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SANDIA REPORT

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Summary of Outgassing Tests Performed in Support of the AL-SX (H1616) Program

A. R. York, II, S. M. Thornberg

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185 and Livermore, California 94550
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SUMMARY OF OUTGASSING TESTS PERFORMED IN SUPPORT OF THE AL-SX (H1616) PROGRAM

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Abstract

The AL-SX/2 and AL-SX/3 are recently certified Type B shipping containers for tritium reservoirs. Both containers consist of an outer stainless steel drum overpack and sealed stainless steel containment vessel. WR reservoirs provide containment of tritium for normal conditions of transport. In accident conditions the containment vessel of the AL-SX must contain the tritium. A variety of reservoirs and materials will be packaged inside the containment vessel. These materials must not produce high pressure gas products that exceed the internal pressure capability of the vessel if the container is in an accident involving fire. This report summarizes outgassing tests performed on various organic materials. Tests of commonly used materials show that increased pressure due to outgassing is not a problem at elevated temperatures that simulate an accident.

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SUMMARY OF OUTGASSING TESTS PERFORMED IN SUPPORT OF THE AL-SX (H1616) PROGRAM

1 Introduction

The AL-SX/2 (Figure 1) and AL-SX/3 are Type B shipping containers certified for shipment of tritium reservoirs. The container consists of a stainless steel drum overpack that protects a stainless steel containment vessel. The tritium reservoir(s) is packaged inside the containment vessel, which is sealed with two elastomeric O-rings.

In the event of an accident, the containment vessel must limit the escape of tritium to a rate less than one A_2 per week.* This requirement comes from 10 CFR 71.† Part of the accident scenario is that the container be subjected to an extreme thermal environment.

The thermal requirement is that the whole package be exposed for not less than 30 minutes to a heat flux not less than that of a radiation environment of 1475°F with an emissivity coefficient of at least 0.9. This thermal environment results in significant heating of the containment vessel and contents.

The pressure buildup inside the containment vessel must be below the maximum allowable pressure. Pressure buildup is due to increased temperature, a reservoir releasing its contents, and outgassing from organic materials. The pressure increases from elevated temperature and a reservoir releasing its contents are easily quantifiable. However, the pressure increase from melting or burning materials is not so easily quantified.

This report summarizes outgassing tests performed on various materials that may be packaged inside the AL-SX during shipment. These materials (except the getter) are normally a part of the reservoir shipping configuration. The objective of the tests was to determine the temperature at which these materials begin to generate high pressure gaseous products.

Outgassing tests were conducted by Division 1823. The getter test was conducted according to a formalized test plan that stipulated specific QA requirements such as completing data sheets and providing calibration certificates of instruments used in the test (Appendix C). Other tests that were more simple in nature followed a standard test request form SA 5360-C1(10-82).

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* An A_2 for tritium is 1000 Ci.

† Title 10, Part 71 of the Code of Federal Regulations, *Packaging and Transportation of Radioactive Material*.

Figure 1. AL-SX/2 Shipping Container

2 Thermal Environment of the AL-SX

Tests were conducted on full scale AL-SX packages to determine the temperature distribution during a simulated accident. These tests were performed in support of container certification and are reported in SAND91-2205.*

An AL-SX/2 container was tested in a 1525°F environment for 30 minutes. Thermocouples were placed on the lid flange so that estimates of the O-ring temperatures could be made. Also, passive temperature indicators were placed throughout the interior of the containment vessel and on the mock-up reservoir. Table 1 lists the maximum temperatures observed. Ideally, materials in the AL-SX should not outgas at these temperatures.

Table 1. Maximum Temperatures

Package Location	Temperature (°F)
Lid flange (exterior)*	353
Lid center (exterior)*	335
Body flange (interior)	340-350
Body middle (interior)	390-410
Reservoir mock-up	310-320

* Temperature determined by thermocouple.

For conservatism, materials packaged inside the containment vessel should be evaluated for outgassing against a temperature of 375° F.

