 (Background corrected)
Analysis Date September 26, 1996
Log-in No. 96-06840

Sample size 1.25 cc stp
Liquid found in vial 3.5 ml
Room temperature 68.5 ° F

	Mole Percent		Estimate of Precision
Argon	0.148	±	0.003
Carbon dioxide	<0.001	±	
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	89.5	±	0.2
Methane	0.025	±	0.001
Nitrogen	8.8	±	0.2
Oxygen	1.53	±	0.03
Nitrous oxide	<0.001	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	0.003	±	0.0005
Xenon 132	0.005	±	0.0005
Xenon 134	0.008	±	0.0005
Xenon 136	0.012	±	0.001

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 01, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 106
Measurement and test equipment WC38625

Sample Id. D102 (Background corrected)
Analysis Date September 26, 1996
Log-in No. 96-06841

Sample size 1.29 cc stp
Liquid found in vial 0.1 ml
Room temperature 68.2 ° F

	Mole Percent		Estimate of Precision
Argon	0.07	±	0.001
Carbon dioxide	<0.001	±	
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	93.8	±	0.2
Methane	0.014	±	0.001
Nitrogen	5.1	±	0.1
Oxygen	0.94	±	0.02
Nitrous oxide	<0.001	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	0.002	±	0.0005
Xenon 131	0.004	±	0.0005
Xenon 132	0.008	±	0.0005
Xenon 134	0.013	±	0.001
Xenon 136	0.02	±	0.001

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 01, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 106
Measurement and test equipment WC38625

Sample Id. D103 (Background corrected)
Analysis Date September 26, 1996
Log-in No. 96-06842

Sample size 1.27 cc stp
Liquid found in vial 0.5 ml
Room temperature 68.2 ° F

	Mole Percent		Estimate of Precision
Argon	0.065	±	0.001
Carbon dioxide	<0.001	±	
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	94	±	0.2
Methane	0.037	±	0.001
Nitrogen	4.63	±	0.09
Oxygen	1.17	±	0.02
Nitrous oxide	<0.001	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	0.002	±	0.0005
Krypton 85	<0.0005	±	
Krypton 86	0.005	±	0.0005
Xenon 131	0.008	±	0.0005
Xenon 132	0.015	±	0.001
Xenon 134	0.024	±	0.001
Xenon 136	0.036	±	0.001

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 01, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 106
Measurement and test equipment WC38625

Sample Id. D104 (Background corrected)
Analysis Date September 27, 1996
Log-in No. 96-06843

Sample size 0.15 cc stp
Liquid found in vial 0.3 ml
Room temperature 69.8 ° F

	Mole Percent	Estimate of Precision
Argon	0.51	± 0.01
Carbon dioxide	<0.001	±
Carbon monoxide	<0.01	±
Helium	<0.001	±
Hydrogen	46.5	± 0.8
Methane	0.153	± 0.001
Nitrogen	42	± 0.8
Oxygen	10.8	± 0.2
Nitrous oxide	<0.001	±
Other nitrogen oxides	<0.005	±
Ethane	<0.001	±
Other hydrocarbons	<0.001	±
Krypton 83	<0.0005	±
Krypton 84	<0.0005	±
Krypton 85	<0.0005	±
Krypton 86	<0.0005	±
Xenon 131	<0.0005	±
Xenon 132	<0.0005	±
Xenon 134	0.009	± 0.001
Xenon 136	0.014	± 0.001

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 29, 1996
Subject: Gas Species Analysis

To: DJ Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 111
Measurement and test equipment WC38625

Sample Id. D165 (Background Corrected)
Analysis Date October 23, 1996
Log-in No.

Sample size 1.28 cc stp
Liquid found in vial
Room temperature 69.8 ° F

	Mole Percent	Estimate of Precision
Argon		±
Carbon dioxide		±
Carbon monoxide		±
Helium		±
Hydrogen		±
Methane		±
Nitrogen		±
Oxygen		±
Nitrous oxide		±
Other nitrogen oxides		±
Ethane		±
Other hydrocarbons		±
Krypton 83		±
Krypton 84		±
Krypton 85		±
Krypton 86		±
Xenon 131		±
Xenon 132		±
Xenon 134		±
Xenon 136		±

Comments Unable to make a background correction

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 29, 1996
Subject: Gas Species Analysis

To: DJ Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 111
Measurement and test equipment WC38625

Sample Id. D165 Dup (Background Corrected)
Analysis Date October 23, 1996
Log-in No.