3 Outgassing Test Description

3.1 Materials Tested

Various materials that are packaged inside the AL-SX were tested for outgassing. The majority of these materials are a part of the reservoir during shipment. Materials tested were the following:

- a carbon-loaded polypropylene electrically conductive bag
- two types of polyurethane foam
- low density molded polyethylene
- soft vinyl
- glass-filled polypropylene
- DEB getter-1,4-bis(phenylethynyl)benzene.

---

* SAND91-2205, *Safety Analysis Report for the AL-SX (H1616) Type B(U) Reservoir Packages*, Sandia National Laboratories, February 1992.

The 3M Velostat bag is an electrically conductive bag that most reservoirs are packaged in for shipment. Two types of rigid polyurethane foam were tested; both samples were supplied by Los Alamos National Laboratory, WX-5. The first sample is commonly known as "sunshine foam" due to its color. This foam is a part of the 1M/2M reservoir and valve assembly. The second foam sample tested is a proposed overpack for the 3U reservoir. The low density polyethylene sample was from an SP981 overpack, which is called the Shipping Container Insert (SCI). The SCI consists of two large molded pieces of opaque polyethylene that thread together, capturing the SP981 reservoir. The soft vinyl plug tested is a thread protector used on an SP1030 reservoir; similar plugs are also used on other reservoirs.

DEB tritium getter was tested because high pressure buildup between the O-rings, as well as in the vessel itself, is undesirable. The volume between the O-rings is considerably less than the volume of the containment vessel. The getter is an option for the AL-SX/3 that can be used when a reservoir is not qualified to Sandia Specification SS393217.

Glass filled polypropylene framed spheres were tested because, at one time, they were being considered as a packing material for the interior of the containment vessel.

One material that was not tested is Nylatron, which is commonly used for reservoir stem protectors. Federal Specification L-P-410a describes the material. Stem protectors are manufactured from nylon 6/6. The specification lists the melting point for this material as 250°C (482°F). This high melting point indicates that outgassing at 375°F is not a concern.

3.2 Results

Tests were conducted by Materials Compatibility and Reliability Division 1823. For each test a sample of material was put into a small chamber. The chamber temperature was controlled by adjusting power to heat blankets (Figure 2). The pressure in the chamber was monitored as the temperature was increased.

Figure 2. Outgassing Test Set-up

The Critical Temperature in Table 2 is the temperature at which the pressure increase goes beyond what is theoretically predicted using the ideal gas law due to only a temperature increase. Below the critical temperature, there is essentially no pressure increase due to outgassing.

Table 2. Test Summaries

Material	Brand Name or Specification	Material Use	Critical Temp. (°F)	Maximum Temp. (°F)
Carbon-loaded polyethylene	Velostat (3M)	Electrically conductive bag for reservoirs	not reached	650
Polyurethane foam*	Uralite (Hexcel)	Part of reservoir and weapon	560	640
Polyurethane foam	LANL 2170363	3U reservoir protector	500	580
Low density polyethylene†	Type 1, Grade II per ASTM D1248	Protective over-pack for reservoir	not reached	650
Soft vinyl plug	p/n 1704-27 (Rob-Roy)	Thread protector for reservoirs	400	405
Glass filled polypropylene	Column Packing (Jaeger)	Proposed packing material for containment vessel	580	625
DEB getter‡	SNL SS396490	Tritium getter for AL-SX/3	not reached	550

* Used on 1M/2M reservoir assembly.

† Used as shipping container insert for SP981 reservoir.

‡ Two samples were tested, unsaturated and saturated (with hydrogen to 78% theoretical).

3.3 Other Tests

Two additional tests not listed in Table 2 were conducted on glass filled polypropylene. These tests were performed by Organic Materials Division 2472. These tests consisted of heating a sample of material and monitoring the weight of the sample. A decrease in weight means that potentially high pressure gas products are being driven off of the sample. The test results are illustrated in Figure 3. The weight of the samples began to decrease at about 250°C (480°F) and 260°C (500°F).

Figure 3. Results of Heating Test on Polypropylene

**APPENDIX A -
REPORT ON OUTGASSING OF FOUR MATERIALS**

Sandia National Laboratories

Albuquerque, New Mexico 87185

date: June 24, 1991

to: Alan York, 5165

from: S. M. Thornberg, 1823

subject: Report on outgassing tests of materials in support of the AL-SX program

Four materials were tested at your request to measure outgassing rates in an inert atmosphere. The materials tested were: 1) Velostat, 2) polyurethane (sunshine foam), 3) low density polyethylene, and 4) polyurethane (WX-5). The samples were weighed and sealed in a 2.75" conflat nipple. The sample chamber was evacuated and filled to about 625 torr using argon. The samples were then heated while recording temperature and pressure readings.

The results showed that little gas was given off by materials #1 and #3. Samples #2 and #4 released a great deal of gas upon heating as can be seen in the data plot. In fact, the heating for sample #4 was terminated early (580°F instead of 650°F) due to its large gas generation rate.

The quantities of materials used in each sample are:

Sample	Weight (grams)
1	.735 g
2	4.37 g
3	12.5 g
4	10.9 g

All data is plotted using the same y-axis scale to show the difference in gas generation rates on the attached dP/dT plots.

SMT:1823

Distribution:

1820 J. Q. Searcy
1821 L. R. Gilliom
1823 J. A. Borders
1823 S. Bender
5165 J. M. Freedman

dP/dT PLOT

York: #2, Polyurethane (sunshine foam)

dP/dT PLOT

York: Samp. #4, Polyurethane (WX-5)

dP/dT PLOT

York: Samp. #3, Low dens. Polyethylene

dP/dT PLOT

York: Sample 1, Velostat

Figure A.1. Pressure Versus Temperature Data for Four Samples

Figure A.2. Samples Following the Outgassing Tests

**APPENDIX B -
REPORT ON OUTGASSING OF POLYPROPYLENE SPHERES**

Sandia National Laboratories

Albuquerque, New Mexico 87185

date: November 15, 1990

to: Alan York, 5165

from:
S. M. Thornberg, 1823

subject: Report on polypropylene sphere outgassing at high temperatures

The spheres were tested on 10/9/90. The maximum temperature reached was about 625°F before the experiment was terminated due to a very rapid pressure increase in the experimental vessel.

In the first page of figures, the temperature profile is plotted on the top half of the page. The bottom half of the page shows the pressure generated (corrected using Charles' Law for temperature effects). It can be seen that the pressure increased to nearly 3 times what was expected under normal heating of dry air and remained 2 times the theoretical pressure even after cooling. From the steepness of the curve at the 600 to 625°F range, much more gas would have been evolved if the heating had continued. Rough estimates of the quantity of gas evolved at 625°F is approximately 50 cc/sphere.

The second figure shows clearly the rapid increase of pressure as the temperature increases above 580°F. From this graph, it is again easily inferred that the pressure would continue increasing at a very rapid rate if the temperature was increased further.

SMT:1823

Copy to:
1823 J. A. Borders
1823 S. M. Thornberg
1823 Dayfile

First Derivative, Pressure vs. Temperature

Air fill, 5 spheres

Data
Points
 Δ

Figure B.1. Photograph of Glitsch and Jaeger Polypropylene Packing

**APPENDIX C -
REPORT ON OUTGASSING OF DEB GETTER**
(with supporting QA information)

Sandia National Laboratories

Albuquerque, New Mexico 87185

date: October 28, 1991

to: A. R. York, 5165

from: S. M. Thornberg, 1823

subject: Outgassing tests on hydrogenated and the pure DEB getter material - REPORT

Executive Summary:

Hydrogenated and pure 1,4-bis(phenylethynyl) benzene (DEB) getter material were tested in accordance with the "AL-SX Getter Outgassing Test Plan" (dtd. 8/6/91). Very little gas was generated upon heating to 550°C. One of the thermal decomposition products found during gas analysis was benzene.