Sample size 1.20 cc stp
Liquid found in vial
Room temperature 69.1 ° F

	Mole Percent	Estimate of Precision
Argon		±
Carbon dioxide		±
Carbon monoxide		±
Helium		±
Hydrogen		±
Methane		±
Nitrogen		±
Oxygen		±
Nitrous oxide		±
Other nitrogen oxides		±
Ethane		±
Other hydrocarbons		±
Krypton 83		±
Krypton 84		±
Krypton 85		±
Krypton 86		±
Xenon 131		±
Xenon 132		±
Xenon 134		±
Xenon 136		±

Comments Unable to make a background correction

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 29, 1996
Subject: Gas Species Analysis

To: DJ Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 111
Measurement and test equipment WC38625

Sample Id. D166 (Background Corrected)
Analysis Date October 23, 1996
Log-in No. 97-00285

Sample size 1.25 cc stp
Liquid found in vial
Room temperature 69.6 ° F

	Mole Percent		Estimate of Precision
Argon	0.164	±	0.004
Carbon dioxide	0.032	±	0.004
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	84.1	±	0.2
Methane	0.017	±	0.002
Nitrogen	12.3	±	0.2
Oxygen	3.28	±	0.07
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.01	±	
Other hydrocarbons	<0.01	±	
Krypton 83	<0.0005	±	
Krypton 84	0.002	±	0.0005
Krypton 85	<0.0005	±	
Krypton 86	0.003	±	0.0005
Xenon 131	0.005	±	0.001
Xenon 132	0.008	±	0.001
Xenon 134	0.013	±	0.002
Xenon 136	0.019	±	0.002

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 29, 1996
Subject: Gas Species Analysis

To: DJ Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 111
Measurement and test equipment WC38625

Sample Id. D175 (Background Corrected)
Analysis Date October 28, 1996
Log-in No. 97-00286

Sample size 1.28
Liquid found in vial
Room temperature 70.7 ° F

	Mole Percent	Estimate of Precision
Argon		±
Carbon dioxide		±
Carbon monoxide		±
Helium		±
Hydrogen		±
Methane		±
Nitrogen		±
Oxygen		±
Nitrous oxide		±
Other nitrogen oxides		±
Ethane		±
Other hydrocarbons		±
Krypton 83		±
Krypton 84		±
Krypton 85		±
Krypton 86		±
Xenon 131		±
Xenon 132		±
Xenon 134		±
Xenon 136		±

Comments Unable to make a background correction

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 29, 1996
Subject: Gas Species Analysis

To: DJ Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 111
Measurement and test equipment WC38625

Sample Id. D176 (Background Corrected)
Analysis Date October 28, 1996
Log-in No. 97-00287

Sample size 0.86
Liquid found in vial
Room temperature 70.2 ° F

	Mole Percent	Estimate of Precision
Argon		±
Carbon dioxide		±
Carbon monoxide		±
Helium		±
Hydrogen		±
Methane		±
Nitrogen		±
Oxygen		±
Nitrous oxide		±
Other nitrogen oxides		±
Ethane		±
Other hydrocarbons		±
Krypton 83		±
Krypton 84		±
Krypton 85		±
Krypton 86		±
Xenon 131		±
Xenon 132		±
Xenon 134		±
Xenon 136		±

Comments Unable to make a background correction

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 29, 1996
Subject: Gas Species Analysis

To: DJ Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 111
Measurement and test equipment WC38625

Sample Id. D178 (Background Corrected)
Analysis Date October 23, 1996
Log-in No. 97-00288

Sample size 1.27 cc stp
Liquid found in vial
Room temperature 69.1 ° F

	Mole Percent		Estimate of Precision
Argon	0.253	±	0.005
Carbon dioxide	0.027	±	0.002
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	55.7	±	0.8
Methane	0.009	±	0.002
Nitrogen	41.9	±	0.8
Oxygen	2.04	±	0.05
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.01	±	
Other hydrocarbons	<0.01	±	
Krypton 83	<0.0005	±	
Krypton 84	0.002	±	0.0005
Krypton 85	<0.0005	±	
Krypton 86	0.004	±	0.001
Xenon 131	0.005	±	0.001
Xenon 132	0.009	±	0.002
Xenon 134	0.015	±	0.002
Xenon 136	0.023	±	0.002

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 29, 1996
Subject: Gas Species Analysis

To: DJ Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 111
Measurement and test equipment WC38625

Sample Id. D181 (Background Corrected)
Analysis Date October 23, 1996
Log-in No. 97-00289

Sample size 1.44 cc stp
Liquid found in vial
Room temperature 76.8 ° F

	Mole Percent		Estimate of Precision
Argon	0.227	±	0.005
Carbon dioxide	0.011	±	0.002
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	77.2	±	0.4
Methane	0.019	±	0.002
Nitrogen	18.4	±	0.4
Oxygen	4.11	±	0.09
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.01	±	
Other hydrocarbons	<0.01	±	
Krypton 83	<0.0005	±	
Krypton 84	0.001	±	0.0005
Krypton 85	<0.0005	±	
Krypton 86	0.002	±	0.0005
Xenon 131	0.004	±	0.0005
Xenon 132	0.006	±	0.001
Xenon 134	0.010	±	0.002
Xenon 136	0.015	±	0.002

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 29, 1996
Subject: Gas Species Analysis

To: DJ Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 111
Measurement and test equipment WC38625

Sample Id. D182 (Background Corrected)
Analysis Date October 23, 1996
Log-in No. 97-00290

Sample size 1.26 cc stp
Liquid found in vial
Room temperature 77.9 ° F

	Mole Percent		Estimate of Precision
Argon	0.113	±	0.003
Carbon dioxide	0.011	±	0.002
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	90.6	±	0.2
Methane	0.021	±	0.002
Nitrogen	7.6	±	0.2
Oxygen	1.63	±	0.04
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.01	±	
Other hydrocarbons		±	
Krypton 83	<0.0005	±	
Krypton 84	0.002	±	0.0005
Krypton 85	<0.0005	±	
Krypton 86	0.003	±	0.0005
Xenon 131	0.004	±	0.001
Xenon 132	0.007	±	0.001
Xenon 134	0.012	±	0.002
Xenon 136	0.017	±	0.002

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 6, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 101
Measurement and test equipment WC38625

Sample Id. E01 (Background corrected)
Analysis Date August 30, 1996
Log-in No. 96-06393

Sample size 1.30 cc stp
Liquid found in vial 1.8 ml

	Mole Percent		Estimate of Precision
Argon	0.145	±	0.003
Carbon dioxide	0.105	±	0.002
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	89.8	±	0.2
Methane	0.018	±	0.001
Nitrogen	8.6	±	0.2
Oxygen	1.34	±	0.03
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	0.001	±	0.0005
Xenon 131	0.002	±	0.0005
Xenon 132	0.002	±	0.0005
Xenon 134	0.004	±	0.0005
Xenon 136	0.006	±	0.0005

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 6, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 101
Measurement and test equipment WC38625

Sample Id. E01 (Dup) Background corrected
Analysis Date September 3, 1996
Log-in No. 96-06393

Sample size 0.99 cc stp
Liquid found in vial 1.8 ml

	Mole Percent		Estimate of Precision
Argon	0.153	±	0.003
Carbon dioxide	0.134	±	0.003
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	88.8	±	0.2
Methane	0.018	±	0.001
Nitrogen	9.2	±	0.2
Oxygen	1.65	±	0.03
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	0.001	±	0.0005
Xenon 131	0.001	±	0.0005
Xenon 132	0.002	±	0.0005
Xenon 134	0.004	±	0.0005
Xenon 136	0.005	±	0.0005

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 6, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6. Page 101
Measurement and test equipment WC38625

Sample Id. E02 (Background corrected)
Analysis Date August 30, 1996
Log-in No. 96-06394

Sample size 0.21 cc stp
Liquid found in vial 0.05 ml

	Mole Percent		Estimate of Precision
Argon	0.132	±	0.003
Carbon dioxide	<0.01	±	
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	89.7	±	0.2
Methane	0.019	±	0.001
Nitrogen	7	±	0.1
Oxygen	3.14	±	0.06
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	0.003	±	0.0005
Krypton 85	<0.0005	±	
Krypton 86	0.003	±	0.0005
Xenon 131	0.003	±	0.0005
Xenon 132	0.004	±	0.0005
Xenon 134	0.007	±	0.0005
Xenon 136	0.009	±	0.0005

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 10, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 102
Measurement and test equipment WC38625

Sample Id. E06 (Background corrected)
Analysis Date September 06, 1996
Log-in No. 96-06444

Sample size 1.22 cc stp
Liquid found in vial 3.5 ml

	Mole Percent		Estimate of Precision
Argon	0.169	±	0.003
Carbon dioxide	0.043	±	0.001
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	84.3	±	0.2
Methane	0.016	±	0.001
Nitrogen	12	±	0.2
Oxygen	3.44	±	0.07
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	0.003	±	0.0005
Xenon 131	0.004	±	0.0005
Xenon 132	0.007	±	0.0005
Xenon 134	0.011	±	0.001
Xenon 136	0.016	±	0.001

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 10, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 102
Measurement and test equipment WC38625

Sample Id. E06 (Dup) : Background corrected
Analysis Date September 06, 1996
Log-in No. 96-06444

Sample size 1.13 cc stp
Liquid found in vial 3.5 ml

	Mole Percent		Estimate of Precision
Argon	0.165	±	0.003
Carbon dioxide	0.041	±	0.001
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	84.6	±	0.2
Methane	0.016	±	0.001
Nitrogen	11.7	±	0.2
Oxygen	3.45	±	0.07
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	0.003	±	0.0005
Xenon 131	0.004	±	0.0005
Xenon 132	0.007	±	0.0005
Xenon 134	0.011	±	0.0005
Xenon 136	0.016	±	0.0005

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 01, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 106
Measurement and test equipment WC38625

Sample Id. E09 (Background corrected)
Analysis Date September 27, 1996
Log-in No. 96-06844

Sample size 1.25 cc stp
Liquid found in vial 1.9 ml
Room temperature 70.7 ° F

	Mole Percent		Estimate of Precision
Argon	0.07	±	0.001
Carbon dioxide	0.007	±	0.001
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	95.2	±	0.2
Methane	0.02	±	0.001
Nitrogen	3.8	±	0.08
Oxygen	0.9	±	0.02
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	0.002	±	0.0005
Krypton 85	<0.0005	±	
Krypton 86	0.003	±	0.0005
Xenon 131	0.005	±	0.0005
Xenon 132	0.009	±	0.001
Xenon 134	0.014	±	0.001
Xenon 136	0.021	±	0.001