Experimental Details:

The procedure, "AL-SX Getter Outgassing Test Plan, August 6, 1991" was used for the test with the following additions:

1. Data was recorded throughout the test from the thermocouple gauges and the pressure gauge in addition to recording the specific points called for in the test plan.
2. The getter material was placed in an aluminum sample "boat" before being placed in the heating flange. This kept the sample from moving around during handling and coming in contact with the sealing surfaces.
3. A helium leak check was performed on the assembly (heating flange, DEB sample, pressure gauge, valves, etc.) before purging with zero air was performed.

Figure 1 shows a plot of flange temperature versus time. These temperature heating curves show the stability and magnitude of the temperatures during the test. Three thermocouples were used during the test but the graph shows a plot of one thermocouple, the mid-range thermocouple. Since the flange was heated using a heating tape and the thermal mass of various parts of the flange are different, the three thermocouples read different temperatures. Consequently, the thermocouple reading between the lowest and highest reading thermocouples was used as an "average" flange temperature.

Results:

Figure 2 shows plots of pressure versus time for hydrogenated and pure DEB. The graphs also show the theoretical pressure calculated using the ideal gas law (the lower curve on each graph). The mismatch between the theoretical and actual, though small, can be explained by two primary factors:

1. The actual gas temperature in the heating flange could not be measured, so the gas temperature could have been higher than that recorded by the thermocouple on the outside of the flange.
2. Compounds that are liquids at room temperature that become totally gaseous at high temperatures would cause an abnormally high pressure reading at high temperatures but would return to the nominal pressure upon cooling. One such compound that was detected in the gas composition analysis is benzene.

Confirmation that very little gas is generated is shown in the dP/dT versus temperature plots shown in fig. 3. The very low numbers ($< .06$ torr/ $^{\circ}K$) indicate very little gas generation.

Gas Composition Analysis:

Gas mass spectral analysis showed the gas composition to be:

N ₂	79.6%
O ₂	0.1%
CO ₂	15.2%

As can be seen from the data, about 5% of the total gas was not detected, i.e., it was another type of gas that was not quantitated. A full mass spectral scan showed qualitatively the presence of benzene and virtually no other compounds so most of the missing 5% is probably benzene. The estimated measurement uncertainty of this technique is $\pm 10\%$ rdg.

Other Attachments:

Attached are the calibration certificates for our instruments and gases used: thermocouple gauge, pressure gauge, helium gas leak used for leak detector calibration, and the zero air gas mixture. Also attached are other data sheets generated during the experiment according to the test plan. The volumes were measured by Brian Joseph (5165).

Conclusions:

Very little gas was generated from either hydrogenated or pure DEB getter when heated to $550^{\circ}C$. Further work would be needed to quantitate the benzene and determine potential interactions in the AL-SX container.

SMT:1823

Copy to:
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1823 S. F. Bender
1824 L. R. Gilliom
5165 J. M. Freedman
5165 R. S. Pacheco
5165 R. E. Stinebaugh

Pure DEB Getter

York Data, 8/28/91

Hydrogenated DEB Getter

York Data, 9/16/91

Figure 1

Pure DEB Getter

York Data, 8/28/91

Hydrogenated DEB Getter

York Data, 9/16/91

Figure 2

Pure DEB Getter

York Data, 8/28/91

Hydrogenated DEB Getter

York, 9/16/91

7.0 Part I Getter Test Data Sheet

Date: 8/28/91

Getter Sample Weight: 2.0085 g

Empty bomb volume:

Loaded bomb volume or getter volume:

~~136.850 cc~~
135.354 cc

Fluke Digital Thermometer
Reading Channel # 3

Table 1: Part I Outgas Data

Room Temp. 72.5 °F

	Desired Temp (°F)	Actual Temp (°F)	Time	Bomb Pressure (psi)
0	initial conditions	76.0	8:38	12.11
1	100 20%	99.1	8:45	12.64
158	100 11%	101.8	9:45	12.70
191	200 40%	195.8	9:57	14.71
346	200 29%	202.1	10:57	15.13
376	300 54%	295.1	11:08	17.06
531	300 40%	302.7	12:08	17.99
558	400 59%	396.0	12:18	20.04
713	400 52%	402.9	1:18	20.79
736	500 70%	497.7	1:27	22.85
893	500 62%	~~545.5~~ 503.3	2:27	23.28
912	550 70%	545.7	2:34	24.16
1067	550 70%	551.1	3:34	24.35
	final conditions	80.7	4:27	12.59

sample taken →
AFTER sample → 80.4 (#1)
Data Recorded by: 8/29/91 68.9 (#2)