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 01, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 106
Measurement and test equipment WC38625

Sample Id. E09 Dup (Background corrected)
Analysis Date September 27, 1996
Log-in No. 96-06844

Sample size 1.16 cc stp
Liquid found in vial 1.9 ml
Room temperature 68.5 ° F

	Mole Percent		Estimate of Precision
Argon	0.072	±	0.001
Carbon dioxide	0.009	±	0.001
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	95	±	0.2
Methane	0.018	±	0.001
Nitrogen	3.9	±	0.08
Oxygen	0.95	±	0.02
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	0.003	±	0.0005
Xenon 131	0.005	±	0.0005
Xenon 132	0.009	±	0.001
Xenon 134	0.014	±	0.001
Xenon 136	0.021	±	0.001

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 01, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 106
Measurement and test equipment WC38625

Sample Id. E11 (Background corrected)
Analysis Date September 27, 1996
Log-in No. 96-06845

Sample size 1.26 cc stp
Liquid found in vial 0 ml
Room temperature 70.7 ° F

	Mole Percent		Estimate of Precision
Argon	0.047	±	0.001
Carbon dioxide	<0.001	±	
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	97.2	±	0.2
Methane	0.016	±	0.001
Nitrogen	2.17	±	0.04
Oxygen	0.49	±	0.01
Nitrous oxide	<0.001	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	0.002	±	0.0005
Krypton 85	<0.0005	±	
Krypton 86	0.004	±	0.0005
Xenon 131	0.005	±	0.0005
Xenon 132	0.009	±	0.001
Xenon 134	0.015	±	0.001
Xenon 136	0.022	±	0.001

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 01, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 106
Measurement and test equipment WC38625

Sample Id. E12 (Background corrected)
Analysis Date September 27, 1996
Log-in No. 96-06846

Sample size 1.21 cc stp
Liquid found in vial 0 ml
Room temperature 69.3 ° F

	Mole Percent		Estimate of Precision
Argon	0.006	±	0.001
Carbon dioxide	<0.001	±	
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	99.9	±	0.1
Methane	0.027	±	0.001
Nitrogen	<0.001	±	
Oxygen	<0.001	±	
Nitrous oxide	<0.001	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	0.003	±	0.0005
Krypton 85	<0.0005	±	
Krypton 86	0.006	±	0.0005
Xenon 131	0.01	±	0.001
Xenon 132	0.017	±	0.001
Xenon 134	0.026	±	0.001
Xenon 136	0.039	±	0.001

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 16, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 103
Measurement and test equipment WC38625

Sample Id. E13 (Background corrected)
Analysis Date September 12, 1996
Log-in No. 96-06655

Sample size 1.16 cc stp
Liquid found in vial 0.5 ml

	Mole Percent		Estimate of Precision
Argon	0.152	±	0.003
Carbon dioxide	0.016	±	0.001
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	81	±	0.4
Methane	<0.001	±	
Nitrogen	17.6	±	0.4
Oxygen	1.14	±	0.02
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	0.002	±	0.0005
Krypton 85	<0.0005	±	
Krypton 86	0.005	±	0.0005
Xenon 131	0.006	±	0.0005
Xenon 132	0.01	±	0.001
Xenon 134	0.017	±	0.001
Xenon 136	0.026	±	0.001

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 24, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 104
Measurement and test equipment WC38625

Sample Id. E-14 (Background corrected)
Analysis Date September 20, 1996
Log-in No. 96-06753

Sample size 1.22 cc stp
Liquid found in vial 1.5 ml

	Mole Percent		Estimate of Precision
Argon	0.169	±	0.003
Carbon dioxide	0.076	±	0.002
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	58.2	±	0.6
Methane	<0.001	±	
Nitrogen	13.5	±	0.3
Oxygen	28.1	±	0.6
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	<0.0005	±	
Xenon 132	<0.0005	±	
Xenon 134	<0.0005	±	
Xenon 136	<0.0005	±	

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 01, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 106
Measurement and test equipment WC38625

Sample Id. E15 (Background corrected)
Analysis Date September 27, 1996
Log-in No. 96-06847

Sample size 0.18 cc stp
Liquid found in vial 1.1 ml
Room temperature 68.0 ° F

	Mole Percent		Estimate of Precision
Argon	0.48	±	0.01
Carbon dioxide	1.08	±	0.02
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	52.8	±	0.9
Methane	0.077	±	0.002
Nitrogen	26.4	±	0.5
Oxygen	19.1	±	0.4
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	<0.0005	±	
Xenon 132	<0.0005	±	
Xenon 134	<0.0005	±	
Xenon 136	0.004	±	0.0005

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 24, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 104
Measurement and test equipment WC38625

Sample Id. E-16 (Background corrected)
Analysis Date September 20, 1996
Log-in No. 96-06754

Sample size 1.21 cc stp
Liquid found in vial 1 ml

	Mole Percent		Estimate of Precision
Argon	0.081	±	0.002
Carbon dioxide	0.016	±	0.001
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	88.4	±	0.2
Methane	0.003	±	0.0005
Nitrogen	5	±	0.1
Oxygen	6.5	±	0.1
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	<0.0005	±	
Xenon 132	<0.0005	±	
Xenon 134	0.003	±	0.0005
Xenon 136	0.004	±	0.0005

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 08, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 107
Measurement and test equipment WC38625

Sample Id. E-18 (Background corrected)
Analysis Date October 4, 1996
Log-in No. 97-00029

Sample size 1.28 cc stp
Liquid found in vial 0.05 ml
Room temperature 72.0 ° F

	Mole Percent		Estimate of Precision
Argon	0.04	±	0.001
Carbon dioxide	<0.001	±	
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	97.5	±	0.2
Methane	0.016	±	0.001
Nitrogen	1.9	±	0.04
Oxygen	0.55	±	0.01
Nitrous oxide	<0.001	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	0.01	±	0.005
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	0.002	±	0.0005
Xenon 131	0.003	±	0.0005
Xenon 132	0.005	±	0.0005
Xenon 134	0.008	±	0.0005
Xenon 136	0.011	±	0.001

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 08, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 107
Measurement and test equipment WC38625

Sample Id. E-18 Dup (Background corrected)
Analysis Date October 4, 1996
Log-in No. 97-00029

Sample size 1.19 cc stp
Liquid found in vial 0.05 ml
Room temperature 68.7 ° F

	Mole Percent		Estimate of Precision
Argon	0.042	±	0.001
Carbon dioxide	<0.001	±	
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	97.2	±	0.2
Methane	0.014	±	0.001
Nitrogen	2.02	±	0.04
Oxygen	0.67	±	0.01
Nitrous oxide	<0.001	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	0.01	±	0.005
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	0.001	±	0.0005
Xenon 131	0.003	±	0.0005
Xenon 132	0.004	±	0.0005
Xenon 134	0.007	±	0.0005
Xenon 136	0.01	±	0.001

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 24, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 104
Measurement and test equipment WC38625

Sample Id. E-20 (Background corrected)
Analysis Date September 20, 1996
Log-in No. 96-06755

Sample size 1.24 cc stp
Liquid found in vial 0.1 ml

	Mole Percent		Estimate of Precision
Argon	0.042	±	0.001
Carbon dioxide	<0.001	±	
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	96.4	±	0.1
Methane	0.002	±	0.0005
Nitrogen	1.78	±	0.04
Oxygen	1.74	±	0.03
Nitrous oxide	<0.001	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	<0.0005	±	
Xenon 132	<0.0005	±	
Xenon 134	0.002	±	0.0005
Xenon 136	0.002	±	0.0005

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 24, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 104
Measurement and test equipment WC38625

Sample Id. E-22 (Background corrected)
Analysis Date September 20, 1996
Log-in No. 96-06756

Sample size 1.22 cc stp
Liquid found in vial 0.6 ml

	Mole Percent	Estimate of Precision
Argon	0.069	± 0.001
Carbon dioxide	0.006	± 0.001
Carbon monoxide	<0.01	±
Helium	<0.001	±
Hydrogen	74.4	± 0.4
Methane	0.008	± 0.001
Nitrogen	4.04	± 0.08
Oxygen	21.4	± 0.4
Nitrous oxide	<0.01	±
Other nitrogen oxides	<0.005	±
Ethane	<0.001	±
Other hydrocarbons	<0.001	±
Krypton 83	<0.0005	±
Krypton 84	<0.0005	±
Krypton 85	<0.0005	±
Krypton 86	<0.0005	±
Xenon 131	<0.0005	±
Xenon 132	0.001	± 0.0005
Xenon 134	0.002	± 0.0005
Xenon 136	0.003	± 0.0005

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 08, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 107
Measurement and test equipment WC38625

Sample Id. E-25 (Background corrected)
Analysis Date October 4, 1996
Log-in No. 97-00030

Sample size 1.28 cc stp
Liquid found in vial 0 ml
Room temperature 72.5 ° F

	Mole Percent		Estimate of Precision
Argon	0.033	±	0.001
Carbon dioxide	<0.001	±	
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	65.5	±	0.7
Methane	0.003	±	0.0005
Nitrogen	1.38	±	0.03
Oxygen	33.1	±	0.7
Nitrous oxide	<0.001	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	0.05	±	0.02
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	<0.0005	±	
Xenon 132	<0.0005	±	
Xenon 134	<0.0005	±	
Xenon 136	0.0007	±	0.0005

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 08, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 107
Measurement and test equipment WC38625

Sample Id. E-26 (Background corrected)
Analysis Date October 4, 1996
Log-in No. 97-00031

Sample size 1.27 cc stp
Liquid found in vial 0.05 ml
Room temperature 70.0 ° F

	Mole Percent		Estimate of Precision
Argon	0.142	±	0.003
Carbon dioxide	<0.001	±	
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	57.6	±	0.6
Methane	0.004	±	0.0005
Nitrogen	10.5	±	0.2
Oxygen	31.7	±	0.4
Nitrous oxide	<0.001	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	0.03	±	0.01
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	<0.0005	±	
Xenon 132	<0.0005	±	
Xenon 134	<0.0005	±	
Xenon 136	<0.0005	±	