Susan Bender
Div. 1823

Test Volume Measurement Volume

Volume Measurement Calculations

August 19, 1991

For evacuated known volume (P1), ambient pressure unknown volume
P2 is pressure after volume measurement valve is open

Test 1: volume measurement of the plumbing line
going to the test volume

INPUTS:

standard volume, cc = 327.51

	ambient press (torr)	P1 (torr)	P2 (torr)	measured volume
trial 1	629.4	22.2	133.3	73.34481
trial 2	629.4	45	151.8	73.23716
trial 3	629.4	9.4	122.1	72.75848
trial 4	629.3	22	132.9	73.16853

OUTPUT:

average vol, cc = 73.12724 PLUMBING LINE

Test 2: Volume measurement of the test volume
and plumbing line going to the test volume

trial 1	629.4	76.4	292.5	210.0769
trial 2	629.4	7.5	250.3	209.7584
trial 3	629.4	4.6	248.7	209.9952
trial 4	629.4	55.8	279.9	209.9999

average vol, cc = 209.9576

Test volume = test 2 - test 1

Test volume, cc = 136.830 TEST VOLUME

8.0 Part II Getter Test Data Sheet

Date: 9/16/91

Getter Sample Weight: 2.03034 g

Empty bomb volume:

135.354 cc

Loaded bomb volume or getter volume:

Fluke Digital Thermometer
Reading Channel #3

Table 2: Part II Outgas Data

	Desired Temp (°F)	Actual Temp (°F)	Time	Bomb Pressure (psi)
me 2	initial conditions	72.3	6:50	12.09
me 16	var 100 20%	97.8	6:56	12.27
me 172	var 100 11%	103.7	7:56	12.75
me 182	var 200 60%	198.4	8:00	13.83
me 339	var 200 25%	205.0	9:00	15.10
me 358	var 300 50%	295.4	9:07	16.63
me 513	var 300 34%	304.0	10:07	17.61
me 530	var 400 60%	395.7	10:13	19.10
me 685	var 400 42%	403.9	11:13	20.27
me 696	var 500 70%	496.6	11:17	21.67
me 852	var 500 52%	502.9	12:17	22.82
me 861	var 550 70%	548.7	12:20	23.46
me 1016	var 550	553.9	1:20	24.24
me 1288	final conditions	75.5	3:04	12.39

me 1288 AFTER sample #1 77.6 3:05 10.04
 me 1291 AFTER sample #2 74.3 3:10 8.16
 Data Recorded by:

Susan Bender
 Division 1823

Test Volume Measurement Volume

Volume Measurement Calculations

August 30, 1991

For evacuated known volume (P1), ambient pressure unknown volume
P2 is pressure after volume measurement valve is open

Test 1: volume measurement of the plumbing line
going to the test volume

INPUTS:

standard volume, cc = 327.51

	ambient press (torr)	P1 (torr)	P2 (torr)	measured volume
trial 1	631.4	14.5	126.7	72.80884
trial 2	631.4	29.6	139	72.76521
trial 3	631.4	5.7	119.4	72.73024
trial 4	631.4	32.3	141.3	72.83940