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 08, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 107
Measurement and test equipment WC38625

Sample Id. E-27 (Background corrected)
Analysis Date October 4, 1996
Log-in No. 97-00032

Sample size 1.28 cc stp
Liquid found in vial 0.8 ml
Room temperature 70.7 ° F

	Mole Percent		Estimate of Precision
Argon	0.129	±	0.003
Carbon dioxide	0.084	±	0.002
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	61.8	±	0.7
Methane	0.005	±	0.0005
Nitrogen	11.9	±	0.2
Oxygen	26.1	±	0.5
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	0.01	±	0.005
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	0.001	±	0.0005
Xenon 132	0.002	±	0.0005
Xenon 134	0.003	±	0.0005
Xenon 136	0.005	±	0.0005

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 08, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 107
Measurement and test equipment WC38625

Sample Id. E-28 (Background corrected)
Analysis Date October 4, 1996
Log-in No. 97-00033

Sample size 1.26 cc stp
Liquid found in vial 1.0 ml
Room temperature 69.8 ° F

	Mole Percent		Estimate of Precision
Argon	0.29	±	0.006
Carbon dioxide	0.026	±	0.001
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	51.6	±	0.9
Methane	0.002	±	0.0005
Nitrogen	44.4	±	0.9
Oxygen	3.6	±	0.07
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	0.01	±	0.005
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	0.002	±	0.0005
Xenon 131	0.003	±	0.0005
Xenon 132	0.004	±	0.0005
Xenon 134	0.007	±	0.0005
Xenon 136	0.01	±	0.001

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 08, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 107
Measurement and test equipment WC38625

Sample Id. E-29 (Background corrected)
Analysis Date October 4, 1996
Log-in No. 97-00034

Sample size 1.27 cc stp
Liquid found in vial 1.0 ml
Room temperature 69.8 ° F

	Mole Percent		Estimate of Precision
Argon	0.31	±	0.006
Carbon dioxide	0.019	±	0.001
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	50.2	±	0.9
Methane	0.002	±	0.0005
Nitrogen	48.2	±	0.9
Oxygen	1.23	±	0.02
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	0.01	±	0.005
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	0.003	±	0.0005
Xenon 131	0.003	±	0.0005
Xenon 132	0.005	±	0.0005
Xenon 134	0.007	±	0.0005
Xenon 136	0.011	±	0.001

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 08, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 107
Measurement and test equipment WC38625

Sample Id. E-30 (Background corrected)
Analysis Date October 4, 1996
Log-in No. 97-00035

Sample size 0.14 cc stp
Liquid found in vial 0.8 ml
Room temperature 68.7 ° F

	Mole Percent		Estimate of Precision
Argon	0.76	±	0.02
Carbon dioxide	<0.01	±	
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	26.2	±	0.5
Methane	0.024	±	0.002
Nitrogen	56.2	±	0.5
Oxygen	16.8	±	0.3
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	0.06	±	0.03
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	<0.0005	±	
Xenon 132	<0.0005	±	
Xenon 134	<0.0005	±	
Xenon 136	<0.0005	±	

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 08, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 107
Measurement and test equipment WC38625

Sample Id. E-32 (Background corrected)
Analysis Date October 4, 1996
Log-in No. 97-00036

Sample size 0.14 cc stp
Liquid found in vial 0.8 ml
Room temperature 68.5 ° F

	Mole Percent		Estimate of Precision
Argon	1.08	±	0.02
Carbon dioxide	0.101	±	0.002
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	0.54	±	0.01
Methane	0.072	±	0.001
Nitrogen	72	±	0.5
Oxygen	26.2	±	0.5
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	0.06	±	0.03
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	<0.0005	±	
Xenon 132	<0.0005	±	
Xenon 134	<0.0005	±	
Xenon 136	<0.0005	±	

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 14, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 109
Measurement and test equipment WC38625

Sample Id. E-33 (Background Corrected)
Analysis Date October 11, 1996
Log-in No. 97-00099

Sample size 1.27 cc stp
Liquid found in vial 0.4 ml
Room temperature 68.2 ° F

	Mole Percent		Estimate of Precision
Argon	0.071	±	0.004
Carbon dioxide	0.013	±	0.008
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	83.7	±	0.3
Methane	0.015	±	0.002
Nitrogen	5	±	0.1
Oxygen	11.1	±	0.3
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	0<0.005	±	
Krypton 83	<0.0005	±	
Krypton 84	0.001	±	0.0005
Krypton 85	<0.0005	±	
Krypton 86	0.002	±	0.001
Xenon 131	0.003	±	0.001
Xenon 132	0.005	±	0.001
Xenon 134	0.007	±	0.001
Xenon 136	0.011	±	0.001

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 14, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 109
Measurement and test equipment WC38625

Sample Id. E-34 (Background Corrected)
Analysis Date October 11, 1996
Log-in No. 97-00100

Sample size 1.23 cc stp
Liquid found in vial 3.8 ml
Room temperature 68.9 ° F

	Mole Percent		Estimate of Precision
Argon	0.104	±	0.004
Carbon dioxide	0.06	±	0.01
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	81.4	±	0.3
Methane	0.032	±	0.003
Nitrogen	5.9	±	0.1
Oxygen	12.5	±	0.3
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	0.01	±	0.005
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	0.002	±	0.001
Xenon 132	0.003	±	0.001
Xenon 134	0.004	±	0.001
Xenon 136	0.006	±	0.001

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 14, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 109
Measurement and test equipment WC38625

Sample Id. E-34 Dup 2nd syringe (Background Corrected)
Analysis Date October 14, 1996
Log-in No. 97-00100

Sample size 1.13 cc stp
Liquid found in vial 3.8 ml
Room temperature 69.8 ° F

	Mole Percent		Estimate of Precision
Argon	0.116	±	0.00232
Carbon dioxide	0.08	±	0.02
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	80.5	±	0.2
Methane	0.034	±	0.003
Nitrogen	6.7	±	0.1
Oxygen	12.5	±	0.3
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	0.01	±	0.0002
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	0.001	±	0.0005
Xenon 132	0.003	±	0.001
Xenon 134	0.004	±	0.001
Xenon 136	0.006	±	0.001

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 14, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 109
Measurement and test equipment WC38625

Sample Id. E-36 (Background Corrected)
Analysis Date October 11, 1996
Log-in No. 97-00101

Sample size 1.27 cc stp
Liquid found in vial 0.1 ml
Room temperature 69.3 ° F

	Mole Percent		Estimate of Precision
Argon	0.155	±	0.005
Carbon dioxide	0.012	±	0.08
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	74.2	±	0.5
Methane	0.006	±	0.001
Nitrogen	24.0	±	0.5
Oxygen	1.59	±	0.03
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.005	±	
Krypton 83	<0.0005	±	
Krypton 84	0.002	±	0.001
Krypton 85	<0.0005	±	
Krypton 86	0.004	±	0.001
Xenon 131	0.005	±	0.001
Xenon 132	0.009	±	0.002
Xenon 134	0.014	±	0.002
Xenon 136	0.021	±	0.002

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 14, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 109
Measurement and test equipment WC38625

Sample Id. E37 (Background Corrected)
Analysis Date October 11, 1996
Log-in No. 97-00102

Sample size 1.26
Liquid found in vial 0.4 ml
Room temperature 68.9 ° F

	Mole Percent		Estimate of Precision
Argon	0.181	±	0.004
Carbon dioxide	0.02	±	0.01
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	71.8	±	0.06
Methane	0.008	±	0.001
Nitrogen	27.1	±	0.6
Oxygen	0.77	±	0.02
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	0.005	±	0.003
Krypton 83	0.001	±	0.0005
Krypton 84	0.003	±	0.001
Krypton 85	<0.0005	±	
Krypton 86	0.004	±	0.001
Xenon 131	0.006	±	0.001
Xenon 132	0.009	±	0.002
Xenon 134	0.015	±	0.002
Xenon 136	0.022	±	0.002

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 14, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 109
Measurement and test equipment WC38625

Sample Id. E38 (Background Corrected)
Analysis Date October 11, 1996
Log-in No. 97-00103

Sample size 1.28 cc stp
Liquid found in vial 0.1 ml
Room temperature 68.5 ° F

	Mole Percent		Estimate of Precision
Argon	0.206	±	0.006
Carbon dioxide	<0.001	±	
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	55	±	1
Methane	0.003	±	0.001
Nitrogen	44	±	1
Oxygen	0.63	±	0.03
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	0.005	±	0.003
Krypton 83	0.001	±	0.0005
Krypton 84	0.002	±	0.001
Krypton 85	<0.0005	±	
Krypton 86	0.003	±	0.001
Xenon 131	0.004	±	0.001
Xenon 132	0.007	±	0.002
Xenon 134	0.012	±	0.002
Xenon 136	0.018	±	0.002

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 14, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 109
Measurement and test equipment WC38625

Sample Id. E39 (Background Corrected)
Analysis Date October 11, 1996
Log-in No. 97-00104

Sample size 1.25 cc stp
Liquid found in vial 1.4 ml
Room temperature 68.0 ° F

	Mole Percent	Estimate of Precision
Argon	0.135	± 0.004
Carbon dioxide	0.04	± 0.01
Carbon monoxide	<0.01	±
Helium	<0.001	±
Hydrogen	82.1	± 0.3
Methane	0.044	± 0.004
Nitrogen	13.6	± 0.3
Oxygen	4.05	± 0.09
Nitrous oxide	<0.01	±
Other nitrogen oxides	<0.005	±
Ethane	<0.001	±
Other hydrocarbons	0.005	± 0.003
Krypton 83	<0.0005	±
Krypton 84	0.002	± 0.001
Krypton 85	<0.0005	±
Krypton 86	0.003	± 0.001
Xenon 131	0.005	± 0.001
Xenon 132	0.008	± 0.002
Xenon 134	0.013	± 0.002
Xenon 136	0.020	± 0.002