OUTPUT:

average vol, cc = 72.78592 PLUMBING LINE

Test 2: Volume measurement of the test volume
and plumbing line going to the test volume

trial 1	631.3	62.8	283.7	208.1327
trial 2	631.3	45.9	273.4	208.1825
trial 3	631.3	61.8	283.1	208.1503
trial 4	631.3	42.4	271.2	208.0929

average vol, cc = 208.1396

Test volume = test 2 - test 1

Test volume, cc = 135.354 TEST VOLUME

TRANSDUCER CALIBRATION REPORT
SANDIA LABS 7414 4/ 4/1991

MANUFACTURER HEISE
MODEL 901A
SERIAL S918205 DATAFILE # 2
TRANSDUCER TYPE DIAL GAGE
CERTIFIED BY AS *A. Shay* EXPIRATION DATE 5/ 1/1992
TEMPERATURE 79 FACILITY USED KING
REQUESTING ORG. 1823
COMMENTS: S. THORNBERG. 1 YEAR INTERVAL.

REFERENCE UNITS PSIA	DIAL GAGE READING	% DEVIATION FULLSCALE
.1000E+02	.1000E+02	-.00
.2001E+02	.2000E+02	-.01
.3001E+02	.3000E+02	-.01
.4001E+02	.4000E+02	-.01
.5002E+02	.5000E+02	-.02
.6002E+02	.6000E+02	-.02
.7002E+02	.7000E+02	-.02
.8003E+02	.8000E+02	-.03
.9003E+02	.9000E+02	-.03
.1000E+03	.1000E+03	-.03
.5002E+02	.5000E+02	-.02
.2001E+02	.2000E+02	-.01
.8002E+02	.8000E+02	-.02

Standards Laboratory Certificate

Sandia National Laboratories

Albuquerque, New Mexico 87185

DIGITAL THERMOMETER
Fluke
Model No. 2190A/2300A
Serial No. 4625003
Property No. V931431

File No. 2624

with
Fluke
Model No. 2300A
Serial No. 4595009
Property No. V931432

Submitted by: 1823

Certified: October 10, 1991
Expires: April 10, 1992

This instrument was tested over a range of:

TEMPERATURE

-70 to 0 deg C

0 to 350 deg C

ACCURACY

+/- 1 deg C

+/- 0.5 deg C or

+/- 4% of rds. (which-
ever is larger)

It is probable that this instrument will remain within +/- +/- 1 deg C
for the certification interval.

It is probable that this instrument will remain within these
accuracies for the certification interval.

Metrologist: F. G. Cajas, 2414

Certified by: R. L. Crabb, 2414

TLC10
8/6/91

Standards Laboratory Certificate

Sandia National Laboratories

Albuquerque, New Mexico 87185

DIGITAL THERMOMETER
FLUKE
Model No. 2190A/2300A
Serial No. 4625003
Property No. V931431

File No. 2624

with
FLUKE
Model No. 2300A
Serial No. 4595009
Property No. V931432

Submitted by: 1823

Certified: March 4, 1991
Expires: September 4, 1991

This instrument was tested over a range of:

TEMPERATURE	ACCURACY
-----	-----
-70 to 0 deg C	+/- 1 deg C
0 to 350 deg C	+/- 0.5 deg C or
	+/- 4% of rds. (which-
	ever is larger).

This instrument is calibrated with four thermocouples labeled 2624-T-1, 2624-T-2, 2624-T-3 and 2624-T-4.

It is probable that this instrument will remain within these accuracies for the certification interval.

Metrologist: G. L. Brown, 7414.

Certified by : R. L. Crabb, 7414

TLC10
11/20/89

ALPHAGAZ

Specialty Gases Div. Liquid Air Corp.
1450 Fifth St., Denver, Colorado 80204

*****

A N A L Y S I S   C E R T I F I C A T I O N

*****

Cylinder #: M895220

Date: 8/1/90
Customer: SANDIA LABS

P.O. #: MR740516
ORDER #: 519490

<u>COMPONENT</u>	<u>REQUESTED</u>	<u>ANALYSIS*</u>
THC		N.D. < 0.1 PPM
WATER		N.D. < 0.2 PPM
AIR	ULTRA ZERO	BALANCE
OXYGEN CONTENT		21.7 %

In general, the accuracy of Analysis is +1% of Component Value.

*Analysis is Percent by Volume Unless Otherwise Specified.