Comments

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From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 22, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 110
Measurement and test equipment WC38625

Sample Id. E40 (Background Corrected)
Analysis Date October 18, 1996
Log-in No. 97-00181

Sample size 1.24 cc stp
Liquid found in vial 1.0 ml
Room temperature 71.8 ° F

	Mole Percent		Estimate of Precision
Argon	0.236	±	0.005
Carbon dioxide	0.052	±	0.001
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	77.8	±	0.3
Methane	0.015	±	0.001
Nitrogen	17.3	±	0.3
Oxygen	4.54	±	0.09
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	0.001	±	0.0005
Krypton 85	<0.0005	±	
Krypton 86	0.003	±	0.0005
Xenon 131	0.004	±	0.0005
Xenon 132	0.007	±	0.0005
Xenon 134	0.012	±	0.001
Xenon 136	0.017	±	0.001

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 22, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 110
Measurement and test equipment WC38625

Sample Id. E41 (Background Corrected)
Analysis Date October 18, 1996
Log-in No. 97-00182

Sample size 1.27 cc stp
Liquid found in vial 2.6 ml
Room temperature 72.1 ° F

	Mole Percent		Estimate of Precision
Argon	0.321	±	0.006
Carbon dioxide	0.062	±	0.001
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	56.4	±	0.8
Methane	0.017	±	0.001
Nitrogen	40.5	±	0.8
Oxygen	2.66	±	0.05
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	0.001	±	0.0005
Xenon 131	0.002	±	0.0005
Xenon 132	0.003	±	0.0005
Xenon 134	0.005	±	0.0005
Xenon 136	0.007	±	0.0005

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: October 14, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 109
Measurement and test equipment WC38625

Sample Id. E42 (Background Corrected)
Analysis Date October 11, 1996
Log-in No. 97-00105

Sample size 1.21 cc stp
Liquid found in vial 1.2 ml
Room temperature 67.8 ° F

	Mole Percent		Estimate of Precision
Argon	0.167	±	0.00334
Carbon dioxide	<0.005	±	
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	81.4	±	1.628
Methane	0.006	±	0.00012
Nitrogen	17.4	±	0.348
Oxygen	0.99	±	0.0198
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.005	±	
Krypton 83	<0.0005	±	
Krypton 84	0.002	±	0.0005
Krypton 85	<0.0005	±	
Krypton 86	0.003	±	0.001
Xenon 131	0.004	±	0.001
Xenon 132	0.008	±	0.002
Xenon 134	0.013	±	0.002
Xenon 136	0.020	±	0.002

Comments

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 24, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 104
Measurement and test equipment WC38625

Sample Id. E-49 (Background corrected)
Analysis Date September 20, 1996
Log-in No. 96-06757

Sample size 0.87 cc stp
Liquid found in vial 0 ml

	Mole Percent		Estimate of Precision
Argon	0.94	±	0.02
Carbon dioxide	0.093	±	0.002
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	0.02	±	0.001
Methane	<0.001	±	
Nitrogen	77.7	±	0.4
Oxygen	21.3	±	0.4
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	<0.0005	±	
Xenon 132	<0.0005	±	
Xenon 134	<0.0005	±	
Xenon 136	<0.0005	±	

Comments Results corrected by subtracting out gas found in new vials

Pacific Northwest National Laboratory

From: 325 Gas & Isotopic Mass Spectrometry
Phone: (509) 376-3358 / mail slot P7-22
Date: September 24, 1996
Subject: Gas Species Analysis

To: D.J. Trimble

Analytical procedure: PNL-MA-599 ALO-284
Record book ACL 6 Page 105
Measurement and test equipment WC38625

Sample Id. E-49 dup (Background corrected)
Analysis Date September 20, 1996
Log-in No. 96-06757

Sample size 0.82 cc stp
Liquid found in vial 0 ml

	Mole Percent		Estimate of Precision
Argon	0.94	±	0.02
Carbon dioxide	0.092	±	0.002
Carbon monoxide	<0.01	±	
Helium	<0.001	±	
Hydrogen	0.018	±	0.001
Methane	<0.001	±	
Nitrogen	77.7	±	0.4
Oxygen	21.3	±	0.4
Nitrous oxide	<0.01	±	
Other nitrogen oxides	<0.005	±	
Ethane	<0.001	±	
Other hydrocarbons	<0.001	±	
Krypton 83	<0.0005	±	
Krypton 84	<0.0005	±	
Krypton 85	<0.0005	±	
Krypton 86	<0.0005	±	
Xenon 131	<0.0005	±	
Xenon 132	<0.0005	±	
Xenon 134	<0.0005	±	
Xenon 136	<0.0005	±	

Comments

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To	From	Page 1 of 2
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Spent Nuclear Fuel Project/HNF-SD-SNF-TI-049, Rev. 0		ECN No.

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