ANALYST

General Purpose Permeation Calibrated Leak

**Order # 0747   Customer: Sandia National Lab.
Albuquerque**

**Vacuum Technology, Inc
133 Valley Court, Oak Ridge, TN
37830 USA
615-481-3342**

ACCU-FLOW GENERAL PURPOSE LEAK

**Model: GPP-8-He-4FVCR   Fill Gas: Helium @ 112 psig
Element Type: Pyrex 7740   Serial # 408**

Calibration Data

L.R. = 5.2×10^{-8} atm-cc/sec (He @ 24.5°C)

n = 2.1×10^{-12} mol/s (+/- 20%)

Cal Temp = 24.5°C

Cal Date 03/03/91

Depletion Rate: 0.2%/yr

Temp Coef: 4%/°C

WARNING!!!

Contents Under High Pressure!

Do Not Exceed 100°C During Bakeout!

Filled with Helium @ 112 psig

For best performance recalibrate annually.

VTI Factory Recalibration Service

Call 615-481-3342

***For Permeation Leaks the isolation valve should be
left open when vented to atmosphere to prevent
saturation of the glass element.**

Figure C.1. Saturated and Unsaturated Getter Samples Before and After Outgassing Tests

APPENDIX D
REPORT ON OUTGASSING OF SOFT VINYL

Sandia National Laboratories

Albuquerque, New Mexico 87185

date: February 14, 1992

to: Alan York, 5165

from: S. M. Thornberg, 1823

subject: Results of thermal outgassing test of Rob-Roy soft vinyl cap

Experimental Details:

A sample of the Rob-Roy soft vinyl cap delivered by A. York, 5165, was tested at temperatures from room temperature to 400° F. The test was intended to continue until 550° F was reached but heating had to be aborted due to the large gas generation rate at 400° F. The attached graphs show the data obtained. The sample was grey-black in color after heating.

The procedure, "AL-SX Getter Outgassing Test Plan, August 6, 1991" was used for the test with the following additions:

1. Data was recorded throughout the test from the thermocouple gauges and the pressure gauge in addition to recording the specific points called for in the test plan.
2. The Rob-Roy cap was placed in an aluminum sample "boat" before being placed in the heating flange. This kept the sample from contacting the walls of the heating flange.
3. A helium leak check was performed on the assembly (heating flange, sample, pressure gauge, valves, etc.) before purging with zero air.

Results:

The data obtained is shown in the attached figures and data table. The gas generation rate for the Rob-Roy soft vinyl cap was very high. The experiment had to be terminated prematurely due to the large gas generation rate.

SMT:1823

Info copy to:

1823 J. A. Borders
1823 S. F. Bender
5165 J. M. Freedman
5165 R. S. Pacheco
5165 R. E. Stinebaugh

Rob-Roy Soft Vinyl Cap

York Data, 1/14/92

Rob-Roy Soft Vinyl Cap

York Data, 1/14/92

Rob-Roy Soft Vinyl Cap

York, 1/14/92

7.0 Part I Getter Test Data Sheet

Date: 1-14-92

Getter Sample Weight:

Empty bomb volume:

Loaded bomb volume or getter volume:

Reading Channel 2

Table 1: Part I Outgas Data

Tow

line 1

line 44

line 125

line 173

line 253

line 298

Line 378

line 403

line 435

Desired Temp (°F)	Actual Temp (°F)	Time	Bomb Pressure (psit)
initial conditions	65	8:57	624.7
100	100.3	9:13	1052.5
100	103.5	9:43	675.6
200	198.4	10:00	784.6
200	204.7	10:30	799.1
300	305.3	10:46	918.3
300	305.0	11:16	962.2
400	401.8	12:25	1165.1
400	404.0	shutoff 11:37	3034.9
500			
500			
550			
550			
final conditions	69.9	2:37	1505.2

Data Recorded by:

Susan Bender

Before sampling: 150

After sampling: 868.7

Rob-Roy Soft Vinyl Cap

Figure D.1. Pressure vs Temperature Curve for Soft Vinyl

Distribution:

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